Table of Contents

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXS

ACRONYMS

BOD	Biodegradable Oxygen Demand
CDC	Centre for Diseases Control
CI	Confidence Interval
CSA	Central Statistics Authority
EA	Enumeration Areas
ETB	Ethiopian Birr
EFMOH	Ethiopian Federal Ministry of Health
EPHA	Ethiopian Public Health Association
EPRDF	Ethiopian People's Revolutionary Democratic Front
ESTC	Ethiopian Science and Technology Commission
FC	Faecal Coliform
FGD	Focus Group Discussion
EPA	Environmental Protection Authority
FMOH	Federal Ministry of Health
HBM	Health Belief Model
IDRC	International Development Research Centre
IEC	Information, Eduction, Communction/Behvioural Change Communction
HIV/AIDS	Human Immuno Virus/Aquired Immuno Deficiency Syndrome
MDGs	Millennium Development Goals
NGO	Non-governmental Organisation
SD	Standard Deviation
STD	Sexually Transmited Diseases
STDs/AIDS	Sexually Transmitted Diseases/ Acquired Immune Delicacy Syndrome
TPB	Theory of Planned Behaviour
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
US	United States
VIP	Ventilated Pit Laterine
WHO	World Health Organization

CHAPTER 1

ORIENTATION OF THE STUDY

1.1 INTRODUCTION

Civilisation is interlinked with urbanisation (Spence, Anney & Buckley 2009). Urbanisation is essentially brought about by humans – hence it is artificial and no longer "natural". Indeed, it has come into being under the influence of the human mind which has created constructions of all kinds, using natural resources. Such infrastructure includes roads, water and electricity supply, factories, informal sector activities, transport and intra-urban and suburban agricultural activities (Gubry, Hunog & Thieng 2009). Urbanisation (and its growth) has a number of positive impacts on the environment and on human wellbeing. For instance, higher population densities tend to enjoy lower per capita costs of providing energy, health care, infrastructure and services that somehow make life what it is (Didem, Tan & Les *2*010; Scott 2007).

Despite all these positive results, however, most major cities have suffered much, partly due to the influx of population from rural areas which, in return, puts pressure on the natural resources and artificial environment such as the socioeconomic, cultural and political environments (ecosystem) (Didem et al 2010; Ichinnura 2003). Although the magnitude varies between developed and developing nations, however, most urban centres in developing countries have great difficulties coping with changes caused by population influx as experienced by western countries. This is because these nations are unable to create sufficient formal employment opportunities, infrastructure and services for the poor (International Council of Science 2011; Scott 2007).

Population growth, particularly in the developing world, places immense pressure on resources like water and land, and results in the release of growing volumes of solid waste and wastewater (Scott 2007). These however, are partly linked to poor management of solid waste and wastewater and therefore create threats to residents' health and safety and cause infectious diseases like chronic diarrheal and gastro-intestinal diseases, respiratory diseases and different forms of allergies (in skin and

hands) (ICSU 2011; Lans, Hengsdijk, Elings, Schans, Aarnink & Yao. 2011; Smit, Nasir & Ratta 2010).

As frequently observed in the literature, when initiating and managing different features, such as, residential developments, factories, recreational facilities and service areas, failure to comply with existing regulations and standards and poor monitoring are major contributors of EcoHealth problems. All this can be attributed to behavioural factors and the socio cultural, economic and political conditions in the countries (Kume & Ahmed 2005: 89).

Nonetheless, the poor environmental/EcoHealth situation disproportionately affects population groups, especially the marginalised poor who have direct contact with different forms of the waste. The most affected includes those who live in the informal settlements, and in poor residential corners. Further the problem affects especially children, the youth, women and the elderly, and those scavenging for metal and plastic scraps with a view to selling, car washing and so on (Scott 2007). Additional exposure routes for the urban poor, who are often migrants with little access to formal settlement and health services, include direct contact with solid waste and wastewater, as for instance through riverside open defecation grounds (Smit et al 2010; Scott 2007).

Developing countries use urban agriculture as a complementary strategy to reduce urban poverty and food insecurity by cultivating urban fringes and riverbanks as potential sites for urban agricultural activities (Food and Agriculture Organisation (FAO) 2009; Resource Centres on Urban Agriculture Foundation (RUAF) 2010). In addition to the socioeconomic benefits described above, urban agriculture contributes to urban greening, improves the urban climate (less dust and heat) and enables cities to adapt to climate change more successfully by improving storm water management, enhancing the use of organic wastes as productive resources and providing recreational services (Lovell 2010; Ruth & Gasper 2007; RUAF 2010).

Urban agriculture (vegetable growing fields) on riverbanks primarily uses wastewater for irrigated production but, if not properly monitored, urban agriculture may also have negative effects on public health and the urban environment (Cities Alliance 2006; Ichiinnura 2003). Use of wastewater irrigation for vegetables and fodder may serve as

the transmission route for heavy metals into the human food chain. For instance, the consumption of raw vegetables that have been irrigated with wastewater presents a number of health hazards (Forsberg 2003, Scott 2007; Ichinnura 2003).

In general, complying with the existing regulations, standards and procedures of EcoHealth complements healthy life in urban centres and recycling wastes reduces pressures on natural resources, and the volume of wastes. Wastewater utilisation is a common phenomenon in most urban centres worldwide. Urban agriculture is part of the urban ecological system and may function as an important strategy for poverty alleviation and social integration. It also serves as the positive incentive to women and youth, enabling them to play an important role in the urban environmental management system. To address solid and liquid wastes properly and to benefit from the reuse of wastewater, urban management systems/policy makers should be provided with evidence to help them to issue policies and support strategies to reinforce regulations that can conserve the EcoHealth system and protect the public (producers, vendors and consumers of the products) from environment-related health risks.

1.2. PROBLEM STATEMENT

In many areas of the city such as in open field and riverbanks, unattended piles of waste are becoming breeding places for disease and vectors/insects and rodents (Smit et al 2010; UNDP 2008). This situation is believed to result in poor urban environmental conditions and a chronic risk of epidemics, which in turn present a formidable threat to the health and productivity of the inhabitants of the city (Finance and Economic Development Bureau 2002: 36; UNDP 2008). Riverbanks, especially the Akaki River (and its tributaries, the Big Akaki and the Little Akaki Rivers) is the main carrier of the untreated liquid and solid wastes which are generated and disposed of from households, industries and health facilities. The untreated wastes released into these rivers include liquid waste from households, municipalities (domestic waste water, overflowing pit latrines, septic tanks, open-space defecation and urination), clinics (infectious, pathological and sharp objects and medicines), fuel stations/garages (used batteries, car-wash effluents and used oil), and other, even more hazardous solids and solution flows (UNDP 2008).

The most common types of polluting industries in these areas are manufacturers of food and beverages, textiles, chemicals, rubber and plastic, paper and paper products, metal and non-metal mineral products; tanneries and wood processors (Asfaw 2007; UNDP 2008). The volume of liquid waste that is discharged from these industries per year is estimated at about 4.88 million cubic metres, of which 95 percent untreated wastes. More than half of these industries are located around the Little Akaki riverbank and, as stated above, the mechanisms for enforcing the existing regulations are weak, with the result that these industries do not see the need to clean up the wastes generated in the process of production, and which continue to affect the environment (Kume & Ahmed 2005:89; UNDP 2008).

However, the unfortunate urban poor: the vegetable growers and people who scavenge from the river rely on the riverbank for their daily bread. About 1500 households use the river bank for vegetable growing and for dispensing their products to the community and vegetable suppliers. Although the research findings depict problems relating to such river water, the vegetable growers' association and the local administration have not yet given sufficient attention to these problems. Instead, they focus on alleviating the known problems (reduction of metal and biological contaminates; controlling pollutant sources). Low public awareness, weak mechanisms for reinforcing the existing regulations and practices are among other problems that affect the general public and particularly the vegetable growers, consumers of vegetables from these sources and people whose livelihood is connected with riverbank (wastewater and scraps).

To address such conditions, the recent paradigm in research has indicated that improvements in health and wellbeing could be achieved if the social and environmental determinants of health addressed and revitalised health promotion by integrating it with EcoHealth (Butler & Sharon 2006; World Health Organisation (WHO) 2005).

To date, the public sector, partners and population groups (woman and youth associations, the health extension programme) in Ethiopia have endeavoured to address the environmental health issues and maintain safe environmental health conditions. These activities, which include solid waste collection and management and

health and education activities, particularly preventing the public from exposure to such hazards, have made a difference to rural communities and to some locations in urban areas. However, attempts to solve the environmental health problems of poor urban areas, the urban slums and the informal settlement areas, and places where uncontrolled urban waste disposal and wastewater exist, have not shown any significant progress. Thus, this study has assessed the knowledge and practice of the urban and per-urban community members on the existing environmental health regulations which are believed to contribute to the EcoHealth situation in these urban settings. The study also tested the contributions of the EcoHealth promotion strategies towards protecting personal and environmental health in urban settings and for use as evidence to policy makers.

1.3 Research Purpose

The purpose of this study was to equip urban and peri-urban EcoHealth markers with skills and knowledge requirements to ensure the sustainability to be gained through the integration with urban health extension workers and vegetable growers cooperatives.

1.4 Research Objectives

The following objectives guided this study:

- To assess knowledge and practices on the existing environmental health policies/regulations/guidelines among urban and peri-urban community members;
- To assess the perspectives of women and youth on urban and peri-urban EcoHealth promotions and protections;
- To evaluate the development and implementation of the health promotion activities on waste water use by applying an ecological model which aimed at changing behaviour and providing biossand filter to promote hand wash practice which helps to reduce potential health risks among urban vegetable growers and

- To recommend to urban and peri-urban EcoHealth managers on environmental health promotion interventions.

1.5. SIGNIFICANCE OF THE STUDY

This study will benefit urban and peri-urban poor, vegetable growers and people who scavenge from the river and rely on the riverbank for their daily bread. This study will identifying social and environmental factors, policies/guidelines and health-promotion strategies, and associated intervention applications that protect health and promote environmental health. The findings of this study contribute to the existing body of knowledge on urban and peri-urban health promotions and urban environmental health protection. The findings could persuade policy makers, donors and development agencies to direct resources towards addressing the urban and peri-urban health-promotion activities. Finally, the study should enable the researcher to make recommendations for further research activities.

1.6 DEFINITION OF KEY CONCEPTS

The following concepts were used consistently in this study:

- **EcoHealth**

The EcoHealth concept is based on the following definition of health: “Good health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity” (Erlichman & Giles 2003: 9). “Health is the extent to which an individual or group is able, on the one hand, to realize aspirations and satisfy needs; and, on the other hand, to change or cope with the environment. It is not an objective for living, but a resource for everyday life. Health includes the notions of the balance or harmony, as well as the capacity to respond and adapt to changing constraints and opportunities”.

- **Ecological systems or ecosystems**

These refer to self-regulating communities or organisms interacting with one another and with their environment (Butler & Sharon 2006).

- **Environment**

Environment in this paper refers to an overall surrounding context during a given time period. (It refers to four environments: social, political, economic, and ecological.)

- **Eco-health markers**

The outcomes from the interaction between the biotic and abiotic components; e.g. Clean air, potable water, proper waste dispal, social norms etc that are necessary for mainataince of life upon the earth (Sinha, Shukla & Shukla 2011:59).

- **Peri-urban area**

It is zone which surrounds the city/town and an area which experiencing the immediate impacts of land demands from urban growth (Srivastva 2007:9).

- **Urban**

The Federal democratic Republic of Ethiop Central Statistics Authority defined urban as a locality with 2000 or more inhabitants (CSA 2004:24).

- **Urban health**

"Urban health is a complex web of both threats to health and supports to health" (Enotes.com Inc. 2010: 8). In this study urban health refers to the well-binges of mankind and the physical, social environment in the city of Addis Ababa, Ethiopia.

Youth

Refers to the population members who are age between 15 to 29 years (Ministry of Youth, Sport and culture 2004: 4).

1.7 FOUNDATION OF THE STUDY

The Eecological Stress Process Model for Environmental Health Promotion was employed, using the multiple baseline study method. Ecological models/approaches are comprehensive, multifaceted and concerned with environmental change, behaviour, and policies that help individuals make healthy choices in their daily lives. The defining feature of an ecological model is that it takes into account the physical environment and its relationship to people at individual, interpersonal, organisational and community levels, and helps in linking health promotion and health protection (Parkes, Panelli & Weinstein 2003).

1.8 RESEARCH DESIGN AND METHOD

In this study a mixed approach on quantitative, qualitative and quasi experimental design were employed. The study was conducted in three phases and, in the first two phases, the researcher collected data on knowledge, and practice regarding environmental policies/regulation which helped to preserve the environment (the solid and liquid waste management) and information on wastewater use from the urban and peri-urban community members (households, women and youth , private and public organisations employees,). In the third phase, the researcher implemented and observed changes (EcoHealth behavioural markers) after applying a stress process EcoHealth promotion model and provided a bio-sand filter for hand washing and harvest washing in selected settings.

1.9 THE SCOPE OF THE STUDY

The samples were selected from households and the vegetable growers in the two subcities of the Addis Ababa City Administration. Household members (household head or members of the household) and urban agriculturalists (vegetable growers in target locations) were targeted for a quantitative data set. Key informants from the community were women and youth engaged in environmental protection activities in the targeted sub-districts were also part of the qualitative study. The two districts (subcities) had been deliberately selected, based on their proximity to the Little Akaki riverbank. The researcher assumes that, to a great extent, the environment-related health problems and interventions are similar to other comparable districts/sub-districts of major urban settings in Ethiopia

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1.10 CONCLUSION

The environmental health problems in urban settings are interlinked with the reinforcement capacity of the different public sectors (health and environmental protection offices) and the follow-up of their implementations. They are also related to the individual and different population groups' behaviour and actions. Identifying the

underlying and immediate causes of urban EcoHealth strategies plus the promotion of the existing regulations and standards, including monitoring their application, are important to maintaining the urban EcoHealth situation.

CHAPTER 2

THE LITERATURE REVIEW

2.1. INTRODUCTION

As stated in the introduction chapter the purpose of this study was to equip urban and peri-urban EcoHealth markers with skills and knowledge requirements to ensure the sustainability to be gained through the integration with urban health extension workers and vegetable growers cooperatives.

A literature review was carried out to assist researchers to understand, consolidate and extend their knowledge of the phenomenon under study (Ethiopian Public Health Association 2009:7). To comply with this recommendation therefore, literatures which comprising theoretical concepts and references relating to the purpose of the study were reviewed in this section and organized as follows. The selection first discussed the environment/ecology components and EcoHhealth markers; the global and urban contexts. These followed by discussion on the different health promotion theories/models and last discussed the development of environmental health services in Ethiopia (the study country) including environmental health regulations and their application indorsed by the central government and regional states.

2.2 ENVIRONMENT

Environment is a complex system that comprises physical, chemical, biological, social and cultural elements and all these elements are interlinked. All major components of the environment, namely, air, water, land, energy, and living things, including humans, are interacting and inter-connected in many ways. As described in the following sections, human beings constitute an important factor which affects the environment (Dave & Katewa 2008: 2; Savalia 2007).

2.2.1 Physical environment

Living things are dependent upon their physical environment: land, water, air and energy, for their existence. As illustrated in Table 2.1, the ecosystemic services include provision of food, fresh water, fuel wood, biochemical and fibre. An ecosystem also consists of a regulating climate, diseases, detoxification and flooding through the eco systemic process (Odum & Warrett 2005:5; Ruth & Gasper 2007; Savalia 2007).

Table 2.1: Ecosystem services

Provisioning	Regulating	Cultural
Goods produced or provided by ecosystems • food • fresh water • fuel wood • fibre • biochemical • genetic resources	**Benefits obtained from regulation of ecosystem processes** • climate regulation • disease regulation • flood regulation • detoxification	**Non-material benefits obtained from ecosystems** • spiritual • recreational • aesthetic • inspirational • educational • communal • symbolic
Supporting **Services necessary for the production of all other ecosystem services.** • Soil formation • Nutrient cycling • Primary production (mainly vegetation)		

Source: Savalia, Ramesh, CEE**:** Ecology and environment: http://www.sayen.org/Ecology%20&%20Environment.pdf

In developing countries, industrialisation often leads to water and air pollution. The water resources become polluted due to the discharge of untreated or partially treated wastes from industry (Savalia 2007). Domestic sewage, fertiliser and pesticide run off from agricultural fields, causing damage to the elements necessary for ecosystem services (Savalia 2007; Drechsel, Scott, Sally, Redwood, & Bahri, 2010 2010). These are the reasons why environment and development need to be linked in a comprehensive framework to allow healthy economic growth and prosperity without causing damage to the environment (Clayton & Bass 2009; Savalia 2007; Pandey 2008:65, Parkes, Morrison, Bunch & Venema 2008; Savalia 2007).

2.2.2 Climate changes

Deviations from average weather patterns have been observed globally, most often involving hotter high and low temperature extremes and more frequent droughts and natural disasters (Chatham 2010; Organisation for Economic Development [OECD] 2008). Mean precipitation increases are variable, with general summer and winter increases in the tropics, eastern North America, northern Europe, and northern and central Asia, while summer decreases have been documented in mid-latitude regions. Precipitation has generally occurred, and is predicted to occur continuously, in short periods and interrupted by more intense and sudden events such as seasonal droughts (OECD 2008). Ruth and Gasper (cited in OECD 2008, maintain that, unlike previous times, the comparison of historical records provides evidence that bad weather events and natural disasters are occurring more frequently and intensely than expected (Ruth & Gasper 2008). As global temperatures continue to increase, these extreme events are predicted to occur more often and with greater severity (Chaoul & Robert 2009; OECD 2008).

Rising water levels and storm surges are known to cause damage to residential properties, displacement of people in the area, discontinuation of transportation mechanisms and wetland loss. Indeed, rising sea levels are known to cause concerns and are already a nuisance to coastal communities globally. Raised sea levels and associated impacts are estimated to impact five times as many residents by the 2080s as they did in 1990 (Cooper, Beevers & Oppenheimer 2008; OECD 2008). Projected rise in sea levels is associated with significant loss of land in coastal regions (Chaoul & Robert 2009).

Climate change will affect health via a range of mechanisms including changes in vector-borne disease transmission, increased risk of disasters (floods, landslides, droughts) and increased malnutrition due to declining food yields. It has the potential to increase diarrheal diseases from contamination of water supplies. Malaria, and diarrheal diseases also have strong seasonal and inter-annual patterns that can be related to climate variability **(**Bird, Marcus & Hugh 2010; Dodman 2009; Kovats & Simon 2009).

Evidence depicts differences in disease patterns in various countries, and even change from district to district within the same country can be explained, in part, by different climate exposures (e.g. Sudan, Mozambique) (Multinomha 2008).

2.2.3 Social environment

Among the several social needs required for good health and better quality of life are proper housing, quality education, access to parks and nature, access to affordable healthy foods, and neighbourhoods that promote physical activity (Multnomah, 2008; Savalia 2007). The Ottawa Charter states, “The fundamental conditions and resources for health are peace, shelter, education, food, income, a stable eco-system, sustainable resources, social justice and equity” (Asian Pacific Ecohealth 2007:13; WHO 2007). This implies the recognition that those factors at environmental and societal levels, combined with personal attributes, lead to poor population health and also affect the health experience of individuals and communities. For example, the high prevalence of HIV/AIDS has deep roots within the socioeconomic situation (Mahiteme 2005; Pradhan, Sundar & Singh 2006). Furthermore, the global obesity epidemic is a health outcome that is a consequence of changes in a constellation of, and interaction between, environmental, social and economic factors that form a complex system. See Figure 2.1 (Asian Pacific Ecohealth 2007).

Contexts of health

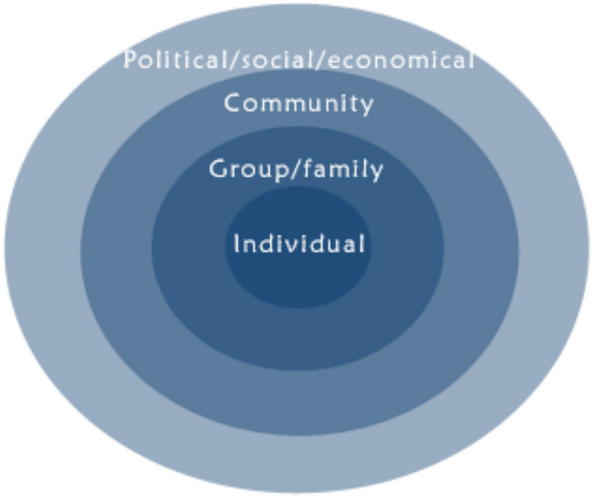


Figure 2.1: Context of health

Source: Victorian Government Health Information: http://www.health.vic.gov.au/healthpromotion/what_is/determinants.htm

Studies have shown that there are factors within and beyond the health sector that contribute to the existing poor progress towards achieving the health-related Millennium Development Goals (MDGs) (United Nations Economic and Social Commission for Asia and the Pacific, United Nations Development Programme & Asian Development Bank, 2007). The major factors relating to these are the social and environmental determinants of health. These obstacles include poverty and hunger, limited education, poor hygiene and health literacy, gender inequality, unsafe water, poor sanitation and housing, migration social exclusion, recurrent internal conflict and humanitarian emergencies such as floods, drought and other natural disasters (WHO 2007). Lee (cited in Solar & Irwin 2010) states, "Interventions aimed at reducing disease burden and saving human lives become fruitful only when they consider and adequately take into account the social determinants of health" (Solar & Irwin 2010). This fact was affirmed by the Interim Statement of the Commission on Social Determinants of Health (CSDH) (Solar & Irwin 2010, WHO 2007).

2.2.4 Urban environment

Urban environment is an environment essentially transformed by humans, artificial and no longer “natural”. Above all, it is under the influence of human constructions, infrastructure and activities of all kinds: roads, water and electricity supply, wastewater discharge and factories’ effluents, informal sector activities, intra-urban and suburban agriculture and transport (Gubry et al 2009). Urbanisation, though characterised by significant regional differences, is following an overwhelming upward trend. The world has seen a ten-to-fifteen-fold increase in urban populations since the beginning of the twentieth century (OECD 2008; Ruth & Gasper 2008). At the turn of the twenty-first century, about half the world’s populations (roughly three billion people) were living in urban areas. It is estimated that in the next twenty-five years, almost two billion more people will move to cities (United Nations University/Institutes of Advanced Studies 2003). Essentially all these dramatic changes will occur in developing countries, in terms of both the total global urban population and the increased percentage of the individual countries’ populations living in urban areas (UNU/IAS 2003).

The urban environment is a dynamic space where social, economic and natural features are working together to produce goods and services. Hence, it has extensive and a long-term impact on its immediate boundaries and entire region since both are areas of development and growth (Srivastva 2007:7). Urban growth has a number of positive impacts on the environment and human wellbeing: higher population densities help to decrease per capita costs of providing energy, health care, infrastructure and services. Moreover, urbanisation has historically been closely related to declining birth rates, which, in turn, reduces population pressure on land and natural resources. Despite all these positive results, however, most major cities have suffered environmental situations that are partly attributed to the influx of population from other areas (Ichinnura, 2003).

The world’s population as a whole is expected to grow by 2.5 billion from 2007 to the year 2050, mainly within the cities (Montgomery 2009). Urban environments are changing, exposing people to new opportunities and to new threats. Already, there are nearly one billion people who live in slums around the world. And the continuous proliferation of slums creates a huge challenge for equitable and sustainable

development (IDRC 2003b). Poverty of the urban environment and the absence of good governance are among the main contributors to the emergence and expansion of slums (Cities Alliance 2006). Hence, people living in slums are denied basic urban services and are deprived of a voice on many social, economic and political issues – not to mention being and vulnerable to abuse. Poor urban governance and planning results in poor provision of social and public goods and services, such as clean water and sanitation, schools and health care (Royal Commission on Environmental Pollution 2007). Unemployment and dismal labour conditions abound. Since slums often crop up in marginal areas prone to flooding and landslides, their populations face increased physical vulnerability (International Development Research Centre 2003b).

A huge number of threats to residents' health and safety in cities stem from problems related to water and air pollution, especially at the levels of households and communities, as a direct result of urbanisation (Cities Alliance 2006; Ichinnura 2003). Serious health consequences can result from uncollected and improperly disposed of solid waste. This may also block drainage systems and affect groundwater at landfill sites (Ichinnura 2003). Also the decomposition of the organic matter in a landfill site produces highly polluting liquid, and this liquid can percolate down, causing groundwater pollution (Forseberg 2003). Urbanisation in coastal areas often leads to the destruction of sensitive ecosystems and can also alter the hydrology of coasts and their natural features such as mangrove swamps, reefs and beaches that serve as barriers to erosion and form important habitats for species (Ichinnura 2003).

Urbanisation has not only local environmental impacts but also large "ecological footprints" (resource consumption and waste generation) beyond their immediate vicinity (Black 2004; Ichinnura 2003). These include conversion of agricultural land and forests as well as reclaiming of wetlands, for urban infrastructure. All this is associated with widespread removal of vegetation to support urban ecosystem, and it puts additional pressure on the nearby areas that may be even more ecologically sensitive. Groundwater overdraft has led to land subsidence and a higher frequency of flooding, particularly in the lowest-lying and poorest areas (Ichinnura 2003).

2.2.4.1 Health risks in the urban environment

Urban living gives rise to creativity and technology and the engines of economic growth. However, urban centres also give rise to poverty, inequality, and health hazards from the environment (Global Research Network on Urban Health Equity 2010; Redman & Jones 2004). Not all urban centres, however, have similar impacts on the environment, while developed world cities have largely overcome their traditional environmental problems (wastewater removal, sanitation, water supply and indoor air pollution) (UNU/IAS report 2003). However, a large share of the world's most deprived urban dwellers live in unsanitary conditions and they are threatened by urban pollution and, increasingly, by climate change (McGranahan 2009).

Developing countries face various urban environmental challenges, including inefficient modes of resource utilisation, as in the areas of water supply, proper housing, or energy supply, and poor capacity to absorb pollution and flooding (UNU/IAS 2003). Almost half the urban centres in Africa, Asia, and Latin America are challenged to deal with water pollution, air pollution, solid waste management and improper land use and management (UNU/IAS 2003).

Urbanisation has changed social relationships and individual behaviour, and potentiates many changes (like eating fast foods, engaging in unprotected sexual intercourse and smoking) in human behaviour that cause disease risks such as obesity, sexually transmitted diseases like HIV, and lung cancer (McMichael & Robert 2009).

Most communicable diseases have intimate links to the environment, whether the vehicle is in the form of soil, water, air or food. Respiratory diseases, diarrheal diseases, cutaneous infections and other, important non-communicable diseases caused by a variety of poisons and pollutants are among many problems which result from the uncontrolled environment (Sergey, Radjhesh, Agnieska, & Fabien 2004; WHO 2002). In epidemiology, the environment is seen as completing a triangle of interactions between host, agent and the environment, with disease occurring when the host is not strong enough to withstand the other two elements (Mutha 2005: 8).

Among the health problems with heaviest impact and disease burden on poor communities or populations with low income in urban settlement areas around the world, are respiratory and diarrheal diseases and tuberculosis. These diseases are mainly attributed to overcrowding, improper sanitation, poor water supplies and low awareness of environmental and health links (Kjellstrom, Sharon, Jane, Carlos, Eva, Diarmid, Fiona, & Jamie 2007, McGranahan 2007).

Diarrhoea remains the second most leading cause of death in children under five globally, being responsible for the death of every fifth child (United Nations Children Fund/World Health Organization 2009). An estimated 88 percent of this burden is attributed to unsafe drinking water supply, inadequate sanitation, overcrowding and uncomfortable houses, and poor hygiene (UNICEF/WHO 2009; Yongsi 2009). These risk factors do not evenly threaten urban districts because slums and informal settlements are more vulnerable to communicable diseases (Yongsi, 2009).

2.3 ECOHEALTH

Human health and wellbeing are intimately tied to the health of the ecosystems/environment that sustain/s life. However, environmental health is poorly defined, rarely quantified and valued and, as humans impact more and more on their environment, the close relationship between health and environment is becoming increasingly evident (IDRC 2003a).A healthy population is dependent on a healthy environment. Although humans have been aware of this crucial relationship for millennia, there has still been a tendency to separate the two fields of endeavour: a tendency to examine health issues in isolation, separate from the environmental factors (Butler & Sharon 2006).

Since 1986, evidence linking health to ecological and environmental factors (such as climate change, biodiversity loss, and the mental health benefits of exposure to nature) has built up considerably and is stimulating a new discipline, sometimes called “ecohealth” (or “EcoHealth”) (Butler & Sharon 2006). EcoHealth extends traditional environmental health by studying the relationship between health and explicitly ecological factors such as biodiversity and ecosystem “services”. More subtly stated, EcoHealth borrows insights developed by human ecology to understand and predict

health through consideration of the relationships between human and non-human species (IDRC 2003a). At the largest scale, EcoHealth conceptually differs from traditional environmental health. It considers humans as a part of the global biosphere and its systemic interacting forces which regulate life and its inorganic substrate. Falling within this scope are topics such as health and the global atmosphere, including climate change, stratospheric ozone depletion, and the movement of transcontinental air pollution and dust clouds. Even more, broadly speaking, EcoHealth grapples with the sustainability of civilisation, and therefore of human health (Butler & Sharon 2006).

2.3.1 Conserving and revitalising the urban ecosystem

To conserve the environment and sustain healthy life, stakeholders responsible for the environment should comply with precautionary measures, regulations stipulated by the sustainable environment principles. Of many strategies, recycling of the renewable resources draws attention to the environment and it supports the point that a sustainable and safe environment is becoming important. Except for a few, most of the solid and liquid wastes generated in the course of production and consumption can be sorted by types and recycled, if the necessary measures and technologies are employed at every step of the production and consumption processes**.**

2.3.2 Wastewater recycling and reuse for urban agriculture

Reuse of wastes from different sources has a long history. Of many kinds of waste reprocessing, recycling or reuse of wastewater for domestic and agricultural purposes has been around for some time. However, the practice has not yet been given formal recognition. Since resources are scarce, the demand for reuse in any form (after or before treatment) is increasing. Because technological advancement, population growth, and urbanisation put stress on the natural water cycle, climate change and pollution compromise the capacity to tap out and distribute water (Azarpanah & Hajgozar 2012; Castro, Merztha, & Veenhuizen 2010). Of many sectors, urban agriculture is the one which uses the most wastewater, especially in developing countries where it is important for sustainable urban development and poverty alleviation. It creates a considerable proportion of jobs and contributes to urban food

security and nutrition. Moreover, reusing wastewater for irrigation and fertilisation of green spaces and agriculture helps improve aquatic ecosystems, increases yields and, if properly treated, it could make more clean water available, thus averting the occurrences of water-borne diseases and exposure to hazardous substances (Castro et al 2010, Devi & Samad [s.a.]).

In some countries there have been projects like the one in Peru, which worked with stockholders to influence national legislation on wastewater use, to advocate for inclusion of the issues in the legal framework, and for greening the parks (eco-parks) using wastewater. Furthermore, there is research in progress in many countries to demonstrate the benefits of recycling wastewater and to provide technology for treating and providing easy and low-cost methods of recycling wastewater (Castro et al 2010).

Of many proposed methods, one is the manmade earth dam, which enables the water to settle and become clean by itself. A mechanical and biological process was used whereby the water was kept for five or more days, the particles settled, fixed, and predatorer taken place. Users were advised to avoid direct contact with wastewater and to protect themselves by wearing boots and heavy-duty plastic gloves – “farm to fork” precautions (Switch Training Kit [s.a.]). Using a bio-sand filter is the other method which can clean the wastewater. The method is similar to the sand filter but with the biological interaction to reduce the microbiological risks like those from faecal matter. Further, the cultivators or users recommend planting trees rather than vegetables which might be consumed before cooking (Doerr & Lehnkuhl 2008; Water and Sanitary Program 2010).

2.3.3 Environmental health regulations and their applications

Preventing or reducing or overcoming inconveniencies and challenges posed by the urban environment requires various practical and proven measures to be put in place. These inconveniencies and challenges include overpopulation, inadequate provision of public services, lifestyle, poverty, air pollution and sound irritation that are determined by physical, chemical, biological, social, and psychosocial factors in the environment (Srivastva 2007:8). Environmental health regulations, therefore, refer to

the application of the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially adversely affect the health of the inhabitants and the generations to come (WHO 2005).

Public health laws provide coverage of a broad range of public health risks, and environmental health started off as environmental sanitation during the phase of urban development in the nineteenth century (Kalbermatten 2007; Miles, Espiritu, Horen, Sebian & Waetzig 2010; The United Nations University 2010; WHO 2003). The link between environmental health and the unsanitary conditions under which people lived, was recognised and considered as the source of many diseases – and improvements to the environment were given due consideration to prevent the diseases and improve the health of the population (Agenbag & Kaipa 2010; WHO 2003).

Improvements in the health status of Western populations at the turn of the twentieth century have resulted primarily from the social, dietary, built and material environments, improved sanitation and other deliberate public health interventions (Aiello, Larson & Sedlak 2007; McMichael & Robert 2009). However, in less developed countries, health gains have been delayed and were the outcome of increased literacy, family planning, improved nutrition, and vector control, assisted by the transfer of knowledge about sanitation, vaccination, and treatment of infectious diseases, partly through global and local development initiatives (McMichael & Robert 2009). The impact of the environment on health is significant. The World Bank asserts that environmental health effects account for at least 20 percent of the burden of disease in the world, that the environmental health burden of disease is equivalent to approximately 6 percent of the 1998 nominal GDP in sub-Saharan Africa, and that improvements in environmental health can be very beneficial to the poor (The World Bank 2010). Adequate environmental management for the benefit of humans can prevent many diseases (Baflour [s.a.]).

The environmental health services which are provided by the municipalities of most countries include adequate and safe water supply, environmental and public health disease control, basic sanitation and safe disposal of solid, toxic and hazardous waste, as well as solid and liquid waste management. In addition, there is control of air and water pollution, chemical and food hygiene and safety. The list which is considered by

most of the countries is not limited to the above-mentioned issues: it includes radiation, noise, vector and vermin control and maintaining a safe human habitat, plus port and occupational health and accident and disaster prevention and control (Baflour [s.a.]). These services are usually rendered by environmental health practitioners and, in some countries, environmental health technicians. In most developing countries, environmental health services are provided by the Ministry of Health while, in developed countries, such services have been handed over to the ministry responsible for the environment (Agenbag & Kaipa 2010; Baflour [s.a.]).

2.4 HEALTH PROMOTION AND ECOHEALTH APPROACH

Health promotion is a systematic and effective, efficient and sustainable approach to achieving good health. It uses different strategies to influence and bring about changes in the behaviour and environment of individuals, groups and communities, to improve health. It uses a combination of strategies and effective health promotion methods, recognising the behavioural and the environmental factors which are responsible for the individual and the collective health. While the EcoHealth approach of integrating different health promotion strategies to understand both causative factors which could be environmental, social and economic, and behavioural factors, it enables the programme managers to design strategies which are capable of addressing the problem without ignoring the different ecosystems.

2.4.1 Health promotion

Health promotion is “the process of enabling people to increase control over the determinants of health, and thereby to improve their health”, as defined in the Ottawa Charter (Sharma 2012; World Health Organization 2012: 8). The concept is seeking to understand and address the complex situations of social, environmental, and political factors that underpin health (e.g. peace, shelter, education, food, stable ecosystem, social justice, equity) rather than focus on factors that cause diseases (Butler & Sharon 2006). Its view implies that human rights, equity, empowerment and engagement fundamental to health promotion and good health are means to a productive and enjoyable life (Voncina, Ognjen & Gordana 2009; World Health Organization 2012.).

The themes of health promotion often centre on fiscal and legislative measures aimed at building healthy public policies (Mercier & Sperber 2011; Mittelmark 2008). These include seeking to radically transform and empower communities by involving them in activities that influence their public health – particularly via agenda setting, political lobbying and advocacy, critical consciousness raising and social education programmes. Health promotion looks to develop and reform social structures by developing participation between representative stakeholders in different sectors and agencies (Mercier & Sperber 2011).

2.4.1.1 Health promotion theories

Assumptions and hypotheses relating to strategies and targets of intervention can be articulated through the use of theory. Debates among policymakers concerning public health programs are often complicated by unspoken assumptions or confusions about which data are relevant (Heimburg 2010; US Department of Health and Human Services 2005; Webster & French 2002). Theory can inform these debates by clarifying key constructs and their presumed relationships. Especially when the evidence base is small, advocates of one approach or another can be challenged to address the mechanisms by which a programme is expected to have an impact. By specifying these alternative pathways to change, programme evaluations can be designed to ensure that, regardless of the outcome, improvements in knowledge, programme design, and implementation will occur (US Department of Health & Human Services 2005).

There are a number of significant theories and models that underpin the practice of health promotion. It would be useful to make a differentiation between theories and models. Theories provide an integrated set of propositions that serve as an explanation or prediction of a phenomenon to provide a basis for explaining certain happenings in life (Coreil 2008; Portillo, Barbolla, Arredono & Uriarte 2008). A model is referred as a subclass of a theory/framework or structure that informs and shapes health promotion work by providing a set of values, tools (knowledge and skills) and practice. But a model does not attempt to explain the processes underlying learning, but only to represent and to provide the vehicle for applying the theories (Lima 2009; Coreil 2008).

The main models and theories utilised for health promotion can be summarised into three:
(1) Those theories that attempt to explain health behaviour and health behaviour change by focusing on the individual;
(2) Theories that explain change in communities and community action for health; and
(3) Models that explain changes in organisations and the creation of health- supportive organisational practices.
Some examples of traditional theories focusing on the individual and changes in health behaviour at individual level included the:

- Health Belief Model;
- Theory of Reasoned Action and Planned Behaviour;
- Trans-Theoretical (stages of change) Model; and the
- Social Learning Theory.

Theories used to promote health at community level are

- Community Mobilisation, Social Planning;
- Social Action; and
- Community Development and Diffusion of Innovations.

Theories in the third category include theories of organisational change (US Department of Health and Human Services 2005).

2.4.1.1.1 Behavioural changes models which focus on individual and interpersonal behavioural changes

a. Health Belief Model

This is possibly the best known model in public health, and also the oldest one, taken from social psychology, and it was developed in 1950s (Hazavehei, Tagadisi, & Saidi 2007). According to this version, action in the Health Belief Model (HBM) is guided by: (1) beliefs about the impact of illness and its consequences (threat perception) which depend on perceived susceptibility or the beliefs about how vulnerable a person consider himself or herself to be in relation to a certain illness or health problem and

perceived severity of the illness (or health problems) and its consequences; (2) health motivation, or readiness to be concerned about health matters (This factor was included later in the HBM, in 1970s.); (3) beliefs about the consequence of health practices and about the possibilities and the effort of putting them into practice. The behavioural evaluation depends on perceived benefits of preventive or therapeutic health practices and perceived barriers, both material and psychological (for example "will-power"), with regard to a certain health practice. (4) Cues to action: these include different, internal and external factors that influence action (e.g. mass media, campaigns, advice from relevant other like family, friends, health staff, etc.). (5) Beliefs and health motivation are conditioned by socio-demographic variables of class, age, gender, religion, et cetera and by the psychological characteristics of the interviewed person (personality, peer group pressure etc.). See table 3 for intervention level (Hazavehei et al 2007; and US Department of Health and Human Services 2005).

While there is evidence that perceived susceptibility, severity, benefits and barriers of the Health Belief Model are relevant factors in health behaviour, the Health Belief Model neglects further determinants which are present in other models, such as previous experiences, advantages of maladaptive behaviour, behavioural intention, perceived control and so on (Grundy & Annear 2010).

b. The Theory of Reasoned Action and Theory of Planned Behaviour

The theory of planned behaviour (TPB) was developed by Ajzen and is an extension of the earlier theory of reasoned action. Both have been developed and amply used in HIV/AIDS research. They centre on factors which lead to a specific intention to act, or behavioural intention, which the TPB situates between the attitudes and behaviour (Krzeski 2011; Sommer 2012). The centrality of behavioural intention questions the classical Model of Belief, Attitude, and Behaviour and has three levels; individual, interpersonal and community levels (see Table 3 for intervention level and focuses). In the TPB, behavioural intention is determine by: attitudes towards behaviour, determined by the belief that a specific behaviour will have a concurrent consequence, and the evaluation or valorisation of this consequence:

- subjective norms or the belief in whether other relevant persons will approve one's behaviour, plus the personal motivation to fulfil the expectations of others;

- perceived behavioural control, determined by the belief about access to the resources needed in order to act successfully, plus the perceived success of these resources (information, abilities, skills, dependence or independence from others, barriers, opportunities etc.);
- Socio-demographic variables and personality traits which condition attitudes, subjective norms and perceived behavioural control; (These are the same as in the HBM.)

The advantage of the TPB is clearly the taking into account of motivational aspects of personal disease control and the influence of social networks and peer pressure. Unfortunately, the TPB approach has scarcely been used outside STDs/AIDS research (Muela, Joan & Isaac 2003).

c. Trans-theoretical (Stages of Change) Model

Trans-theoretical (Stages of Change) Model was developed by Prochaska and DiClemente (Wirth 2004). The core constructs of the Stages of Change (Trans-theoretical) model describe the stages and processes people go through when changing behaviours. In this model behaviour change is viewed as a process, not as an event, with individuals at various levels of motivation or "readiness" to change (Sohn 2000; Centre for Diseases Control 2007). The Trans-theoretical Model is stage oriented rather than action oriented. It is facilitative rather than imposed (King & Piggott [s.a.]). The stages of change include: (1) Pre-contemplation – during which the person has no intention to adopt (and may not even be thinking about adopting) the recommended protective behaviour; (2) Contemplation –during which the person has formed either an immediate or long-term intention to adopt the behaviour but has not, as yet, begun to practise that behaviour; (3) Preparation – during which there is a firm intention to change in the immediate future, accompanied by some attempt to change the behaviour; (4) Action – during which the behaviour is being consistently performed but for less than six months; and (5) Maintenance – the period beginning six months after behaviour change has occurred and during which the person continues to work to prevent relapse (CDC 2007;Shumaker, Ockene, & Riekert 2009 (eds); Toscos & Connelly 2009).

d. Social Learning Theory.

Social Learning Theory is derived from the work of Albert Bandura, which proposed that social learning occurred through four main stages of imitation: close contact, imitation of superiors, understanding of concepts and role model behaviour (Sanditov [s.a.]). This theory has sometimes been called a bridge between behaviourist and cognitive learning theories because it encompasses attention, memory, and motivation (Learning Theories.com 2008).

Social Learning Theory focuses on learning that happens within a social environment and emphasises the premise that people learn from one another by means of observational learning. The theory argues that individuals are strongly influenced by society's reward and punishment systems and model their behaviours accordingly (Learning Theories.com 2008). Please see Table 2.2, Summary of Health Promotion Theories: Focus and Key Concepts.

Table 2.2: Summaries of health promotion theories: focus and key concepts

Intervention level	Theory	Focus	Key concepts
Individual Level	Stages of Change Model	Individual's readiness to change or attempt to change toward healthy behaviours	Pre-contemplation Contemplation Decision/ Determination Action Maintenance
	Health Belief Model	Person's perception of the threat of a health problem and the appraisal of recommended behaviour(s) for preventing or managing the problem	Perceived susceptibility Perceived severity Perceived benefits of action Cues to action Self-efficacy
Interpersonal Level	Social Learning Theory	Behaviour is explained via a 3-way, dynamic reciprocal theory in which personal factors, environmental influences and behaviour continually interact.	Behaviour capability Reciprocal determinism Expectations Self-efficacy Observational learning Reinforcement
Community Level	Community Organization Theories	Emphasises active participation and development of communities that are more able to evaluate and solve health and social problems.	Empowerment Community competence Participation and relevance Issue selection Critical consciousness
	Organizational Change Theory	Concerns processes and strategies for increasing the chances that healthy policies and programmes will be adopted and maintained in formal organisations.	Problem definition (awareness stage) Initiation of action (adoption stage) Implementation of change Institutionalisation of change
	Diffusion of Innovations Theory	Addresses how new ideas, products and social practices spread within a society or from one society to another	Relative advantage Compatibility Complexity Trial-ability Observe-ability

Source: Modified/copy; Frost, R. 2008. http://azrapeprevention.org/sites/azrapeprevention.org/files/2008_01_UA.pdf

2.4.1.1.2 Behavioural changes models which focus on group or community level behavioural changes.

a. Community Organization Theories

In recent years, community organising has gained a great deal of attention due to several factors: the success of community organising efforts to advance educational reform, low-income housing, health-care reform, and environmental justice (Wood 2009; Pastor 2005). It is a process through which community groups are helped to

identify common problems, mobilise resources, and develop and implement strategies to reach collective goals (Wood 2009).

Strict definitions of community organising assume that the community itself identifies the problems to address (not an outside change agent). Community organising is consistent with an ecological perspective in that it recognises multiple levels of a health problem (Minkler, Garcia & Rubin 2012; US Department of Health and Human Services 2005). It can be integrated with socio-culturally-based (SCT-based) strategies that take into account the dynamic between personal factors, environmental factors, and human behaviour (US Department of Health & Human Service 2005).

Theories of social networks and social support (exploring the influence of social relationships on health decision making and behaviour) (Glanz, Rimer, & Viswanath 2008; US Department of Health and Human Services 2005) can be used to adapt community organising strategies to health education goals. Social (exploring how organisations in a community interact with each other and the outside world) is also useful for this purpose (US Department of Health and Human Services 2005).

Community organising is not a single mode of practice; it can involve different approaches to effecting change. Jack Rothman produced the best-known classification of these change models, describing community organising according to three general types: locality development, social planning, and social action. These models sometimes overlap and can be combined (US Department of Health and Human Services 2005).

- Locality development (or community development) is process oriented. With the aim of developing group identity and cohesion, it focuses on building consensus and capacity.
- Social planning is task oriented. It stresses problem solving and usually relies heavily on expert practitioners.
- Social action is both process and task oriented. Its goals are to increase the community's capacity to solve problems and to achieve concrete changes that redress social injustices.

The different approaches broadly classified as community organising have in common several concepts that are key to achieving and measuring change. Empowerment describes a social action process through which individuals, organisations or communities gains confidence and skills to improve their quality of life (US Department of Health and Human Services 2005).

b. Organizational Change Theory

Experts define organisations as complex and layered social systems, composed of resources, members, roles, exchanges, and unique cultures. Over the years there have been many efforts to improve the performance of one organisational category: health systems. In addition, other organisations influence health. Theories of organisational change help to identify ways to influence the adoption and institutionalisation of health-promoting policies and programmes within organisations (Murphy 2004:8).

Organizational change theory addresses the processes and strategies for creating and sustaining change policies and procedures that influence the success of programmes in the organisation (Glanz et al 2008). Organizational Stage Theory is based on the observation that organisations, like individuals, pass through a series of stages as they change. Thus, interventions can be focused on moving the organisation from one stage to the next. Groups can be resistant to change and need encouragement, new skills, and confidence to make a successful transition. An organisation begins the process by first defining a problem and identifying solutions; and management or workers might be the first to identify a problem and propose solutions. The next step is to initiate an action to address the problem and allocate resources to implement the change. The implementation stage follows and initial changes occur, then more change until the problem is solved. The last step – institutionalisation – is critically important. Without incorporating the changes as an on-going part of the institution, problem identification and problem solving are expensive, ephemeral exercises (Murphy 2004).

c. Diffusion of Innovations Theory

Diffusion of Innovations theory addresses new ideas, products, and social practices spread within an organisation, community, or society, or from one society to another (Robinson 2009:1). An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption. The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption (Sahin 2006; Robinson 2009).

In Diffusion of Innovations Theory, the proportion of respondents to the innovations or required changes for new behaviour estimated/rated is as follows: Innovators – 2.5 percent, early adopters – 13.5 percent

2.4.1.2 EcoHealth Approach

Published articles on environmental health interventions, instead of understanding and intervening on social or behavioural processes, have focused largely on risk factors such as reduction or removal of hazardous substances (Parkes et al 2008). Researchers have begun exploring how the application of health promotion models and incorporation of social and behavioural theories may serve to enhance the traditional environmental health interventions (US Department of Health and Human Services 2005; Fleckenstein 2006). The new approach which is an ecosystem approach to human health is a holistic and enables to explores the relationships between various ecosystem components that define and determines human well-being including health (Dakubo 2011; Guldbrandsson & Sven 2005). The ecohealth recognises the inextricable links between humans and their biophysical, social, and economic environments that are reflected in an individual's health (Eldis community group 2009). The approach is cognizant of the heterogeneity of communities, and is especially attentive to vulnerable groups, such as women, children, the elderly and other groups that may be part of a socially, politically, and economically disadvantaged ecosystem (IDRC 2004).

Ecosystems in this approach are defined relative to the research problem. They refer to social, political, economic, and ecological subsystems in interaction, on both a

temporal and a spatial scale. These contexts are altered by human activities (or stressors) and the stressors in turn have positive or negative effects on individuals and communities involved (IDRC 2004). The approach currently has three core elements or pillars and is trans-disciplinary, featuring social and gender equity and stakeholder participation (IDRC 2004; Butler & Sharon 2006).These elements are key to improving health and wellbeing since they allow for an understanding of change that explicitly links the interacting subsystems. As we learn the requirements for understanding the interactions between society and science and among various subsystems of the ecosystem, these core elements continue to evolve at the same time (IDRC 2004).

Ecological health promotion models are among the many tools that the environmental health and public health promotion researchers are providing to improve public health promotion activities (Crosby, Michelle &Ralph 2008).

2.4.2 Ecological stress process model

The Stress Process Model focuses on stressors, conceptualised as “environmental demands that tax or exceed the adaptive capacity of an organism resulting in psychological and biological changes that may place persons at risk of disease” (Chitnis, Rane, Vij & Gupta 2013:5). These environmental demands may be physical environmental stressors or social environmental stressors. The Stress Process Model draws on work from multiple disciplines to provide a comprehensive and integrated theoretical framework that can be used to guide the conduct of public health interventions (Parkes et al 2008; Schulz , Edith, Barbara, Alex, Maggi & Muslisa 2002).

Models presented by Parkes et al 2008 and Schulz et al (2002), suggests that there are five categories of stressors: ambient environment, major life events, daily hassles, chronic strains, and cataclysmic events.

- *Ambient environmental stressors* are the continuous conditions that exist in the physical environment that can affect an individual. Examples of ambient environmental stressors may include exposure to hazardous materials (toxic residuals and pathogenic organisms), high lead levels, high noise levels, or,

high levels of particulate matter or high levels of indoor allergens, absences or shortage of safe and clean water.

- *Major life events* are discrete events that occur and disrupt or threaten to disrupt normal activities. Major life events, whether seemingly positive in nature, such as the birth of a child, or seemingly more negative in nature, such as the death of a loved one or a divorce, can be sources of stress due to their disruption of normal activities.
- *Daily hassles* are the ongoing minor events that may be perceived as bothersome, for example, meeting deadlines, or daily traffic commute, interruptions of supplies of utilities and goods (water, electricity, and detergents).
- *Chronic strains* are challenges that people experience over time, such as poverty, unemployment, racism, or economic disinvestment.
- *Cataclysmic events* are sudden physical environmental disasters such as floods, toxic spills, or major fires, and harvest losses that necessitate major adaptive responses. Cataclysmic events are essentially rare but, when they occur, environmental health practitioners are often brought in to assist communities in these crisis situations.

Although exposure to some objective stressors (e.g. exposure of asthmatic children sensitised to a particular allergen) may directly affect health, the health effects of exposure to other stressors depend in part on the extent to which those exposed to them perceive them to be stressful (Parks et al 2008).

Major life events, daily hassles, and chronic strains are important to consider in environmental health promotion programmes because they can be sources of stress that might hamper an individual's ability to undertake suggested behaviours to reduce exposure to a stressor (Parks et al 2008).

The degree of perceived stress may be affected by many of the concepts identified in the Health Belief Model, such as perceived susceptibility and perceived severity of the stressor. Both direct environmental exposures and perceived stress concerning exposure to environmental and other stressors may lead to short-term responses

(Parkes et al 2008). These short-term responses may occur at different levels of the ecological framework and include the following: *physiological short-term responses* (e.g. wheezing episodes in asthmatic children, elevated blood pressure), *psychological short-term responses* (e.g. anxiety attack of acute or chronic diseases, minor depression), *behavioural responses* (e.g. hand washing, smoking, alcohol use), *physical/structural responses* (e.g. residents relocate to different housing, abandoned housing), and *socioeconomic responses* (e.g. income loss due to harvest loss for self-employed urban agriculturalists, price changes of the products, reduction of jobs) (Parkes et alSchulz et al 2002).

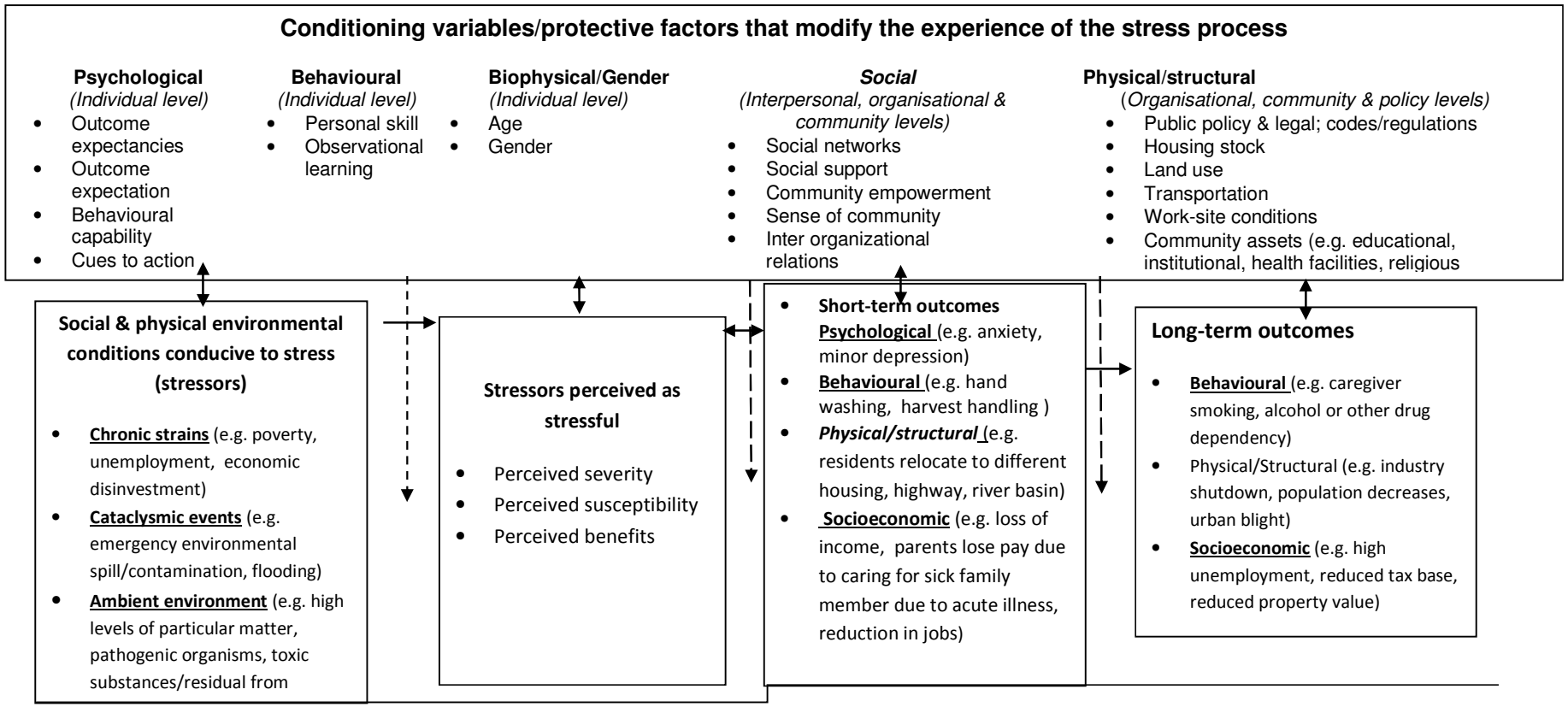


Figure 2.2: Ecological stress process model for environmnetal helth promoton

Source: Adopted from: Parker, Baldwin, Israel & Salinas (2004) http://www.citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.134.8224...

Note: Solid lines between boxes indicate presumed relationships. Dotted lines indicate **hypothesised** buffering effect of modifying variables on relationship between stressors and perceived stress, between stress and short-term response, and between short-term response and long-term response to stress.

This model is modified to (1) identify the relationships between ecological conditions (physical and social environment) and environmental health on the Little Akai River basin; (2) design specific health promotion intervention to address factors for environmental health problems and strengthening conditioning variables; and (3) identify strategies and policy direction to strengthen partnership among different actors (public, private and community organisations). Urban agriculture practitioners and their family members, key informants from the community (women and youth and employee in public and private sector who engaged in environmental protection activities) in the study area were the primary focuses of this study and were the primary actors in the process.

2.4.3 Advantages and limitations of using an EcoHhealth promotion methods

The health promotion theories and models which aimed at individual and group levels targets changes on behavior or promoting good behavior for the intended targets. While the ecological health promotion theories/model expands responsibility for health beyond the individual and targeted the community and environment. These approaches enhancing participations and calls for community leadership to improve health. Its' dimension expanded and includes person, people, place, institute and community. No single variable cause for approved and disapproved behavior change (Charron 2012: 94, Parkes et al 2008).

Moreover, it is paradigm shift compared to the other models (models which intervene on intrapersonal and interpersonal level). The ecological health promotion theories/models involve multiple disciplines, theories and models. The ecological analysis characterized environmental settings as having physical, social and cultural dimensions that can influence a variety of health outcomes, being physical and emotionally well, developmental maturation and social cohesions (Charron 2012: 94; Davies & Macdowall 2006:36). Its major strength over the other individual and group focused behavioral change theories/models. This approches integrates gain in behavior changes and

environmental enhancement within a broad frameworks. However, ecological health promotion models reflects certain practical limitations. Most importantly ecological models require the integration of knowledge from several different disciplines and close coordination among persons and groups from various sectors of the community. Uniquely it use combined passive and active interventions and multi-level and methods assessments of program outcomes over extended period for long period makes the logistics complex and expensive (Davies & Macdowall 2006:36). In contrast to the other models for example, behavioral change and environmental enhancement and restructuring models. However, the ecological health promotion models uniquely integrates the different environment (for example physical, social environment) and preferred method over the behavioral change and environmental enhancement models described in the above section (Charron 2012: 7).

2.5 THE CONTEXT OF THE STUDY AREA

The rapid population growth and urbanisation in Ethiopia has similarly been putting tremendous pressures on the urban centres, not least in terms of environmental degradation. For instance, 35 percent of the solid waste generated by the Addis Ababa city is not collected (Gebreselassie 2007). River, soil, air and water pollution as a result of industrial wastes, is poorly managed, and is becoming a growing concern in Addis Ababa (UN-HABITAT 2008).

2.5.1 Local level action

The current government (EPRDF) has made opportunities possible for the socioeconomic development of the country, based on the decentralisation and democratisation of the health system. Health policies and strategies, prospective health plans in health sector development programmes (HSDPs), and health extension packages serve as backgrounds for the development of environmental health services

(FMOH 2005b:13; Saharty, Kebede, Dubusho & Siadat 2009). In terms of a Public Health Proclamation issued in 2000, each regional state was delegated to formulate region-specific policies, regulations, and to develop its natural and human resources. Based on the 2000 Public Health Proclamation, regions have endorsed Environmental Health Regulation: focused solid and liquid waste management (FMOH, 2005a:21; Saharty et al 2009).

Accordingly, the Addis Ababa City Administration, and the Regional States of Amhara, Tigrai, and Oromia have enacted hygiene and environmental regulations. These regulations have brought together the previous fragmented ones under one core set of sanitary regulations. New additions like the prevention of noise and air pollution were also included in the regulations. They have also explicitly indicated the kind of measures that would be taken in cases of sanitary violations. Power delegations to exercise the provisions of the regulations were also clearly indicated: environmental health workers (environmental health inspectors) and sanitary guards for managing technical matters and sanitation petty officers, respectively as in the case of Addis Ababa City regulation (Kume & Ahmed 2005: 89).

As stated in Table 2.3, the Federal Ministry of Health has facilitated the Public Health Proclamation No 200/2000 which concentrated on the hygienic aspect of water, air, soil, and workplaces to structure and harmonise the existing regional specific sanitary regulations (Kume & Ahmed 2005: 89; Saharty et al 2009).

With the view to facilitating maximum community participation and accountability on the part of the health service providers, the Urban Health Extension Programme strives to work on the basic principle that ensures provision of services at the level closest to the recipients. Unlike the facility-based health service approach, environmental health practitioners work in the community. This, therefore, would enable them to properly understand and monitor developments in health conditions on the ground and to provide solutions that are more realistic, due to their proximity to the community. This proximity

also ensures the making of timely interventions (FMOH, 2005b:27 and FMOH, 2005a:23).

However, the applications of these regulations is varied in every level and plagued by numerous challenges. These challenges include low public awareness of the various regulation section, limited capacity of the regulatory sector and lack of infrastructure including technology to measure stated standards or monitoring. To improvise and scale up well-accepted coverage of regulations, further assessment including operational researches are required to identify strategy in order to promote its applications and increase the awareness of the various stakeholders, policy makers, private and public sectors, private for non-profit-making groups, and the general public.

2.5.1 The environmental health conditions and challenges in the urban centre of Ethiopia

Urbanisation is a product of population change: the size, the mix and the technological advancement and demanding huge volume of foods and supplies. The by-product in return has produced diverse and big volumes of liquid, solid and other forms of wastes (chemical, radiological, and pathogenic). Moreover, the informal and congested settlement and individual households, the public and the private sector behaviour and actions relating to waste disposal in urban centres make it difficult to monitor, prevent and control (Girardet 2004: 125; The Blue Planet Prize Laureates 2012). Low public awareness and limited involvement of the media and other stakeholders in the promotion of EcoHealth is also contributing to the poor urban health situations in developing countries. In addition, bio-physical changes and externalities have added pressure to the environmental health situation in the urban centres in developing countries (The Blue Planet Prize Laureates 2012). Over and above these, the sectors responsible for environmental protection and the public health, for example, the municipality and the environmental protection offices' capacity is limited and has not been able to properly and regularly monitor and reinforce the existing environmental health standards and regulations in these countries.

At the same time, the sanitary conditions in the urban centres of Ethiopia are generally poor. Safe water supply and the provision of latrine services reported in the recent development and health survey were 95 percent and 84 percent respectively in urban Ethiopia but overall provision was 54 percent improved access to water sources and 65 percent for any form of latrine provision (Central Statistical Agency [Ethiopia] & ICF International 2012:33), and the capacity for proper collecting and managing of solid waste by municipality and designated departments in the Woreda administration was reported to be very low by Regassa and his colleagues (Regassa, Undaraa & Seboka 2011). The urban centre, especially Addis Ababa, is suffering because the city is rapidly increasing in size, which is due to the population growth, rural-urban migration and the change in the economy development, respectively. The country reported 7 to 11 percent economic growth in the last three years and this indicates that many more industries and process and service centres will be needed, and the shift from an agriculture-led economy to an industrial and service-oriented sector will create additional jobs and attract more labour to the centre and the vicinity (Guteta 2007).

The factors mentioned, therefore, are increasing the volume of liquid and solid wastes, including the kinds and levels of air and noise pollutions. The air pollution stems mainly from vehicles, the various industries (very limited scale) and the indoor pollution in households (Indian Institute of Management 2010; Stoop (ed) 2009). Music shops, bars and nightclubs, flourmills, and religious institutions are indicated for the noise pollution (Gebre, Feleke, Demissie, 2010; Stoop (ed) 2009; Tesafye & Gebru 2011 (eds); Worku 2008).

However, the capacity to collect and manage the wastes timeously, the technology used for collection, recycling and the management are the longstanding challenges for both the community and the responsible public sector offices such as Addis Ababa Water and Sewerage Authority, the desk in the woreda administration for solid waste collection and disposal administration (Gebreselase 2007; UN-Habitat 2008).

Moreover, failure to comply with the existing regulation, and to conduct and implement recommendations of the environmental impact assessment and to carry out follow-ups plus failure to include the waste management plan in the newly established and the existing factories, processing centres and services establishments all contribute to the environmental health problems in the Addis Ababa and the vicinity. Furthermore the unattended solid and liquid wastes in community and public places are affecting the environment, the land fertility, and underground and surface water bodies (Kume & Ahmed 2005:89; UN-Habitat 2008).

Of the many future threatened sites in the urban centre, it is the river basins which are the most exposed to points (industries and establishments – and households) that are sources of wastes. Most industries and processing centres (hide and skin, food and other kinds of production centres) in Addis Ababa are established close to the river basin, especially the two Akaki Rivers (Big and Little Akaki Rivers). The main reason for the selection of these locations was partly to access the established links with the river water and to discharge the by-products and wastes directly into the river (Mohammed 2007). Again, it is the contaminants (chemicals, minerals from the environment) and the existence of the landfills which are found close to the Little Akaki River that increase the pollution levels (Beyene & Banerjee 2011; Mohammed 2007; Tegegn 2012). The results of the available studies in these regard indicate that the physical, chemical and the pathogenic organisms (micro-biological analysis reports) in the two Akaki Rivers are beyond the national and the WHO standards for river water quality as well as the national standard issued by the Ministry of Water Resources (Ministry of Water Resources Ethiopia 2008). The most common contaminates reported by the different authors include radio-active minerals, fluorides, metals, faecal matter (Tegegn 2012).

Prabu (2009) in his study identified and analysed seven heavy metals Cd, Cr, Cu, Zn, Mn, Fe and Ni and the result indicated that the concentration of the heavy metals in Akaki River water was higher than the natural elemental levels in freshwater. The heavy metals content in soil was higher than vegetable samples. Tegegn (2012) in his study results also reported the nitrate and phosphate concentration of the Little Akaki River water was

beyond the WHO standards for river water quality parameters. Furthermore, Mohammed (2007) reported the high concentrations of potentially harmful substances such as heavy metals (Fe, Mn and Cr), ammonia, hydrogen sulphide, sulphates and phosphates in the different courses of the Akaki River.

Despite the fact that the environmental condition of the river basin is deteriorating, however, various population groups, including the government, are engaged in socioeconomic activities around the river basin. For example, the vegetable growers use the water for irrigation and harvest cleaning, urban agriculturists are growing fodder for domestic animals and letting the animals drink from the river, the poor are scavenging for scraps and salvaging items to sell. Furthermore, the built environment is extending into the river basin (formally and informally), leaving only a few meters between the river and housing units or the public or private sector buildings or premises. This means that those who are in direct contact with the wastewater, like practitioners and community members who are interacting with the vegetable growers (vendors and people who consume vegetables from these sources) and the rest of the population who are living around, are exposed to the above-mentioned harmful substances (Gebre & Rooijen 2009; Rooijen & Taddesse 2009, Weldesilassie 2010). The risk is not, however, limited to direct contact with polluted water, but extends to the products: metallic and radio-active chemicals absorbed by the vegetables' root systems could causes chronic illness when consumed over a long period. Mekonnen's (2007) plant tissue analysis report for selected vegetables which were produced using the Little Akai River provided evidence of the presence of zinc, copper and chromium (Mekonnen 2007).

In most traditional societies, especially in developing countries, it is usually women and the youth who do most of the handling, collection and disposal of wastes from different sources. As mentioned above, the population influx (migrants from rural to urban localities) together with residents of the city, those unable to find employment opportunities are the ones engaged in the collection and disposal of solid waste in Addis Ababa. Moreover, in the households, it is women or young girl children who take responsibility for various household chores, including collection, storage and disposal of

solid and liquid wastes (Galinsky, Auman & Bond 2011; Reddy 2004, WHO 2010). Thus, it is necessary to understand the environment in which women and young people are living in order to improvise workable strategies and promote the environmental health of these groups: women, youth (including children) and the elderly.

In the light of the growing trends: the population, size, the economy and the expansion of the city, it is important to explore the possible causes, potential strategies and courses of action to improve the sanitary conditions of the river basin and protect the public from potential diseases, disabilities and mortality caused by these sources.

2.5.2 The modern health services and environmental health activities development and challenges in Ethiopia

The introduction and use of modern health services and an environmental health programme in Ethiopia goes back to beginning of the twentieth century and has come a long way from the traditional medicine-based approach to the current Sector-Wide Approach programme (Derso 2010:1; Hailemariam & Kloos 2006:229; Kassaye, Alemayehu Binyam & Yunis 2006:1; Kume & Ahmed 2005:89).

At the beginning of the twentieth century, the modern health services in the country were provided by a few clinics and hospitals which were owned by the government and mainly religious missions. But encouraging progress was made when, in 1908, the Government health department was established within the Ministry of the Interior. This department was responsible for the health of the people for the first time in Ethiopia and this phase extended to 1936 when it was interrupted by the Italian invasion (the second time there was an invasion) (Kitaw, Teka, Meche, Hailemariam, & Fantahun 2012:28; Hailemariam & Kloos 2006:230). The Italian invasion period (1936-1940) reintroduced the western health care after the destruction of all that had been developed by the country. However, the efforts which the colonial regime made benefited only the occupying and settling Italians and almost none of the Ethiopians (Hailemariam & Kloos 2006:230).

After the departure of the invading Italians, in 194,1 the introduction and development aspect of modern medicine in Ethiopia continued (Hailemariam & Kloos 2006:230). The country's health system evolved through four restructuring phases:

- **First phase – reconstruction (1941-1953)**: In 1942, the Directorate of Medicine was established to undertake medical and public health services. The issue of sanitation was considered as a domestic affair during that time. The Ministry of Interior consolidated its power to exercise decisions over health matters during the post-Italian invasion period through the Public Health Proclamation of 1942, P26, and legal notices following its mandate in sanitation: 2/11 (1943) L25, 2/11 (1943) L26, 7/1(1947) L104 (13) (Kitaw et al 2012:52; Kume & Ahmed 2005:89, UN Habitat 2008).
- **Second phase – the basic health service period (1953-1974):** This phase started in 1947 with new organisation and tasks and the period ended in 1974. During this period health service activities were carried out through four consecutive five-year plans. The emphasis was expansion of decartelized, primitive, preventive, and curative health services, especially to the rural population, the control of communicable diseases being given more attention (Hailemariam & Kloos 2006:230; Kitaw et al 2012:67). During this phase the Public Health Proclamation No 91/1947 had opened the way widely for the development of environmental health services in Ethiopia.
- **Third phase – the primary health care (1974-1991):** From late 1970s to end of 1989 (phase three) the socialist regime took power and adopted Primary Health Care (PHC) to suit its Health Policy statements. Drinking water and sanitation became formal components of PHC. Ethiopia, during this time, had adopted a ten-year perspective plan which the PHC activities implemented (Hailemariam & Kloos 2006:235; Kitaw et al 2012: 99; Kume & Ahmed 2005:89).
- **Fourth phase – the sector-wide approach (1991-2002):** The fourth phase entailed restructuring the health policy and shifting into new strategies (1990 to date) (Health Policy, 1993). This phase is the time after the Socialist Regime was overthrown by the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF).

> A new economic and political system was established with decentralisation of powers down to the grassroots level: the expansion of the private sector, democratisation of the social and economic systems, and encouraging of investments form the background against which environmental health services are managed (Forum for environment 2010:4; Kitaw et al 2012:137; WHO 2009).

Moreover, section 151 the Federal Democratic Republic Ethiopia Constitution identifies municipal health service as a municipal function, but there is no specification as to which the type (collective or mayoral or combined or subcouncil system) of municipality it functions under (Kume & Ahmed 2005:89). The Municipal Structures Act 117 of 1998 section 6 and subsection 83-89 provided clarity on the matter by giving district municipalities the function of providing municipal health services (Municipality Structures Act [s.a.]). The Act further provides for the Minister of Regional and Local Government to authorise a local municipality to perform certain functions that are allocated to district municipalities, including municipal health services. Such authorisation is within a framework of consultation, transfer of staff, assets and liabilities (Kume & Ahmed 2005:89).

Furthermore, the Federal Democratic Republic of Ethiopia government issued a proclamation, **Proclamation No 661/2009** to be applicable to regulatory activities in respect of food, medicine, environmental health, health professionals, health and controllable health-related institutions in the country. Article 2, section 3, Article 2, section 29 and Article 30, section 3 are specific to environmental health issues such as occupational health, environmental sanitation focused on institutes and liquid waste management (Federal Negarit Gazeta 2010). See Table 2.2: the summary table for a list of regulations which the central and regional governments in Ethiopia issued in the last two decades.

At the level of the Federal Ministry of Health in Ethiopia, environmental health encompasses the functions that include monitoring all environmental health services in the country, supporting provinces and municipalities, being responsible for the

International Health Regulations, the Hazardous Substances Act, 1973 (Act 15 of 1973), relevant sections of the National Health Act, 2003 (Act 61 of 2003), and cooperating with other government departments on air quality, water treatment chemical safety, health-care waste, and water and sanitation (Kume & Ahmed 2005:89).

Table 2.3: Highlights of environmental health-related laws and regulations

Provisions	Brief Description
Constitution: Proclamation No 1/1995	Expresses the fundamental laws of the nation including health and environment: article 4: All persons have the right to clean and healthy environment.
Health policy in 1993	Expresses that among Others, environmental health, occupational health, and safeguarding of the environment are priority needs.
Public Health Proclamation No 200 of 2000	Provides the basic description of hygiene and sanitation needs for enforcement: water and food sanitation; waste management; ambient pollution control are key areas.
Labour Proclamation: No 377/2004	The enforcement of occupational health requirements and standards in workplaces
Regional regulations: such as No1 of 1994 for Addis Ababa; Regulation No16/2000 of Amhara Region;	Sanitary regulation and guidelines that are enacted by Regional States pursuant to their powers and duties.
Proclamation No 295/2002	Establishing the Environmental Protection Organs
Proclamation No 299/2002	Need for Environmental Impact Assessment
Proclamation No 300/2002	Environmental Pollution Control: wastes; hazardous waste, municipal waste; needs for environmental standards; inspection provisions
Water and Sanitation Policy	Descriptions of the conservation, exploitation, and use of natural water and its protection
Proclamation No 7/1992	Powers and duties of Central and Regional Government
Proclamation No 661/2009	A proclamation to provide for food, medicine and health-care administration control

Source: Kume A & Ahmed A. 2005. *Ethiopian Journal of Health Development:* Vol19, November 2: 88 164; Forum for environment 2010

2.6 CONCLUSION

The Stress Process Model which is a participatory and ecological method that is important for identifying stressors that are responsible for the environmental health of the study area, was used to identify problems and to promote EcoHealth measures (see the section 2.4.2 above).

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research design and methods which were used in this study. The chapter re-states the purpose of the research, describes the study design, study population, sampling and sampling techniques, data collection tools and data collection procedure and analysis. The methods for ensuring validity, reliability and trustworthiness of the research findings and the ethical considerations followed during this research are also discussed. Additionally, the mixed methods and triangulation design, including the methods/types appropriate to this study are presented. The two methods (quantitative and qualitative designs) and three phases, at which this study was conducted, are discussed in detail.

3.2 RESEARCH DESIGN

Alaqeel (2011) described research design as the strategy, the plan, and the structure of conducting a research project. It is a logical framework (the conceptual structure) for the collection, measurement and analysis of evidence to answer questions or to test theories as unambiguously as possible (Kothari 2007:30). When designing research, it is essential that we identify the clear research question and purpose. Asking relevant research questions and stating a clear purpose enable the researcher to collect the right data and consequently to provide the analysis with the necessary input to answer the research question in a convincing way (Boeije 2009; Khalid, Hilman, & Kumar 2012).

Research design refers to the structure of an enquiry: it is a logical matter rather than a logistical one – nor is it related to any particular method of collecting data or any particular type of data. In principle, research design can use any type of data collection method (either quantitative or qualitative data). It has been argued that the central role of research design is to minimise the chance of drawing incorrect causal inferences from

data. This means that we must not simply collect evidence that is consistent with a particular theory or explanation (de Vaus 2011).

As stated above, design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. More explicitly, the design decisions happen to relate to several questions such as “What is the study about?”; “Where will the study be carried out?” and “What types of data are required?” (Kothari 2007:31).

Keeping the above-stated explanations for design decisions in mind, Kothari (2007:32) split the overall research design into four categories: descriptive, correlational, experimental and operational research designs. *Descriptive design:* the sampling design which deals with the method of selecting items to be observed for the given study. *Correlational design:* This is the observational design which relates to the conditions under which the observations are to be made. *Experimental (hypothesis testing):* This design is the statistical design which is concerned with the question of how many items are to be observed and how the information and data gathered are to be analysed. *Operational design*: This deals with the technique whereby the procedure specified in the sampling, statistical and observational designs can be carried out (Vaus 2011; Kothari 2007:32).

Research needs to be structured in such a way that the evidence also has a bearing on alternative rival explanations and enables us to identify which of the competing explanations is most compelling empirically. It also means that we must not simply look for evidence that supports our favourite theories: we should also look for evidence that has the potential to disprove our preferred explanations (Vaus 2011).

By aligning with the research problems and purpose, this study employed descriptive and experimental (quasi-experimental) designs to answer the research objectives that are outlined in the introductory chapter. The descriptive design was used to collect baseline information: knowledge, attitude and practice regarding the EcoHealth,

environmental health regulations and health promotion in urban and peri-urban areas, to assess the influence of women and youth in urban and per-urban ecohealth promotions and protections. Meanwhile, the experimental (quasi-experimental) design was employed to document changes in knowledge, attitude and practice of the urban agriculture, practitioners on wastewater use, hand-washing and proper handling of harvest and farm tools, after introducing the health communication activities (intervention), using the EcoHealth promotion model.

3.2.1 Descriptive study design

Descriptive designs form a type of observational studies in which the investigator observes the events occurring in the population without interrupting or manipulating anything. This research includes surveys and fact finding of different kinds (Kothari 2007:3). These types of studies aim at describing how certain variables are related, without providing explanations for the relationship, and they describe the frequency or possible determinants of a condition (Bordens & Abbott 2011:43, CareSearch 2008). In these studies there are no formal comparison groups and the first step is identifying risk factors, which provides clues for generating a hypothesis or proposed generalisation from observation (Bordens & Abbott 2011:43).

These study designs are further categorised into two; cross-sectional and longitudinal studies (Babbie 2007:98). Cross-sectional studies involve either observations or a single sample or phenomenon or a single examination of a cross-section of population at one point in time (Babbie 2007:98, McBurney & White 2007:341). Results can be projected on the whole population, provided the sampling has been done randomly (McBurney & White 2007:341). While in *longitudinal studies*: observations of the same phenomenon are repeated in the same population over an extended period of time (Babbie 2007:99). These study designs are useful for studying the natural history of disease and its future outcome, for identifying risk factors of disease and for finding out incidence rate in epidemiology researches (Hennekns & Buring 1987:102).

As stated above, one of the designs which this study employed was a descriptive –cross-sectional design for objective I. Detailed procedures and required steps, which were implemented, are discussed in the sections below (see section 3.4).

3.2.2 Experimental study design

Experimental research design refers to the framework or structure of an experiment (Kothari 2007:41). The goal of this design is to establish the possible causal relationships by manipulating selected independent variable to influence the dependent variable(s) in the test group, and by controlling the other relevant variables, and measuring the effects of the manipulation by some statistical means. By manipulating the independent variable, the researcher can see if the intervention makes a difference to the subjects (Bordens & Abbott 2011: 261).

The experimental design is classified into three broad categories: (1) between subjects; (2) within subjects; and (3) single-subject designs (Bordens & Abbott 2011:262). Another form of classification of the experimental design is that of formal and informal designs (Kothari 2007:41). The distinct experimental design characteristics in experimental designs are the principle of replication, randomisation and local control. Formal experimental design (true experimental design) maintains complete control over the who of the experiment and involves two of the above principles: the principles of randomisation and replication (Kothari 2007:41, McBurney & White 2007:265). McBurney & White (2007:265) argued that control over the what, when and how of the experiment means that the researcher has complete control over the way the experiment is to be conducted, and contrasts true experiment design advantages with the quasi-experimental design (another nomenclature of informal experimental design) the control over which by the researcher is impossible.

The randomised controlled trial is the accepted gold standard for the evaluation of interventions in experimental research. However, applying a randomised control trial in population-based settings is challenging. This is because population groups, as opposed

to individuals, become the units of analysis, and recruitment of the typically large sample sizes required may be difficult and expensive. Furthermore, the costs of implementing interventions across multiple entire populations are often prohibitive (Hawkins, Sanson, RW, Shakeshaft, D'Este & Green 2007). Therefore scholars and researchers endorse different alternative methodologies for evaluating population interventions and these includes informal experimental design or the non- randomised control trial such as before-and-after control design, the interrupted time series design, and other, more alternative designs may be potentially suited to population-based intervention analysis (Hawkins et al, 2007, Kothari 2007:41). However, due to potential internal and external biases, the ethical and logistical challenges of removing an intervention from a population group, and the potential lack of generalizability of findings most of them, are not widely endorsed (Hawkins et al 2007).

The informal experimental designs as stated above are best suited to a research project when the ethical issues, the settings, research project cost and the like are concerned (Hawkins et al 2007). The informal experimental designs (single subject designs) are those designs that normally use a less sophisticated form of analysis and are classified into three: (1) before-and-after without control design; (2) after-only with control design and (3) before-and-after with control design. The third option (before-and-after with control design) is superior to the above designs for the simple reason that it avoids extraneous variation, resulting both from the passing of time and from non-comparability of the test and the control area (Kothari 2007:41).

An advantage of before-and-after with control design is that it may be used with as few as two groups, making it relatively inexpensive to implement. However, due to lack of historical data (time) or a comparable control area, using single points of data collection does not allow assessment of the impact of other simultaneously occurring events on the outcomes (Kothari 2007:41). Nonetheless, the recommendation for improving these situations is selecting one of the two informal designs discussed above or using the modified version, for example, multiple baseline design or interrupted time-series

designs. These designs allow the same group to be compared over time by repeatedly measuring and overcoming the mentioned problems (Hawkins et al 2007).

3.2.3 Multiple baseline design

Although multiple baseline design emerged as a potentially useful choice for community-based study as far back as 1968, few efforts have been made to document it and also very little descriptive literature has focused on the multiple baseline design (Hawkins et al 2007). This design investigates multiple persons, traits/behaviour, or settings both before and after an experimental treatment/intervention has been implemented. The key in this research is that the treatment/intervention condition is successively administered to the different people, behaviours, or settings and documents time-series events for analysis (Liu 2010).

Multiple baseline experiments are most commonly used in cases where the dependent variable is not expected to return to normal after the treatment has been applied, or when medical/ethical reasons forbid the withdrawal of a treatment (Grant & Sugerman 2004). The multiple baseline design requires that baseline behaviour is collected on the two or more people, traits/behaviours, or settings and then the experimental treatment or the intervention is successively administered to the people, behaviours, or settings (see Figure: 3.1 design illustration). The experimental treatment effect is demonstrated if a change in response occurs when the treatment or intervention is administered to each person, behaviour, or setting (South Alabama Education [s.a.]).

Multiple-baseline design

		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Different people, different behaviors, or different settings	A	Baseline	Treatment	Treatment	Treatment	Treatment
	B	Baseline	Baseline	Treatment	Treatment	Treatment
	C	Baseline	Baseline	Baseline	Treatment	Treatment
	D	Baseline	Baseline	Baseline	Baseline	Treatment

Figure 3.1: Multiple baseline design

Source: http://www.southalabama.edu/coe/bset/johnson/lectures/lec10.htm

The multiple baseline design advantage over the other single subject designs is that this design avoids the problem of failure to revert to baseline that can exist in other traditional single-subject designs: Baseline-Treatment-Treatment reversal design and Baseline-Treatment-Treatment Reversal-Treatment Design [A-B-A and A-B-A-B designs] (South Alabama Education [s.a.]).

Besides these strengths, however, this design is associated with potential confounds introduced by an experimenter bias which must be addressed in order to preserve objectivity. In particular, researchers are advised to develop all test schedules and data collection limits beforehand (Mack, Woodsong, MacQueen, Guest & Namey 2005:20). Moreover, rival hypotheses are unlikely to account for the changes in the behaviour if the behaviour change only occurs after the treatment effect is administered to each successive person, behaviour, or setting (South Alabama Education [s.a.]). The researchers should therefore consider the following specific methodological recommendations to comply with and improve the internal and external validity of the study (Hawkins et al 2007):

- **Step1:** Identify the target population.
- **Step2:** Match the population units by potential confounders (e.g. demographic characteristics, behaviours).
- **Step 3:** Randomly select the desired number of matching units for analysis.

- **Step4:** Determine the appropriate time and number of measures needed to collect baseline data.
- **Step5:** Select outcome measure (s) suitable for repeated data collection.
- **Step6:** Determine the optimal time interval between intervention implementations in each unit.
- **Step7:** Randomly assign each unit to an order of intervention implementation.
- **Step8**: Implement intervention according to the predetermined schedule.
- **Step9:** Examine outcome using statistical methods suitable for time-series data.

Multiple baseline design is currently a relatively novel, under-used methodology. The strategy to increase confidence in its scientific rigour requires maintaining the following eight rules of causality in all processes of this design application (Hawkins et al 2007) These eight rules of causality are derived from nine rules formulated by Sackett Haynes & Tugwell (cited in Hawkins et al 2007):

- Explore supporting evidences from other data sources.
- Explore whether the intervention effect is strong or not.
- Check whether the findings are consistent across each time series or not.
- Check whether the intervention effect is temporarily consistent across each time series or not.
- Check whether the intervention effect is temporally consistent with the complexity of the intervention.
- Check whether the intervention effect is consistent with fundamental behavioural knowledge.
- Check whether the intervention effect is specific.
- Check whether the intervention effect is consistent in related fields.

To establish basic methodological rigour, researchers employing the multiple baseline design must be able to follow the above steps to show that (1) a change in behaviour has occurred, (2) the change is a likely result of the intervention, and (3) the change is statistically and practically significant (Hawkins et al 2007).

Although the socioeconomic and other variables of the proposed study population are reasonably homogeneous, the study set-up and the ethical concerns geared the design choice to that multiple baselines design. Therefore, this study used this method to apply the EcoHealth interventions (using the ecological behavioural changes model for key problem identification and intervention) in the vegetable producers' community members who are working along the Little Akaki River basin. The baseline and treatment process was observed for a ten-month period. The details are discussed in the relevant section below.

3.3 RESEARCH METHOD

The research purposes and questions direct what approach or conceptual structure to take, the types of data required (qualitative, quantitative or both types of data) and how to pursue more data (Gerhardt 2004; Hasnson, Creswell, Creswell, Clark & Petska 2005; Kothari 2007:31) Determining which method to choose; whether to use qualitative or quantitative research, rested on the purpose and data sets to be analysed. For example, quantitative studies are typically geared towards revealing relationships between variables, while qualitative studies inquire into processes associated with change or individuals' meaning-making, seeking knowledge in variation and in diverse perspectives (Gerhardt2004). Mixing the two approaches helps to reduce researcher bias and allows documentation to be measured and analysed more effectively (Galt 2008; Rocco, Bliss, Gallagher, & Pérezz-Praado 2003). Adding the qualitative method to the quantitative method helps to insure construct validity, as well as internal and external validity, while allowing complex issues to be examined, using the respondents' language (Rocco et al 2003).

3.3.1 Triangulation

Triangulation refers to the use of more than one approach to the investigation of research question in order to assure the validity of the research results. It is a means of overcoming the weaknesses and biases which can arise from the use of only one of the methods and offers the prospect of enhanced confidence (Garbarino & Holland 2009; Ghrayeb, Damodaran, & Vohra 2011; Golafshani 2003; Hussein 2009). Triangulation allows researchers to collect and blend both quantitative and qualitative data from both primary and secondary sources (Golafshani 2003; Hussein 2009; Perone & Tucker 2003). Consistent and stable data are key to replicating the findings, which is of major concern in the quantitative arena, while validity of the qualitative findings are paramount to ensure that data are representative of a true and full picture of the constructs under investigation (Junk 2011; Perone & Tucker 2003). Therefore combining the two methods is useful because then they complement each other which enhances the research design strength and enables the resulting method and findings to be more valid and reliable. The inadequacies of individual methods are minimised and more threats to internal validity are realised and addressed (Perone & Tucker 2003).

The distinct types of combinations that are employed in triangulation methods are data triangulation, investigator triangulation, methodological triangulation and theoretical triangulation (Ghrayeb et al 2011). Denzin (1970, cited in Hussein 2009) listed and described the following four forms of triangulation methods:

- **Data triangulation** involves time, space and persons. This means data or observations were collected at different time periods across different set-ups (cultures, region or districts) and involving a number of different people.
- **Investigator triangulation** uses multiple rather than single observers to record the same event (people with different backgrounds or competency will observe the same phenomenon differently).
- **Theory triangulation** employs a number of different theories to explain the conclusions of the research

- **Methodological triangulation** is a combination of any of these methods.

In this study, the researcher collected data on knowledgeand practice regarding environmental regulation, and EcoHealth behavioural markers from the urban and peri-urban community members. Data was collected, using different methods from different population groups: vegetable producers working in the Little Akaki River area, community members, women and youth groups, local administrators and key informants from key informants from the community (public and private sectore employees, women and youth engaged in environmental protection activities). Methodological, space and person triangulations were employed during the same period (data collection time) and the findings were integrated during interpretation (data triangulation).

3.3.1.1 Qualitative method

Qualitative research is a type of scientific research consisting of an investigation that seeks answers to a question and systematically uses a predefined set of procedures to answer the question, collects evidence, produces findings that were not determined in advance and produces findings that are applicable beyond the immediate boundaries of the study (Mack et al:2005:11). Qualitative research methods are gaining in popularity outside the traditional academic social sciences, particularly in public health and international development research (Basavanthappa 2007:54; Mack et al 2005:7). Qualitative research is concerned with elucidating the human environment and human experiences within a variety of conceptual frameworks. This means the method is particularly well suited to the human experience (Hay 2002:4). This method focuses primarily on the whole of human experience and the meanings ascribed by individuals living the experience. It also permits broader understanding and deeper insight into complex human behaviour than might be obtained from surveys and other linear measures of perceptions (Basavanthappa 2007:54). Qualitative research is enabling researchers to generate culturally specific and contextually rich data. These opportunities are proving critical in the design of comprehensive solutions to public health problems in developing countries (Dahlgren, Emmelin & Winkvist, 2007:12; Mack

et al 2005:7). Today, scientists, health workers (including clinicians), pharmaceutical companies, and humanitarian organisations have come to recognise that biomedical solutions are only partial remedies. Rathebr, the success of a health intervention – that is, whether it actually reaches the people it is intended to help – rests also on how well it addresses socio-behavioural factors such as cultural norms, ethnic identities, gender norms, stigma, and socioeconomic status (Mack et al 2005:7).

Quantitative and qualitative research methods differ primarily in their analytical objectives, the type of questions they pose, the data collection instruments they use, the forms of data they produce and in the degree of flexibility built into the study design. Qualitative research explores attitudes, traits or behaviours and experience, whereas quantitative method generates statistics (Dawson 2005:14; Mack et al 2005:12)

Qualitative methods attempt to get an in-depth opinion through the common methods: participant observation, in-depth interviews and focus group discussions (FGDs) (Dawson 2005:14, Mack et al 2005:12). Each method is particularly suited to obtaining a specific type of data. Participant observation is appropriate for collecting data on naturally occurring behaviours in their usual contexts. In-depth interviews in contrast are optimal for collecting data on individuals' personal histories, perspectives, and experiences, particularly when sensitive topics are being explored. The focus groups are effective in eliciting data on the cultural norms of a group and in generating broad overviews of issues of concern to the cultural groups or subgroups represented (Mack et al 2005:12).

In this study, participant observation, FGD and in-depth interview tools were used to investigate participants' knowledge and practices regarding existing environmental health regulations. Participants' observation tool was used in specific objective II to document changes in hand-washing behaviour. The in-depth interviewing and FGD tools were employed to collect data for specific objectives I, II and III from different groups of population (women, youth, experts, administrators).

3.3.1.2 Quantitative research method

Borrego, Douglas & Amelink (2009) explained quantitative methodologies as means to test theory deductively from existing knowledge, through developing hypothesised relationships and proposed outcomes for study. Quantitative design is expressed in mathematical terms and guided by certain ideas, perspectives or intuitions regarding the subject to be investigated (Bordens & Abbott, 2011: 42). In the quantitative method the information about a phenomenon is expressed in numeric terms and analysed by statistical methods (Dawson 2005:15; Mamia 2006). The observations can be directly numeric information or can be classified into numeric variables. Observations are transformed into a data matrix in which each observation unit (e.g. individual) occupies one row and each variable one column. The data matrix is the starting point for the analysis (Mamia 2006).

Quantitative approach is essentially concerned with numbers and anything that is quantifiable. In quantitative research, evidence is generated according to the specified plan, using formal instruments such as questionnaires to collect the needed information. The data collected is generally numerical and is analysed using statistical procedures in order to enhance objectivity (Mengistu 2011:51). Quantitative design can be experimental, quasi-experimental, or non-experimental and may use descriptive and inferential statistics. This design can be cross-sectional or longitudinal (Basavanthappa 2007:53).

Phase I: In-depth interviews and focus group discussions (FGD) were used to collect information from public-office officials, experts/employees of public and private sectors, schools, women and youth groups, and urban agricultural practitioners (vegetable growers). In general, people who are working in an organisation or a setting which engages in environmental interventions **(**environmental conservation and health) and people working in settings or organisations that have direct or indirect influence over the environment were included for this phase. The findings from these phase were used to define existing environmental problems of the study area, perspectives on and

contributions of various population groups (women, youth and other stakeholders) to conserving EcoHealth and used to identify policy issues if there were any. The results from this data were used to improve the quantitative data collection tools.

Phase II: Data were collected using a quantitative method from the residents of the study area (adults from all social and economic status levels) on knowledge, attitude and practices regarding the existing environmental health regulations (see section 3.4).

Phase III: The planned intervention was introduced in a test group and time-series data (quantitative data) collected over 10 months from vegetable growers who are working along the Littlie Akaki River (single subjects). A quantitative data collection instrument and an observation checklist were used in this phase to collect data on collective and behavioural changes of individuals in the study group. Vegetable growers and their family members were recruited for this phase. This group was observed for behavioural changes and intention to use the introduced hand-washing facility (see 3.4 and 3.6).

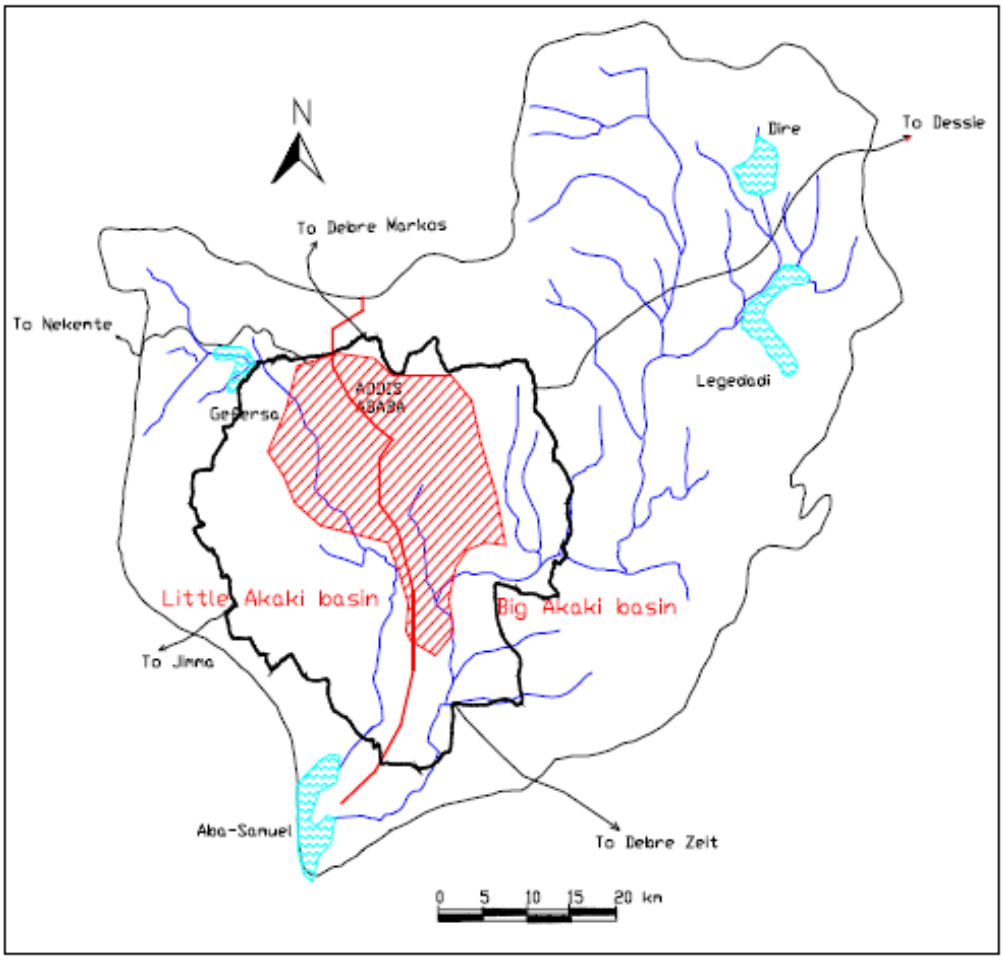
3.4 QUANTITATIVE METHOD

In this study two quantitative data sets were used for the experimental (quasi-experimental) and non-experimental designs. The quantitative method data collection tool was used to identify and collect data on knowledge, and practice relating to existing environmental health regulations from the urban and per-urban community members. The tool design for the quasi-experimental method was used to measure pre-treatment knowledge (hand-washing facility), attitude, and behaviours and changes in behaviour among the urban agriculturists (vegetable growers) in the course of EcoHealth promotion model application. In so doing, the researchers explained, described, understood and predicted the factors relating to EcoHealth knowledge, attitude and practice in the community and the urban agriculture practitioners (vegetable growers). The findings from this method were used in modifying and applying the EcoHealth promotion model and in identifying policy issues relating to EcoHealth and environmental health promotions.

3.4.1 Study areas

The study areas of this project were two subcities in Addis Ababa City Administration, Nefasilke-Lafto subcity and Kality Akaki subcity.

Figure 3.2: Akaki river catchment



Akaki river catchment (in red built up area)

Source: Mazhindu, Gumbo, & Gondo, 2012.http//: www.un.urbanwater.net/cities/addababa.html

3.4.2 Study population and sampling

In the research, *population* refers to the entire collection of individuals or a total category of persons or objects that meet the criteria for the study established by the researcher, that is, any set of persons, objects or measurements having observable characteristics in common (Basavanthhappa 2007:189; McBurney & White 2007: 373). The study population in this research includes people living in the two subcities: the Nefasilke-Lafto and Akaki Kality subcities of Addis Ababa: people who live near to or around the Little Akaki riverbanks, urban agriculturalists/vegetable growers and their family members, sector-offices officials/experts (health, agriculture, environmental health offices, non-governmental organisations, various private and government establishments, schools and factories along the Little Akaki riverbanks) and local administrators.

3.4.3 The study population

The selection of the study population for this research was arranged by objectives. Households with members aged 18 years and above and residing in the two study sites (Nefasilke-Lafto and Akaki Kality subcities, Addis Ababa) were targeted for objective I study tools. For objective II, the urban agriculturalists and their family members living on the Little Akai riverbanks participated in the quantitative and qualitative designs. The urban agriculturalists (vegetable growers) and their families also took part in the quantitative study (multiple baseline surveys). This group was observed at different points and times for behavioural changes (changes in EcoHealth knowledge, practices: hand washing, harvest and agricultural tools and handling of wastewater) after being provided with health information which was believed would contribute to behavioural changes. The primary investigator and the field supervisors also held periodic panel meetings with urban agriculturists and documented changes in their knowledge and practices regarding conservation of EcoHealth, hand washing, agricultural tools, harvesting and handling of wastewater. For objectives I and III, key informants, women and young people who are employees or members of public and private organisations

and associations in study areas, including local administration officials were included in the interviews.

3.4.4 Sampling and sample size determination

According to Basavanthhappa (2007:188), sampling refers to "the process of selecting sample from the target population or sub groups which the total group of population or objects meeting the designated set of criteria or interest to the researchers". Often researchers find it necessary to define a subpopulation for study considering cost, time and labour and other potential factors which would limit the researcher to studying a larger group like a region of the country (Basavanthappa 2007: 188, Bordens & Abbott 2011:157). The objective of sampling is to make an inference about an unknown parameter from a measurable sample statistic and to test a statistical hypothesis relating to a population (Basavanthappa 2007:188). This eases the research process, cost and time.

The way the respondents are sampled makes a great difference to the value of surveys (MucBury & White 2007:247). The researcher therefore decides on appropriate sampling methods (comparing probability and non-probability methods) to sample respondents, considering the context of the research project (cost, the nature etc.). Although probability sampling remains the method of selecting a large, representative sample for research today, probability sampling can be impossible or inappropriate in many research situations – hence the use the non-probability sampling method by researchers (Babbie 2007:164, MucBury & White 2007:247). The non-probability method is often conducted in a situation that does not permit the kind of probability samples used in large-scale surveys (Babbie 2007: 164) (see section 3.7 for ethical issues related to sampling).

Multistage sampling is highly efficient (Babbie 2007: 187). A multistage sampling strategy was used to determine samples for objective I. Subcities crossed or occupied by zones of the Littlie Akaki River were stratified according to administration levels

(region/city administration, zone/subcity and Woreda/Kebele), and six Woredas/Kebeles were randomly selected and the subjects finally distributed to Woredas/Kebeles in proportion to population size. The identity numbers of the selected Woreda/Kebele households were used to select housing units/ subjects. Individual housing units were selected, using a simple random probability method. While the research was engaged in objective II, the vegetable producers' cooperatives (totalling 11) in Nefasilke-Lafto subcity were enlisted according to woredas and plot locations. Furthermore, these cooperatives were subdivided into vegetable plots (fragments/blocks) by locations, and six plots randomly selected (all six for follow-up and three for mounting bio-sand filters and follow-up). All the members in these plots were included in the study.

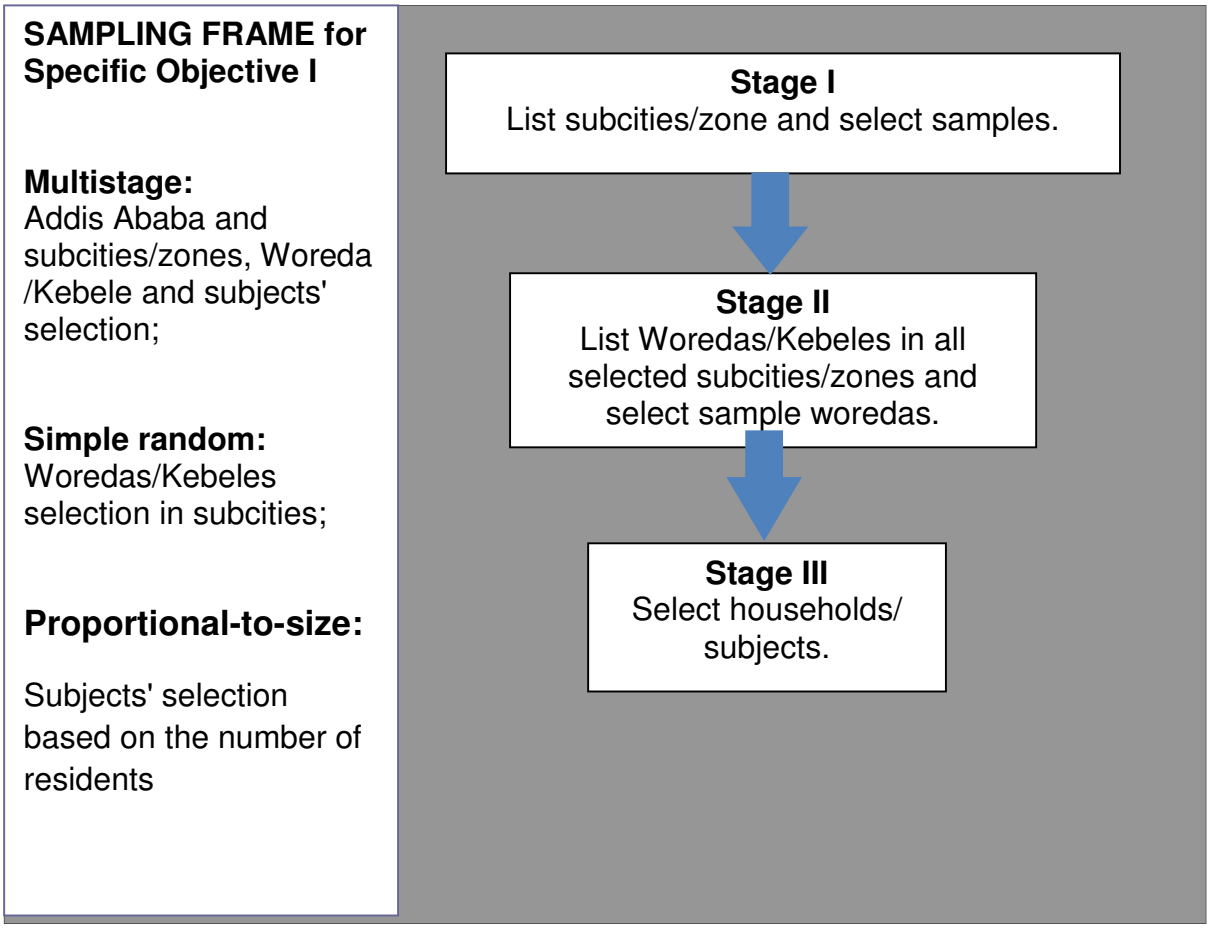


Figure 3.3: Sampling frame for specific objective I

3.4.4.1 Sample size determination

Sample size determination is a component crucial to planning a statistical study and influencing the detection of significant differences, relationships or interaction between the study variables (Ahmed, Amin, Alegn & Mohammed 2012; DMS-Statistical Consulting Group, 2006). Its main objective is to include sufficient numbers of subjects so that statistically significant results can be detected (Datta, Funnell, & Ramuscak 2012).

Sample size determination involves both statistical and non-statistical consideration. Non-statistical issues include resource availability, nature of the study, and method of sampling followed, nature of population, respondents and other field conditions for consideration. The degree of error that we are willing to tolerate in the sample estimates (degree of accuracy) and degree of confidence desired are among the statistical considerations in the calculation of sample size (Basavanthappa 2007:232).

For example, an undersized study can be a waste of resources for not having the capability to produce useful results, while an oversized study would consume more resources than necessary (Ahmed et al 2012; Needham 2008). This implies that resources such as budget, time and other constraints are issues in sample size determination and thus, when researchers use an inadequate sample size, they should report the ideal sample size required, and methods and variables used to calculate or determine the size indicated in their research report (Needham 2008).

There are several approaches to determining sample size, and these methods are based on the specific variables they choose to consider for the calculation and issues to measure. For example, one can specify the desired width of a confidence interval and determine the sample size that achieves that goal, or a Bayesian approach can be used where we optimise some utility function – perhaps one that involves precision of both estimation and cost (Ahmed et al 2012; Datta, Funnell & Ramuscak 2012).

1. In this study, a single-population proportion formula was employed to calculate sample size for the first specific objective. Objective I – see table: 1.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Assumptions:

- Z = Standard normal distribution value for 95 percent confidence interval; that is 1.96.
- P = Population proportion: 0.50 proportion (exposure frequency 50 percent for unknown population) was taken for exposure for information regarding existing environmental health regulations and as a proxy 0.34 (34 percent) care-taker knowledge level on the importance of hand washing in reducing diarrheal diseases in the general public in urban settings, considered for sample size calculation (data referring to study by Coombes & Devine 2010 in Uganda).
- q = [1-p) Proportion of unexposed proportion
- d = Expected margin of error: taken at 0.05
- n = Sample size required:
    - Knowledge of the existing environmental health regulations is considered the major outcome variable of this research and used to determine the final sample size for the two specific objectives (objectives I and II).
    - A 90 percent response rate and design effect of 2 was considered to arrive at the final sample size requirement of 854 households.

Table 3.1: Sample size determination using single-population proportion formula (for specific objective I)

S. no	Variables/Objectives	P	(q) 1-P	D	Sample size
1	Know the existing environmental health regulations	50%	50%	5%	854
2	Caregivers know the importance of hand washing for reducing diarrheal diseases	34%	66%	5%	460
3	Caregivers washing their hand after cleaning child bottom	19%	81	5%	526

2. To get an ideal sample size for specific Objective II, multiple sampling methods used. First all vegetables growers (the cooperatives members) in Nefasilke-Lafto subcity listed and stratified in plot (fragments/blocks of vegetable fields) and randomly selected six fragments (theose whos vegitable growing feld is close to soil dams of the Litile Akaki river/three locations). All vegetable growers in the selected fragments/blocks and their family members included for this study. The average size of members per cluster of block was six . The interventions for this method includes provision of health behaviour change information. for the first 16 weeks. These followed by provision of hand wash facility (appropriate and low cost facility; biossand filter, fixed around the selected clusters/blocks plus the raw and the treated water tested at different points for change in the selected physical, chemical and microbiological parameters. Study participants in this section given training to prepar the hand washing means (-the bio-sand filter) (see multiple baseline design pre and post interventions survey schedule for each blocks in Table 3.2).

Table 3.2: Baseline (B) and intervention (I) schedule implementation (multiple baseline design)

<table>
<tr><td rowspan="2">Intervention (I)</td><td></td><td colspan="6">Phases (Intervention One)</td><td colspan="6" rowspan="2">Intervention One
• Independent variable: Health information (risk in use of wastewater, environmental health regulation, hand-washing information and preparation of low-cost appropriate technology)
• Outcomes:
o Know possible health hazards due to wastewater use.
o Change in attitude and intention to use treated or pipe water after work or for harvest washing.
o Willing to work stakeholder.</td></tr>
<tr><td>Stings</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td rowspan="5">One</td><td>A</td><td>B</td><td>I</td><td>I</td><td>I</td><td>I</td><td>I</td></tr>
<tr><td>B</td><td>B</td><td>B</td><td>I</td><td>I</td><td>I</td><td>I</td></tr>
<tr><td>C</td><td>B</td><td>B</td><td>B</td><td>I</td><td>I</td><td>I</td></tr>
<tr><td>D</td><td>B</td><td>B</td><td>B</td><td>B</td><td>I</td><td>I</td><td colspan="6">Phase (Intervention Two)</td></tr>
<tr><td>E</td><td>B</td><td>B</td><td>B</td><td>B</td><td>B</td><td>I</td><td>1</td><td>2</td><td>3</td><td>4</td><td></td><td rowspan="4">Outcomes
• Use of hand-washing facility</td></tr>
<tr><td rowspan="3">Two</td><td>A</td><td colspan="6" rowspan="3">Intervention Two
• Independent variable; Provision of hand-washing facility (appropriate and low-cost facility)
• Outcome: hand-washing behaviour</td><td>B</td><td>I</td><td>I</td><td>I</td><td></td></tr>
<tr><td>B</td><td>B</td><td>B</td><td>I</td><td>I</td><td></td></tr>
<tr><td>C</td><td>B</td><td>B</td><td>B</td><td>I</td><td></td></tr>
</table>

3.4.5 Data collection

Basavanthappa (2007:279) defined the method of data collection as the "means of gathering systematically information or data in the course of study". Basavanthappa (2007:279) and Selltiz, Jahoda, Deutsch & Cook (2007:66) describe data collection as generating or bringing together information that has been systematically observed, recorded, organised, categorised, or defined in such a way that logical processing and inferences may occur. Both quantitative and qualitative data can be collected and analysed either concurrently, sequentially, or iteratively before the question is addressed (Onwuegbuzie & Leech 2006; Johnson, Onwuegbuzie & Turner 2007). During the quantitative design data collection, the researcher could use self-administered questionnaires or collect data through trained data collectors while, for qualitative questionnaires, the moderator and recorder are required to capture the information (Babbie 2007: 231; Dawson 2005:77).

3.4.5.1 Data collection approach and method

In this study, the researcher used a structured questionnaire for the quantitative method. These tools are organised by identifying items from standard questionnaires (identified and adopted from other studies). The questionnaires are prepared after reviewing relevant sections of the Ethiopian demographic health survey 2005 report and reviewing the data tools in other, similar studies (Central Statistical Agency [Ethiopia] & ICF International 2006 : 5; The World Bank 2010). The instrument was prepared in English and translated into Amharic (the Ethiopian National Language) and then it was translated back into English by a language expert to ensure consistency of meanings. These interview tools were also pre-tested in similar settings and revision was made accordingly. The interviews were conducted in Amharic. A total of 36 data collectors and four supervisors were recruited for the purpose. The minimum criteria for selection were a high school diploma and knowledge of the local language. Prior to holding the interviews, data collectors were given two days training. Data were then collected through face-to-face interviews at household level. The filled-in questionnaires were checked by supervisors every day (three supervisors plus the primary investigator with different qualifications – health, social science) and incomplete or inconsistent ones were sent back to the field for corrections.

3.4.5.2 Development and testing of data collection instrument

The term “questionnaire” refers to a collection of questions and can be generic or adopted from previous studies (that used formal standard questionnaires). A formal standardised questionnaire is a survey instrument used to collect data from individuals about themselves, or about a social unit such as a household or a school (Babbie 2007:215: Siniscalco & Auriat 2005). The options available to researchers when creating questionnaires include using questions or statements and choosing open-ended or closed-ended questions. Using both questions and statements in a given questionnaire gives more flexibility in the designing of items and can make the questionnaire more interesting as well (Babbie 2007:215).

The other point which researcher consider when designing or choosing study/data collection tools is the types of questionnaire. The three basic options available are closed-ended questions, open-ended questions and a combination of both (Dawson 2005:30). Closed-ended questions are the most familiar to most people who have engaged with researches (researchers and respondents) and are used to generate statistics in quantitative research. Although open-ended questionnaires are used in qualitative research, some researchers quantify the answers during the analysis. The combinations of closed-ended and open-ended questions are also preferred by many researchers (Babbie, 2007:215, Dawson 2005:30). The choice of data collection tools (questionnaires) rests on the methodology and research questions to be answered in the research processes. In this study, both closed- ended and open-ended questionnaires are designed. These tools are generic and structured, and based on the objectives of the study. The tools were pretested and the pre-test outcomes were used to revise the tools.

The data collection tools for this study are organised in five modules (see Annex 1). Modules 1 and 2 are semi-structured (with closed-ended and opened-ended questions) while modules 3 and 4 contain open-ended questions. The discussion guides and module 5 contain observation checklists.

Module I: This consists of 10 sections and 86 questions: dedicated for objective two and has questions on socioeconomic background, housing condition, air and noise pollution, water, sanitation, liquid waste solid waste management, land use and health conditions relating to the environmental factors and existing regulations (Annex 1).

Module II: This consists of four items and 40 questions: these include demographic and socioeconomic factors and health problems relating to environment and wastewater uses. Of 40th questions, 5 are questions that enabled the study to collect data before and after introducing health behaviour changing messages and provisions of appropriate and low-cost hand-washing facilities (used for objective II) Annex 1.

Modules III and IV: These modules designed to collect data for objective I and II. They are an in-depth interview and an FGD guide respectively, used to collect qualitative data from community members which includes: women and youth, local administrators, public and private organisations and community-based organisations (CBOs), and employees who are engaged in environmental protection activities: the questions are on their views, contributions and the responses from the public (Annex 2).

Module V: Observation checklist: This tool was used to observe the washing practices of hands, tools and the harvests of the vegetable growers in target settings (objective III)- Annex 2.

Table 3.3: Summary of data collection process of the study

Phases	Objectives	Design	Data collection tools	Target population
Phase I	Objective I: To assess knowledge and practices on the existing environmental health policies/regulations/guidelines among urban and peri-urban community members;	Qualitative	In-depth interviews and FGD guides	Key informants (local administration, women and youth engaged in environmental protection activities)
	Objective II: Assess the perspectives of women To assess the perspectives of women and youth on urban and peri-urban EcoHealth promotions and protections;	Qualitative		
Phase II	**Objective I:** To assess knowledge and practices on the existing environmental health policies/regulations/guidelines among urban and peri-urban community members;	Quantitative	House hold survey/questionnaire	Households (household heads or family members in selected households)
Phase III	**Objective III:** To evaluate the development and implementation of the health promotion activities on waste water use by applying an ecological model aimed at changing behaviour and providing biossand filter to promote hand wash practice which helps to reduce potential health risks among urban vegetable growers	Quasi-experimental/ Multiple base line survey	Quantitative tool and structured observation checklist	Vegetable growers and their families

3.4.5.3 Pre-testing of the questionnaire

Designing a questionnaire is a complex procedure needing due consideration of the purpose of the study, type of questions, formats and pre-test, if original, or riveted to ensure clarity and social desirability (McBurney & White 2007:239). Escalada (2009) defines pre-test as "a try-out of the questionnaire to see how it works and whether changes are necessary before the start of the actual survey". Pretesting is conducted in order to identify possible weaknesses in the research instruments. Escalada (2009) and Siniscalco & Auriat (2005) listed a number of points in a questionnaire that a researcher could check/do to ensure the benefits of administering a pre-test. They are as follows:

- Estimate the time needed to conduct the interview.
- Check the clarity of the instructions: check the accuracy and adequacy of the questionnaire's instructions such as "Skip" and "Go to".
- Improve the wording of the questionnaire if it is unclear or ambiguous.
- See whether there are any major omissions in the questionnaires.
- Check whether the layout is clear and attractive.
- Identify potential confounding variables that need control.
- Provide information on possible ethical problems previously overlooked.

In this study, the data collection tools were pretested before the actual data collection and revised. The quantitative tools were tested on 10 households from woredas/kebels which have similar characteristics, as well as two individuals and one group, each for qualitative tools. The comments and problems identified in these processes were used to revise the questionnaires and the discussion guide.

3.4.5.4 Data collection process

Once the questionnaire designing process was finalised and comments from the pre-test incorporated, it was printed and reproduced, and used to collect data. The trained enumerators, under close supervision of the researcher and supervisors, conducted face-to-face interviews at household level. The researcher and the research assistants

(three supervisors) held the in-depth and FGD interviews, arranged activities, and conducted observations in different settings and community groups (local administration, health and other public sector offices, schools, civil societies, factories and private sector offices).

3.4.6 Data analysis

According to Kothari (2007:122) the term “analysis” refers to “the computation of certain measures along with searching for patterns of relationship that exist among data groups.” Babbie (2007:442) also described analysis as a process which enters into research in one form or another from the very beginning. In general, analysis of data involves a number of closely related operations which are performed with the purpose of summarising the gathered data, organising the information in such manner that it answers the research question(s) (Kothari 2007:122). The processing operation includes editing, coding, classification according to attributes, class intervals and tabulation (Kothari 2007:122, Selltiz et al 2007:405). The analysis for the two research methods is quite different. For qualitative data, the researcher might analyse as the research progresses, continually refining and reorganising in light of the emerging results. On other hand, quantitative data can be left until the end of the data collection process and, if it is large survey, statistical software is essential (Dawson 2005:111)

Since the data set is diverse and large, the qualitative data for specific objective I was entered and cleaned using Epi Info version 3.2 and transferred to SPSS statistical software. Analysis was done using SPSS version 16. For Objective II, descriptive statistics and interrupted time-series analysis were conducted. The result of the analysis was presented in the form of frequency tables, charts, and text, where appropriate.

3.5 INTERNAL AND EXTERNAL VALIDITY OF THE STUDY

3.5.1 Validity and reliability

Validity of a study is classified into internal validity (validity pertaining to the source population) and external validity or generalizability (validity as it pertains to population outside the study population). Internal validity implies accurate measurement of effects in studies of causation. Biases cause distorting of the estimate of epidemiological measurements. Biases can, in turn, be classified as selection bias, information bias and confounding. No epidemiological study is free from bias and the type of bias depends on study design (Merrill 2010: 85).

3.5.2 Selection bias

The basis for selection bias implies that the exposure and outcome status is different for those who participate and for those who are eligible to participate but do not do so because of the selection procedure or refusal. To control this in objectives I and II, participants were randomly selected, using each sub-district/kebele registry/database. As a control for the non-response rate in this study, 10 percent was allotted for sampling to reduce the chance of bias due to selection.

3.5.2.1 Information bias (observation bias)

Information bias is related to errors in obtaining information from study participants. Data collection for all specific objectives was conducted using a face-to-face interview, and might introduce observation bias. This can be both on the part of the study participants and on the part of the interviewers. To minimise these biases, data collectors and supervisors were given sufficient training on the tools and on how to communicate with study subjects.

3.5.2.2 Confounding variables

A confounder is a third or extraneous variable which is associated with both the outcome and the exposure variable and distorts the effect of the exposure. The distortion introduced by a confounder may underestimate, overestimate or even change the direction of the association (Merrill 2010: 145). However, when the confounding variable is known or when there is no effect on the dependent or criterion variable, or when its known effect can be taken into account in the analysis (Bordens & Abbott 2011:110). In this study, the specific objective one data were analysed, using a multivariate analysis method to control confounding variables. For all objectives, the modules were adjusted for socio-demographic variables after looking for interacting terms. For example, objectives I and II included age, education, employment status, and assets held as independent predictors of knowledge of the environmental health regulations.

3.5.2.3 Generalizability of the study

The study area features similarities in the socioeconomic situations, the use of environmental resources and the patterns of settlement in the big urban centres of the central, southern, western and northern parts of Ethiopia. For example, the existence of urban health extension programmes, socioeconomic activities, the types of vegetables cultivated the mode of irrigation and fetching of river water, are scenarios similar to those of central Ethiopia where the urban and peri-urban population are living near to the riverbanks (Itanna, 2002:295). Furthermore, the study employed a randomly selected large sample size for the cross-sectional study. In the light of the above-mentioned features, this study can be generalised to the urban and peri-urban environments which have similar features in Ethiopia, especially to those in similar economic and social situations.

3.6 QUALITATIVE REASERCH DESIGN

Qualitative research methods are used to describe the context of a phenomenon and activities of interest or to discover new concepts as a major research method (Mack et al 2005: 11). A qualitative research method can be combined with a quantitative method to complement or triangulate the findings of a survey (Johnson & Onwuegbuzie 2004). In this study, specific objectives I and II will also use a qualitative method to complement and triangulate the results of the quantitative survey and enrich the interpretation of the findings. For objective III a qualitative design was used.

For objective II, local administrators, public and private sector employees, women and youth groups, schools, factories and community based organisation members, health-extension workers and those working in solid waste management (Environmental Protection Authority, health departments, NGOs, factories/establishments, workers, young people's and women's associations that engaged in solid waste management) were included. The EcoHealth promotion model was applied and observations were made to measure changes in the knowledge and behaviour of the study participants (the urban agriculturalists/vegetable growers working along Littlie Akaki Rriver).

For objective III the ecological health Stress Process Promotion Model used. First: maintained consensus in identified stresses, priorities and solutions (environmental factors and predictors of behavioural changes on promotion of environmental health in urban and peri-urban settings) together with study participants. Second: applied a combination of health behavioural change methods (provided IEC material and biosand filter for hand wash) and finally observed and documented changes in the identified behavioural changes (outcomes). On this level, an observation checklist, in-depth interviews and FGD guides were prepared and used for the qualitative method. The data were collected, using a moderator (the primary investigator) and rapporteurs (supervisors) (see Annexure 2: Modules III and IV).

3.6.1 Inclusion criteria

Permanent residents (Central Statistics Agency [CSA] standard used to determine/ to qualify this): This includes any individual or group that has direct or indirect impact on the management of the environmental resources and decision makers considered for this study. Moreover, permanent employees of organisations/facilities and organisations which have by-products that could contaminate the riverbanks (e.g. tanneries) and organisations which are located in the study areas and are directly or indirectly contributing to the environmental protections (e.g. health facilities, NGOs), and schools were included. However, new employees (employees who have remained in the organisation less than six months) or visitors were excluded from the study.

3.6.2 Data collection

Qualitative information was collected by the principal investigator and field supervisors from the community, public sector (sub-cities health, education and environmental protection offices, schools) and administration offices, and health facilities, using a structured and semi-structured, in-depth interview and an FGD/topic/guide. The observations checklist, in-depth and FGD/ guide were designed by the investigators. Interviews were tape-recorded, transcribed and translated into English. The interview continued until information redundancy was observed. In addition, observation checklists were prepared (following similar steps as discussed above) and used to collect data regarding the environmental situation (solid and liquid waste management, housing conditions, and safety issues). The observations were made while collecting data from households, different organizations/establishments to complement the quantitative data collected for Objectives I, and II.

3.6.3 Data analysis

The qualitative data were entered into an Open Code program (Dahlgren et al 2007:111) and analysed, using content analysis (Graneheim & Lundman 2004). The analysis was done by importing the transcribed text into the Open Code program to facilitate the coding process (Dahlgren et al 2007:112). Relevant meanings and units were examined line by line and coded by the primary investigator. The coding results were discussed among members of the research team and discrepancies in the interpretations negotiated.

3.6.4 Trustworthiness

Trustworthiness or truth value refers to the ability of the study to capture what the researcher intended studying, meaning that the results are not simply the product of research design error, misunderstanding, or influence of unknown factors. In quantitative research we care about internal validity or strive to minimise bias while, in qualitative research, the truth value is assessed by credibility (Dahlgren et al 2007:45). Qualitative researchers need to follow two particular steps to ensure and argue the trustworthiness of their research interpretive communities. The first step in this regard is to design strategies to ensure trustworthiness in the early stage of the research design, and applied at various stages in the research process. The second step to be considered in qualitative study is careful documentation of each research stage so that the work might be reported to the interpretive communities (Hay 2002:46). In this research the following points have been taken into consideration to ensure the credibility of the findings were examined against following issues throughout the study process:

- The use of additional sampling, data collection and analysis techniques was guided.
- There was thick description of qualitative data collection, entry and analysis.
- Premature closure of the data was prevented and evidence of theoretical saturation was provided.

- Triangulation was done to ensure convergence and corroboration of data and results from different methods to increase the validity and credibility of the study.
- A validation workshop was conducted and the findings were taken back to the group/community that participated in the discussions.
- The preliminary result was shared with the community to check whether the collected data/information was well understood or not the reliability of the findings was checked through seminar/discussion et cetera.
- There was a review of the findings by the professionals who did not take part in data collection and analysis process.

3.7 ETHICAL CONSIDERATIONS

In most dictionaries and in common usage, ethics is typically associated with morality, and the two words that relate to the matter are “right” and “wrong”. It is what the particular society considers ethical and unethical (Babbie 2007:64). Velasquez and his colleagues (2009) refer to ethics “as standards of behaviour that tell us how human beings ought to act in the many situations in which they find themselves – as friends, parents, children, citizens, business people, teachers, professionals, and so on” (Velasquez, Moberg, Meyer, Shanks, McLean DeCosse & KO 2009: 1). Velasquez, Andre, Shanks, & Mayer (2010:1) add that ethics refers to “well-founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to society, fairness, or specific virtues”. It is also the study and development of one's ethical standards.

In contrast, according to the Belmont Report, ethics in research means “a set of principles or guidelines that will assist the researcher in making difficult research decisions and in deciding which goals are most important in reconciling conflicting values” (Fouka & Mantzorou 2011; Psychology 2004:50). This implies that, in research, the issue of morals and ethics is clearly related to methodology and needs to recognise and protect human rights in all courses of the research process and beyond (Basavanthapp 2007:243).

Therefore, ethical consideration in research should consider fairness, honesty, openness, disclosure of methods, and the purpose for which the research is being carried out. Based on this understanding, the researcher adopted the following ethical standards during the process of this study.

3.7.1 Protecting the participants

Ethical standards include standards relating to rights: every individual is entitled to the right to privacy and dignity. In this study the researcher will treat the respondents with respect and seek their cooperation through an informed written consent (Annexure 1 and 2 , the five modules) (Basavanthappa 2007:244, McBurney & White 2007:56). Ethical treatment of participants mandates that participants should be informed about the research purpose and should give or decline permission to proceed. The researcher should ensure that the participants' identities are protected so that the information collected does not harm them in any way. To ensure anonymity and confidentiality, participants' names were not recorded in any form on the questionnaires and the researcher will not at any point relate any information collected to any particular participant (Babbie 2007:66, Bordens & Abbott 2011:171). The researcher will only collect data necessary for this study, and will make the necessary effort not disclose and keep confidential their responses. Before the participants give their consent, the researcher will explain to them the importance of their participation, their benefit from the study results, and the value of the study and how the information will be used. Participation in this study was voluntary and participants were informed of their right to withdraw from the study even if they had initially given their consent. No form of coercion was used on those individuals who refused to participate in the study (Basavanthappa 2007:246; McBurney & White 2007:57; Royal College of Nursing 2011).

3.7.2 Protecting the right of the Institution

The researcher has already requested and received ethical clearance for the study from the Research and Ethics Committee at the Department of Health Studies of the University of South Africa (see Annexure 2). The researcher presented the Unisa certificate of ethical clearance to the Addis Ababa City Administration Health Bureau and secured clearance to collect data in the study areas (see Annexure 3). At the district (woreda) and institution levels, permission was requested from the district (woreda) administration and respective heads of the participating institutions (see Annexure 3). The researcher maintained the promises which were made in the beginning and abides by the agreements made during the negotiations for permission to conduct the study and follow the policies and ethical guidelines relating to this research (Babbie 2007:70, Bordens & Abbott 2011:170).

3.7.3 Scientific integrity of the research

The researcher respected the work of others by acknowledging the sources and using objective methods to collect the data analyse and report the study findings. Therefore, the researcher has chosen to use the methodology based on the research objectives and not for any other reason. The data were interpreted according to the methodological standards and not the researcher's interests. The researcher adheres to truth when writing and reporting the findings by properly explaining the methods used, and the reasons for doing so. No fabrication or false or deceptive data and statements were made to fit what the researcher wanted to achieve (McBurney & White 2007: 60). The researcher reported only what the data revealed and that related to the analysis (Babbie 2007:69). The researcher honoured the participants' privacy. This study holds no risk since it did not involve the collection of any specimen from the respondents, and the researcher and research team did not have contact with or introduce or use any harmful substances. Consequently, no harm is anticipated to be caused to the participants by this study.

3.8 CHAPTER SUMMARY

In this chapter the researcher has presented theoretical background and has explained the research designs and methodologies that were used to conduct this study. The mixed methods: qualitative and quantitative methods, descriptive and experimental designs including triangulation (space, people and methods triangulation) have been presented in detail. The sampling and sampling techniques and the structure of the data collection instruments have been presented. The methods that were used to ensure that data collected was analysed and reported ethically were also presented in this section. Lastly, the section discussed strategies that were used to ensure the validity, reliability and trustworthiness of study findings.

3.9 CONCLUSION

Integrating the different study methdologies and designs gives researchers a better opportunity to capture and analyse data, and reach the conclusions that explain the reality of the research that will provide the decision makers with the relevant evidence.

CHAPTER 4
ANALYSIS PRESENTATION AND DESCRIPTION OF RESEARCH FINDNGS

4.1 INTRODUCTION

This chapter presents the analysis, presentation and description of data from the three methods which the study employed, namely quantitative, qualitative and intervention methods. The data were aggregated from multiple sources to expand the understanding of the environmental health promotion matters in urban and peri-urban settings. Each data set presented information/evidence required for the general and the specific objectives of the study (Table 4.1).

This study used multiple study methods to find out the factors enabling and preventing EcoHealth promotion in the urban and peri-urban environment of Addis Ababa. Of all employed methods, the qualitative and quantitative methods provided evidence for environmental health situations and sources, and information on potential environmental pollutants, which could be used to design strategies for the EcoHealth promotion in urban settings. The intervention methods exposed selected population groups to the different forms of health promotion information and gave them access to devices which could help to reduce physical, chemical and biological hazards while using river wastewater.

4.1.1 Purpose of the study

As stated in chapter one, in the introduction section, the purpose of this study was to equip urban and peri-urban EcoHealth markers with skills and knowledge requirements to ensure the sustainability to be gained through the integration with urban health extension workers and vegetable growers cooperatives. (See Table 4.1: summary of the objectives and significant outcomes of the study).

Table 4.1: Issues addressed and major findings of the study, EcoHhealth promotion Study, Addis Ababa, Ethiopia, and April-May 2012

Issues addressed (Objectives)	Major findings
To assess knowledge and practices on the existing environmental health policies/regulations/guidelines among urban and peri-urban community members;	• About 77 percent of participants reported awareness of one or more of selected environmental health and EcoHealth regulations. • Ownership of assets and education influence the public awareness of selected EcoHealth and environmental health regulations.
Assess the perspectives of women and youth on urban and peri-urban EcoHealth promotions and protections.	• Women and youth found to be significant contributors to better urban and peri-urban EcoHealth situations and to be primarily affected by environmental hazards. .
To evaluate the development and implementation of the health promotion activities on waste water use by applying an ecological model aimed at changing behaviour and by providing biossand filter to promote hand wash practice which helps to reduce potential health risks among urban vegetable growers	• Evidence-based IEC interventions and ecological health promotion methods were found to be useful in promoting EcoHealth in urban environment.
	• Bio-sand filter was found to be useful for wastewater treatment and significantly reduces chemical, physical and biological contaminates from the wastewater.

The researcher, therefore, applied the methodologies and study tools presented in chapter three to collect data from multiple sources: individual households, different population categories such as women, youth and experts from the public and private sectors. The data were organised and computed, using different statistical models and presented in the form of tables, graphs, charts, rates and ratios in this section.

4.2 RESULTS PRESENTATION ANALYSIS AND DESCRIPTION: QUANTITATIVE DATA SET

The quantitative data were collected using the pre-arranged semi-structured survey tools (see Annexure 1) from the households and community members who were practising urban agriculture using wastewater from the Little Akaki River. Data were collected from 845 households during the May-to-June 2012 period, and analysed and described as follows:

4.2.1 Selected demographic and socioeconomic characteristics of the respondents

Initially, the plan was to interview 856 individuals and a total of 845 (98.7 percent response rate) were included in this study. The face-to-face interviews were conducted by 36 trained data collectors from 27 to 30 May 2012. A total of 36 enumeration areas selected from two subcities and six woredas of the urban and semi-urban Addis Ababa City Administration. One each data collector assigned and each were under taking six to seven interview per day. Enumeration areas (EAs) were selected considering the previous urban administrative subdivisions (Kebeles and Ketenas). Household listing was conducted in each EA and sample households selected, using the random sampling method. Of all the respondents, 89 percent of the study population were from urban and the remaining 11 percent were from semi-urban areas. The demographic and socioeconomic characteristics of respondents are summarised in Table 4.2.

The age of the respondents included in the study ranged between 14 and 78 and their mean age was 35 years (SD$\pm$14.48 years). The proportion of the female participants was higher than the men and was 58.2 percent, and 41.8 percent respectively. Sixty percent of the respondents were married, 32.6 percent single, 5.3 percent widowed/widowers and very few, 1.8 percent, were separated or divorced. Regarding the economic profile of the respondents, 26.3 percent were private-sector employees (including self-employees), 11.4 percent public-sector employees, 9.8 percent students, 6.3 percent farmers, 17.2 percent housewives, 6 percent pensioners, 22.5 percent unemployed and a few, 0.6 percent employed in community based organisations (faith based and private and non-profit-making organisations).

The mean family size was five (ranging from 1 to 13) and about 70 percent of the respondents were able to estimate their average monthly family income. Of these, 88.8 percent reported a monthly income of about 2,000 and less Ethiopian Birr (the low-income group) and only 11.2 percent reported above 2,000 Ethiopian Birr (ETB). The

remaining 30 percent could not estimate their family income due to the nature of their work (farmers, labourers, petty-traders, vendors, etc.). The mean income of the respondents was 1,189 ETB and mode 1,000 ETB (range from 140 to 8,000 ETB).

Regarding the educational background of the respondents, about 14 percent reported that they cannot read and write, 6.6 percent can read and write but have never been in formal education, 13.6 percent attended primary education (grades 1-6), 30.1 percent secondary school (grades 7-10), 16.9 percent attended preparatory level (grades 11-12) and 18.7 percent college and above (Table 4.2).

Table 4.2: Selected socio-demographic characteristics of respondents, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April- May 2012

Variable	Respondents	
	Frequency	%
Sex: n= 845		
Female	492	58.2
Male	353	41.8
Age in years: n=845		
≤ 19	126	14.9
20 to 29	281	33.3
30 to 39	189	22.3
40 to 49	127	15.0
50 to-64	81	9.6
≥65	41	4.9
Marital status: n=843		
Single	275	32.6
Married	508	60.3
Widowed/widower	45	5.3
Divorced/separated	15	1.8
Education: n= 845		
Cannot read and write	119	14.1
Can read and write, with no formal education.	56	6.6
Grades 1-6	115	13.6
Grades 7-10	254	30.1
Grades 11-12	143	16.9
College and above	158	18.7
Economic activities: n=845		
Private sector	222	26.3
Unemployed	190	22.5
Housewives	145	17.2
Public sector employee	96	11.4
Student	83	9.8
Farmer	53	6.3
Pensioner	51	6.0
Community based organization	5	0.6
Income in ETB: n=586		
<500	181	30.9
501-1000	206	35.2
1001-2000	133	22.7
2001-3000	42	7.2
3001-5000	20	3.4
>5000	4	0.7

4.2.2 Respondents' housing conditions and household environment

Fifty four percent of respondents reported that they owned the house they are living in and 36.7 percent rented from Woreda Administration/Kebeles' houses or from private owners, 8.9 percent per sharing with other households. Of all reported and observed housing units, 95.1 percent of houses' roofs were covered with corrugated iron sheet, while 3.6 percent with grass and a very few (1.3 percent) covered with plastic sheets and reed/bamboo. About seventy two percent of the respondents' houses wall is built with wood and mud, 18.5 percent cement blocks, 8 percent stone with lime/cement, and 2.2 percent stone with mud. Fifty six percent housing units of the respondents' floor covered with cement, 40.1 percent with soil and clay and 2.6 percent with ceramic and plastic tiles and 1.2 percent with wooden planks (Table 4.3).

TABLE 4.3: Household ownership and characteristics, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April- May 2012

Variable	Respondents	
	Frequency	**%**
Ownership status n=845		
Owned	460	54.4
Rented	310	36.7
Shared with others	75	8.9
Roof of the main housing n = 845		
Corrugated iron sheeting	804	95.1
Thatch/leaf/grass	30	3.6
Plastic sheet/reed/bamboo	11	1.3
Wall of the main housing n= 845 Wood and mud	602	71.2
Cement blocks/bricks	156	18.5
Stone with lime/cement	68	8.0
Stone with mud	19	2.2
Flooring materials n=845		
Cement	474	56.1
Earth/sand	339	40.1
Ceramic tiles/ Plastic tiles	22	2.6
Wood/planks	10	1.2
Rooms used for sleeping n= 845		
One	312	36.9
Two	366	43.3
Three or more	167	19.8
Place for cooking n=845		
In the main house	169	20.0
In a separate building	623	73.7
Outdoors	53	6.3

4.2.2.1 Households' source of energy and awareness of air pollution

Sixty three percent of the respondents reported that they are using charcoal for cooking of which 17.4 percent use an additional source of energy. While, 48.3 percent reported using electricity power, 35 percent use wood and straw/shrubs, 22.7 percent kerosene, 15.7 percent animal dung and 7.7 percent liquid/natural gas or biogas (Table 4.4).

Seventy four percent of the respondents reported their families' use an open fire or stove without chimney hood, 20.4 percent open fire or stove with chimney hood and 6 percent closed stove with chimney hood for major cooking. Seventy four percent of the respondents' household cooking is usually done in a separate building, while 20 percent are cooking in a main house/ building and for 6 percent cooking is done outdoors (any corner in the compound) (Table 4.3).

Table 4.4: Household energy source for cooking, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

	Respondents	
Variable	**Frequency**	**%**
Energy source for cooking =845*		
Electricity	408	48.3
LPG/Natural gas/biogas	55	6.5
Kerosene	192	22.7
Charcoal	529	62.6
Wood	277	32
Straw/shrubs/grass	16	1.9
Animal dung	133	15.7

*Multiple responses were considered.

About 17 percent of the respondents claimed the existence of an air pollution source and 49.3 percent reported factories as the source, 31.9 percent the solid waste disposal landfill, 15.3 percent health facilities (incinerators and open fire methods used for medical waste management), 13.2 percent food and beverage facilities (bars, restaurants, hotels), and 10.4 percent reported vehicles as the main sources of air pollution in their locality (Table 4.5).

Fifty-nine percent of the respondents reported that smoke or carbon dioxide from households could harm the environment or human beings. Of all who reported, 82 percent of the respondents believed smoke from the household could be the cause for respiratory tract infections and 18 percent reported that smoke emits carbon dioxide/pollutant to environment.

Table 4.5: Respondents responses to possible source of air pollution in their environment – household energy source for cooking, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable	Respondents	
	Frequency	%
Air pollution		
Yes	144	17
No/Do not know	701	83
Smoke/dust from factories	71	49.3
The landfill	46	31.9
Health facilities (incineration)	22	15.3
Food and drink establishments	19	13.2
Vehicles	15	10.4

*Multiple responses were considered.

Only 42.4 percent reported they know of the existence of standards and regulations to be followed or implemented to prevent air pollution, of which 57 percent mentioned cooking done in a separate kitchen; 22 percent use no smoke or little smoke as a source of energy, and 21% are maintaining sufficient ventilation everywhere (such as in houses, production centres, transport and recreation areas) because the major contents of the standards/regulations advise the community to prevent and control indoor and outdoor air pollution.

4.2.2.2 Status of sanitation facilities

About thirty percent (31.2%) of the respondents reported not having a toilet and their family sharing toilet a facility with other households. Of all the respondents, 59 percent reported their families are using pit latrines, 13 percent used an improved ventilated pit latrine (VIP), 12.3 percent flushed to septic tanks, 11.4 percent piped to the municipality sewerage system and 4.4 percent practised open veld defecation.

Respondents were asked if they knew any instructions or regulations to be considered while constructing a housing unit or built-in features, and 33 percent of the respondents

reported knowing about regulations regarding location of the toilet in relation to the water source, kitchen and main house, 15 percent t reported theirs was some distance from the water source, 15 percent aligned a vent pipe and toilet entrance leeward of the wind (wind direction for vent pipe and door), 14.4 percent knew about the construction materials, types and quality, 13 percent knew about size and number of seats listed against the users' numbers, and 7 percent had some knowledge of the toilet structure strength in terms of the main contents of the instructions pertaining to the initiation of new housing and toilet construction. About 14 percent of respondents reported the existence of households, organisations and business complexes that are connecting the toilet system to the open drainage system, which becomes a real nuisance in the community. In the same vein, 63 percent of respondents reported individual households as major sources of liquid and solid wastes, and 17 percent of the respondents deemed food and beverage establishments to be sources of environmental contamination, while 9 percent reported factories, 7 percent schools and 5 percent public sector offices as major sources of the dislodging/connecting of toilet facilities into/to open drainage systems in their community.

About forty-eight percent of the respondents contended that the Woreda/Kebele Health Offices or delegated offices are responsible for regulating and inspecting the environment and for enforcing the existing environment-related regulations/laws in their locality. While 30 percent of the respondents think it is everybody's (each individual's) responsibility and believed all should comply with the existing environmental standards or regulations, 11.8 percent of respondents believe that the local administration offices (Woreda/Kebele) are the offices responsible for such issues, 6.5 percent of them reported the community based organizations/associations for being negligent, and 4.4 percent named the Environmental Protection Authority as the body responsible for monitoring the applications and enforcing the existing environmental health regulations.

Table 4.6: Household sanitation facilities, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable n=845	Respondents	
	Frequency	%
Improved, not shared facility		
Flushed/poured to piped sewer system	81	9.6
Flushed/poured to septic tank	73	8.6
Flushed/poured to pit latrine	312	36.9
Ventilated improved pit (VIP) latrine	78	9.2
Improved, shared facility		
Flushed/poured to piped sewer system	15	1.8
Flushed/poured to septic tank	31	3.7
Flushed/poured to pit latrine	186	22.0
Ventilated improved pit (VIP) latrine	32	3.8
Non-improved facility		
No facility/bush/field	37	4.4

Of all reported sanitation facilities, the improved but not shared facilities account for 64.4 percent, while the improved, but shared with other households, was 31.2 percent, and the households with non-improved sanitary facilities accounted for 4.4 percent (Table 4.6).

4.2.2.3 Water sources

Fifty-one percent of the respondents reported the water source for drinking and other purposes to be piped water connected to the dwelling house or the compound (owned or neighbours' compound). About 5.6 percent reportedly comes from water points and only 0.42 percent, which is about three respondents, get water from an unprotected well or spring. About three-quarters (75.5%percen) of the respondents' water sources are fitted into their own premises, 18.2 percent have it within a short walking distance of the neighbour's compound, 5.6 percent fetch it from water point and about one percent get water from elsewhere in their locality. The maximum time taken to fetch water is 50 minutes (respondents who fetch water from springs). Eighty-eight percent of the respondents reported women usually fetch the water for their family, 6.4 percent reported

adult men, and very few (3.9%) reported girl children do it, and 1.1 percent reported boys below the age of 15 as responsible for such activities in the households (Table 4.7). About 69 percent of the respondents reported that they do not usually treat water in any way to make it safe before drinking. But 31 percent treat water before they use it for drinking. Of those who treat the water before drinking, 68 percent use chemicals for treatment, 31 percent boil the water before use and three respondents (1 percent) of them store the water in the container to settle before use (Table 4.7).

Table 4.7: Source of water for drinking and other purposes for households, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable	Respondents	
	Frequency	%
Source of drinking water n=845		
Piped into dwelling	281	33.3
Piped to yard/plot	357	42.2
Piped from next compound (neighbour's house)	154	18.2
Public tap/standing pipe	47	5.6
Protected well	3	0.4
Unprotected spring	3	0.4
Time to obtain drinking water (round trip) n=845		
Water on premises	633	74.9
Less than 30 minutes	207	24.5
30 minutes or longer	5	0.6
Person/s who usually collect/s drinking water n=845		
Adult women	749	88.6
Adult men	54	6.4
Female child under the age of 15	33	3.9
Male child under the age of 15	9	1.1
Water on premises	?	?
Water treatment prior to dinking n=810		
Boiled	76	9.4
Use chemicals/water makers	170	20.9
Let it stand and settle	3	0.4
No treatment	561	69.3

4.2.2.3 Solid and liquid waste management

About forty-seven percent of study participants reported they collect and store garbage in designated containers in the household, 35.4 percent store in any available container (plastic bag), and 11.7 percent dump inside the compound whenever generated, 3.4 percent dump in the backyard whenever generated, 2.7 percent reported putting it wherever convenient at any corner in the household (Table 4.8).

Forty percent of the respondents primarily collect liquid waste with any container and dispose of it outside the compound (open field, open ditch or roadside sewerage lines), 19 percent reported that the household sewerage system is fitted with the municipality sewerage line, 8.4 percent pumped it into open the sewerage line which is meant to carry rain water and prevent flooding and erosion. Eleven percent of households' sewerage line is fitted with collection chamber/septic tank in the household and 11.4 percent reported collecting any liquid waste from household activities in a bucket and disposing of it into the nearby stream or river (Table 4.8).

More than eighty percent (84.7%) of the respondents reported that organised groups/associations are collecting garbage from their households, while 15 percent of the respondents reported that they dump garbage anywhere (any open space in the community/outside their compound) and very few (n=2) reported their household dumps garbage into the nearby river (Table 4.8).

Eighty eight percent of the respondents reported that adult women usually do the collecting, organising and disposing of garbage in the households, and 6.4 percent of households reported adult men. Girl children and boy children below the age of 15 were reported by 3.9 percent, and 1.1 percent of respondents, respectively (Table 4.8). Also, 65.2 percent of respondents think unattended garbage or waste could facilitate the breeding of flies or other insects and the transmission of infections such as diarrheal diseases, 37.3 percent reported that unattended garbage or waste has a nuisance value,

while 33.7 percent believe it causes respiratory diseases, and 14.1 percent maintain that it feeds and hides rodents, and facilitates breeding.

Regarding the contents of the wastes, 60 percent of respondents reported plastic and degradable wastes as the major contents of waste generated in their locality, 31.8 percent reported waste from household activities, 22.6 percent named food and related waste from establishments, 6.8 percent mentioned remnants of dead animals, and 3.1 percent indicated chemical waste from the industries as the major wastes.

Table 4.8: Solid and liquid waste management/disposal, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable	Respondents	
	Frequency	%
Households' solid waste collection before disposal (n= 845)		
Collected with proper/designated containers.	395	46.7
Put into plastic or any used containers.	299	35.4
Put wherever convenient/any corners in the household.	23	2.7
Disposed at backyard whenever generated.	29	3.4
Disposed outside the compound whenever generated.	99	11.7
Solid waste management method (n= 845)		
Collected by municipality/associations/youth and women in the kebele.	716	84.7
Dumped in open space outside the compound.	127	15
Dumped into the nearby stream/river.	2	0.2
Liquid waste collection and disposal (n=845)		
All sources connected to the collection chamber (septic tank).	97	11.4
All sources in the household connected to the municipality sewerage system	162	19.2
Collected with bucket or any container and dump at roadside sewerage line.	366	43.3
Collected with bucket or any container and dumped into nearby river/stream.	96	11.4
Pumped to the street.	71	8.4
Pumped into the river.	53	6.3

Seventy percent of participants rated their residential location as a somewhat clean environment, while 21 percent rated it as clean and 9 percent disagreed with the above two groups and rated their environment as not clean. Almost all respondents (95.4%) consigned the issue to the community itself to keep the environment clean and safe, while 5 percent think it is the responsibility of the municipality and the local administrations.

4.2.2.4 Awareness of noise pollution and protection methods

About sixty-seven percent of the respondents feel that they are living in a somewhat quiet environment (no excessive noise in their village), while 33 percent of the respondents disagree with the first group and feel that it is polluted and affected by excessive noise. Thirty percent of the participants claim music shops, 16.3 percent flour mills, 13.5 percent bars and restaurants, 9.2 percent nightclubs, 7 percent factories and few (5 percent) reported animals, vehicles, loud noise from churches and mosques during sermons, as sources of noise pollutions in their environment, while 19 percent of the respondents identified no pollutant to their environment. About 39 percent of the respondents reported that they know the level of sounds which human beings can safely be exposed to or the level to be avoided from human environment (home or workplaces at different times). And then, 34.2 percent of this group reported that they know the different sound levels for day and night times and 26.8 percent reported that they know standards and regulations to be followed and noise limits for different places, times and situations. Media, including TV, radio and newspapers, were considered as information sources by 92.9 percent of participants who reported knowledge of the standards, while workplaces and schools were considered as information sources by 4.2 percent and 2.9 percent of respondents, respectively.

About 62 percent of the respondents do not know what to do if they become aware of excessive noise (noise pollution) in their residence, 23.6 percent reported that they would apply for help to the concerned authority or office, 9.2 percent would approach the person (he or she) who is responsible for noise pollution and advise them to control the sound

or stop disturbing the environment, and 5.2 percent reported they would do nothing if such a problem happens.

4.2.2.4 Built-up environment and EcoHealth regulations

Respondents were asked if they were aware of the need for and existence of environmental health regulations or standards pertaining to initiating constructions in the urban centre by individuals or groups, including the public and private sectors. In response, a total of 68 percent of the respondents reported that the local administration and the government (through the public sector offices) are fighting illegal construction. However, 13 percent of the respondents believed that the public sector offices are neither fully controlling illegal constructions nor preventing them. About 20% of respondents did not know the efforts that the public sector offices exert to prevention and control of illegal constructions in their environment. Off all the participants, 64 percent believed that the public sector offices and local administration made an effort to prevent expansions of illegal construction, but 12.8 percent participants did not agree with the above respondents' acknowledgement and believed that the actions so far taken or implemented were not yet fully able to control illegal construction.

About sixty percent (60.7%) of respondents believed that improperly built-in or uncontrolled environmental structures (housing units or business complexes) could harm human health and affect environmental health. Of these, 48 percent mentioned overcrowding, 25 percent communicable diseases, 15 percent accidents and landslides as major risks arising from the substandard and uncontrolled built-in environment in their community.

Fifty-six percent of respondents knew of the existence of standards and regulations directing communities to keep their environment clean and, of these, 92 percent listed issues in the standards/regulations whose existence they acknowledged. These include keeping the environment clean (66.4%), treating waste before disposing of it (27.5%), and following the safety rules in the workplace (6%).

Of all the respondents who reported awareness of the existing standards/regulations on construction and expansion of residential or business complexes, 72 percent reported the public sector offices (Woreda Administration/Land Administration and Kebele offices) as the main sources of information regarding awareness of these standards, while 17 percent reported media as the main source. Eleven percent does not remember the source but acknowledge that they have known about the existence of the standards/regulations.

Adequate space (63%) and ventilation (11%) were mentioned by the majority as the components of the existing housing regulation. While 9 percent reported a separate kitchen, 6 percent natural light and the remaining proportion (11%) mentioned roof catchment and drainage, type and quality of construction material and distance between toilet as components of the existing regulation regarding the built-in environment in urban areas, especially in the construction of residential houses (Figure 4.1).

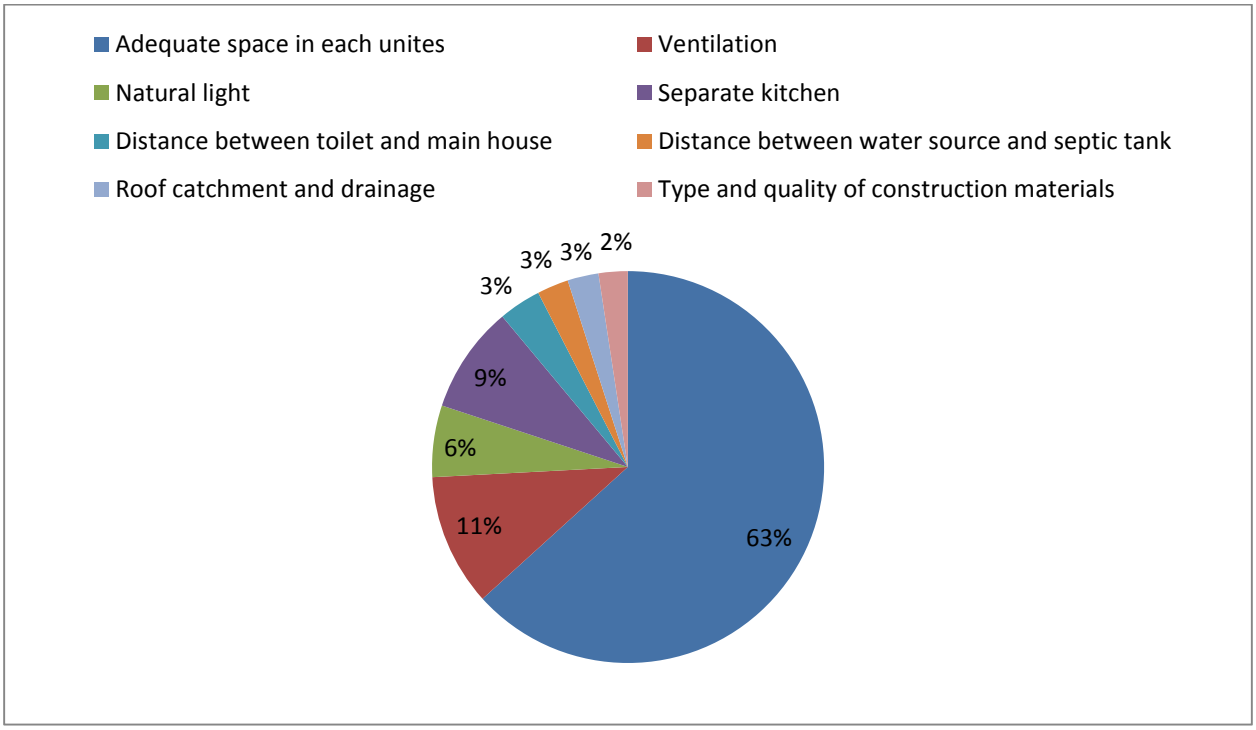


Figure 4.1: Participants Responses on the components of existing regulation for built-in environment. EcoHealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

4.2.2.5 Standards and regulations on water, hygiene and sanitation

Sixty seven percent of the respondents reported that they know laws/regulations that control households and community actions on waste disposal. In this category (regulation), the one reported by 51.7 percent of the respondents states that individual households or establishments are responsible/accountable for and should keep clean or inform to designated authority if violated by other group about 20 meters radius from their premises. They should keep clean and if found waste unattended this household will be penalized. Regarding the application of this regulation, 17 percent of the respondents reported that they have ever been penalised when found with unattended garbage outside their premises and of which 30 percent did not agree on the fine but paid anyway, 25 percent felt guilty of their action and 46 percent do not remember their feeling.

Table 4.9: Knowledge of respondents regarding selected environmental health and protection laws/regulations and standards, EcoHhealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable		Respondents	
		Frequency	%
Knowledge/awareness of standards, regulations/laws to be followed when constructing residential houses**: n=845**	Yes	457	54
	No	388	46
Knowledge/awareness of standards, laws, regulations relating to environmental protection and environmental sanitation, hygiene**: n= 845**	Yes	473	56
	No	372	44
Knowledge/awareness of standards, laws/regulations which advise individuals and firms to prevent air pollution**: n= 845**	Yes	358	42
	No	487	58
Knowledge/awareness of standards, laws/regulations which advise individuals and firms to prevent/control noise pollution**: n=845**	Yes	311	37
	No	534	63
Knowledge/awareness of standards, laws/regulations which should be followed while installing water line or community water points**: n=845**	Yes	407	48.2
	No	438	51.8
Knowledge/awareness of standards, regulations/laws which monitor individuals and community action regarding solid waste management**: n= 831**	Yes	332	40
	No	499	60

Respondents' responses to various environmental requirements and regulations namely air, water and sanitation, built-in environment and noise are summarised in a Table 4.8. In total, 652 (77%) participants reported awareness of one or more regulations. Of these, 71 percent reported three or more of these regulations, while 15 percent reported only one of the regulations listed above and only 3 percent reported awareness of all of the regulations listed above. Of those who reported awareness of one or more regulations, 59 percent were females and 41 percent males, 55.5 percent owned the house and 44.5 percent rented or shared with other families (Table 4.8).

Forty eight percent (48.2%) reported the existence of standards, procedures or regulations to be followed when installing a water line for facility, household or community water points, and 36 percent reported that the water and sewage authority is the designated authority to follow up on the implementation of the standards. Sixty-three percent hold the local administration responsible, 2.6 percent the Woreda Health Office,

1.9 percent the Urban Development and Works Office and 1.4 percent the kebeles offices.

Table 4.10: Logistics regression using socio-demographic characteristics and public awareness of selected EcoHhealth / environmental health regulations, Addis Ababa, April-May 2012

Descriptions (Xi)		Respondents' responses & practices				Crude OR (95% CI)	Adjusted OR (95% CI)
		Yes		No			
		N	%	N	%		
Y = (reported awareness of selected Environment-related standards /regulations)	**Sex**						
	Male	207	24.5	147	17.4		
	Female	258	30.5	234	27.7	0.695 (0.431,1.120)	0.734 (0.515, 1.046)
	Age						
	< 30 years	227	26.8	180	21.3		
	> 30 years	238	28.1	200	23.6	1.060 (0.808,1.390)	1.222 (0.855, 1.745)
	Education						
	Cannot read/write	43	5.1	76	9.0		
	Grades 1-6	74	8.7	97	11.5		
	Grades 7-10	133	15.7	121	14.3		
	Grades 11-12	99	11.7	44	5.2	**1.495 (1.345,1.662)**	**1.443 (1.252,1.664)**
	College and above	116	13.7	42	5.0		
	Ownership/ House						
	Owned	193	22.8	192	22.7	**1.0**	
	Rented/shared etc.	272	32.2	188	22.2	**0.611 (0.377,0.988)**	**0.657(0.467,0.925)**
	Income						
	≤ 2000 ETB	285	33.7	235	27.8		
	>2000 ETB	46	5.4	20	2.4	**1.896 (1.091,3.296**)	1.182 (0.656,1.745)

Y: Respondents' awareness of existing environmental regulations, while Xi independent variables: X1-sex, X2-age, X3-eduction, and X4-assets and X5 income

Selected socio-demographic characteristics (Xi) as potential predictors (sex, age, education, income and asset (owning houses/land), were computed, using Logistics Regression Model with respondent awareness of existing environmental health-related standards/regulations (Y). Each predictor was computed independently with outcome variables (Y) education (X3), assets (X4) and income (X5) and showed a relationship but, when it was computed with other confounding variables/controlled, the X5 finding was reverted. A test of the full model against the constant only model was statistically significant, indicating that the predictors [education (X3) and house/land ownership/asset/ (X5)] as a sets, reliably indicated relationship with awareness of selected environmental health-related standards/regulation [education (X3) and ownership (X5)] (chi square= 46.450, p=0.000, with df=5)]. The Wald criterion also demonstrated that education (X3) and ownership (X5) made a significant contribution to prediction (p=0000 and p=0.016 respectively). But sex, age and income came out as insignificant predictors (Table 4.9).

4.2.3 Health education and EcoHealth promotion

Of all respondents, only 41.4 percent have ever participated in health education forums and 75 percent of the respondents reported the only sessions which they have ever attended were facilitated by health extension workers. About 11 percent of them claimed media (TV, radio and newspapers) were their sources, and for 9 percent of the respondents, health workers were the source for environment related information (Figure 4.2).

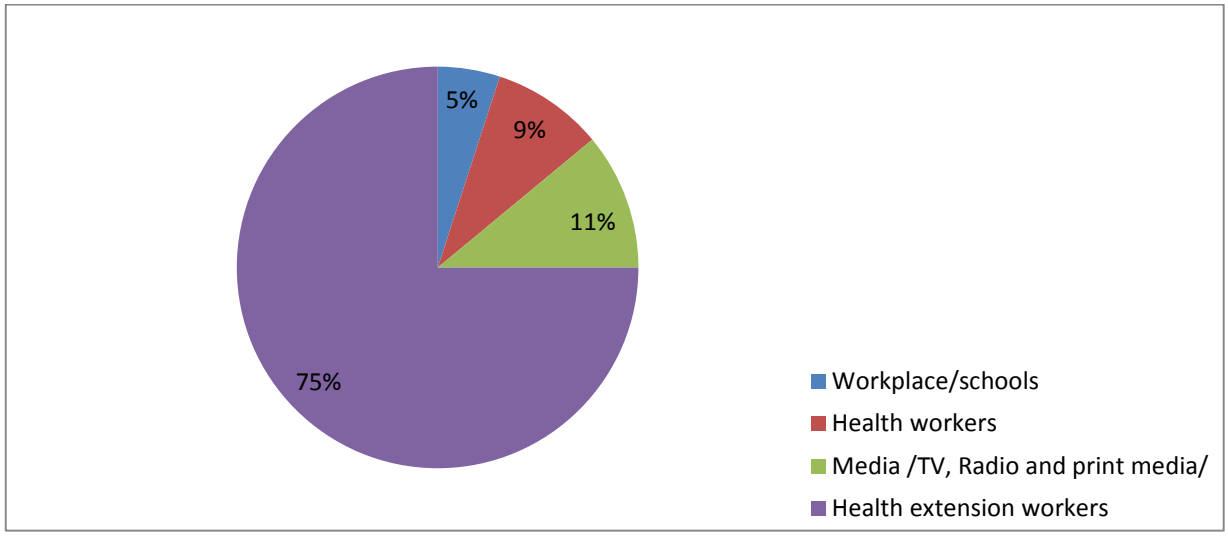


Figure 4.2: Sources of information on environmental issues. EcoHealth Promotion Study, Addis Ababa, May-June 2012

4.2.3.1 Participants' perceptions of health risks due to poor environmental conditions

With regard to health problems in the area, 50 percent of the respondents reported acute respiratory diseases, 17.2 percent skin diseases, 12.3 percent diarrheal diseases, 6.4 percent intestinal parasites, 4 percent malaria and 2.4 percent food poisoning as a major health problem in their community. A total of 532 (63%) of the respondents reported that children under 15 are the most vulnerable victims of the environmental health problems in their locality.

4.2.4 Policy issues

About 23.2 percent of respondents suggested promoting existing regulations, monitoring and reviewing the implementation progress, identifying gaps and complementing these with strategies to make them feasible everywhere. About twenty percent (21.1%) suggested strengthening the reinforcing mechanisms for effective use of available environmental health regulations/standards, 20.6 percent of respondents mentioned the importance and the application of the industrial and residential regulations at all levels,

and 19.5 percent suggested mainstreaming environmental and ecological issues in every sector where applicable, to improve the environmental and EcoHealth situations.

4.3 RESULTS PRESENTATION ANALYSIS AND DESCRIPTION: QUALITATIVE METHOD

The qualitative data set was collected, using three methods; FGD, in-depth interviews and observation. The data were collected from different population groups; women, youth, experts from the public sector and key informants from the community. The methods used for analysis and descriptions discussed are as follows:

4.3.1 Methods and materials

A total of 17 FGDs and 12 in-depth interviews (structured with five themes) were conducted during March to August 2012, and a total of 152 people (140 FGD and a total of 12 in-depth interview participants) from different socio-demographic backgrounds participated. The major groups which the participants represented included women and youth groups, health extension workers, experts from the Woreda Health Office and Environmental Protection Office, and dust-bin collectors, experts from public and private organisations, factories and establishments (food and restaurants). Most interviews and discussions (health, women and youth affairs, environmental protection and administration) were conducted at the woreda administration, sector offices.

Pre-designed interview guides for both discussion groups (FGD and in-depth interview structured with themes) featuring five main and about 12 probing questions were used for discussion. Verbal consent was obtained before each discussion.

4.3.2 Overview of data collection, and analysis

Data were collected through FGDs and in-depth interviews. All discussions were recorded on audio devices, using the local language Amharic, transcribed and translated into English. Open Code version 3.4, special software, available through free distribution from Umea University, was used to organise, categorise and analyse the qualitative data. Moreover, the findings were manually checked for accuracy and analysed, using the content analysis method.

4.3.2.1 Organisation of data

The audio records were transcribed and translated into English language by a primary investigator, and saved in text format. The field notes were used to verify participants' identification and maintain the coherences. To understand and get familiarised within the flow, each record was run at least twice before the transcription was begun. The translated version was recorded with the Microsoft Word software and transported to text format to fit in with the open-code software. Furthermore, the coded data was printed and revisited for accuracy/consistency using pencil and different colours of highlighters and checked against the electronically coded version by concepts and attributes that were identified for each theme. The coded scripts were used as a way forward for developing a comprehensive framework for analysis. The comprehensive framework was then transferred to open-code software and coded, categorised and analysed, based on the following five thematic areas:

THEME 1: Defining EcoHealth and factors responsible for environmental health (Objective # 1)

THEME 2: Identifying key environmental/EcoHealth problems and factors contributing to the challenges relating to the health of women and youth (Objective # 3)

THEME 3: Women and youth awareness of existing environmental health standards, laws and regulations (Objectives # 1 and 3)

THEME 4: The role of women and youth in the environmental health of the urban and peri-urban environment (Objective # 3)
THEME 5: Participants' suggestions to improve EcoHealth (Cuts across all objectives.)

4.3.2.2 Reporting on techniques used for analysing the data

The reporting process follows five essential steps: familiarisation, identifying a thematic framework, indexing, charting, mapping and interpretation. Each step has been explained below:

Familiarisation: The research engaged in in-depth familiarisation of the data in order to systematically code and carry out thematic content analysis on the data. To achieve this, the researcher was substantially immersed in the raw data by listening to tapes, reading transcripts and studying notes in order to list key ideas and recurrent themes. The researcher also shared the transcript with the research team for suggestions to the note taker (reporter) and to those who assisted with the quantitative survey supervision to enrich the data analysis process. The analysis was then checked for comparability and similarity, and discrepancies were resolved.

Identifying a thematic framework: The researcher identified key ideas, issues, concepts, and themes as examined and referenced in the data. This was guided by the aims and objectives of the study. It was also guided by issues raised by the respondents themselves, as well as perceptions or experiences that recur in the data. The end product of this stage was a detailed index of the data, labelled into a manageable size for subsequent retrieval and exploration.

Indexing: Thematic framework was used to systematically index the data in textual form. This was done by annotating the transcripts with numerical codes from the index. Each index was supported by short text descriptors to elaborate the index heading. Single passages of text were made to encompass a large number of different themes, each of which was recorded in the margin of the transcript.

4.3.2.3 Data analysis

In section 4.3.3.2, the demographic and socioeconomic data of participants who participated in focus group discussions were presented and quantified. This might be important for contextualising some qualitative data presented and discussed in sections 4.3.2.5 and discussion section, respectively. The number and depth found in the quotes under the themes indicated data saturation.

4.3.3 Demographic data of participants

A brief demographic and socioeconomic profile of participants per study of socio-demographic groups for both methods (for FGDs and in-depth interviews) is presented in the table below (Table 4.10).

A total of 152 participants, 72.4 percent female and 27.6 percent male participated in the qualitative study. Of these, 65.1 percent were aged between 20 and 29, and 34.9 percent between the ages of 30 and 65. About 15.8 percent received a primary level education, 40.8 percent secondary school level; 33.6 percent attended college, and a few (9.9%) reported university degrees in various fields of study. The majority (60.5%) work in the public sector, 13.6 percent farmers, 11.8 percent engaged in private-for-profit and non-profit-making enterprises (10.5% in private-for-profit and 1.3 percent private non-profit-making endeavours), 4.6 percent are students and 9.9 percent are unemployed.

Table 4.11: Profile of study participants, EcoHealth promotion Study, Addis Ababa, Ethiopia, May-August 2012

	Frequency per-subgroups							
	Woman	**Youth**	**Dustbin collectors**	**Vegetable growers**	**HEWs**	**Admin & Public office, Factories**	**Total**	**%**
No of sessions (FGDs)	3	6	3	2	3	0	17	100
Participants FGD	26	49	25	16	24	0	140	100
In-depth interviews	0	0	0	2	3	7	12	100
Sex (both sexes)	26	49	25	18	27	7	152	-
Male	0	18	9	12	3	4	42	27.6
Female	30	31	16	6	24	3	110	72.4
Age								-
20-29	14	47	13	2	27	0	99	65.1
30-39	9	2	6	4	0	5	26	17.1
40-49	5	0	4	7	0	1	17	11.2
50-64	2	0	2	5	0	1	10	6.6
≥ 65	0	0	0	0	0	0	0	0
Education								-
Primary level	4	-	17	9	0	0	24	15.8
Secondary school	16	29	8	7	0	0	62	40.8
Diploma	7	15	0	2	24	3	51	33.6
University degree	3	5	0	0	3	4	15	9.9
Occupation								-
Public sector employee	18	21	25	0	27	5	92	60.5
Private-for-profit	3	11	0	0	0	2	16	10.5
Private-for-non-profit-making	1	1	0	0	0	0	2	1.3
Farmers/vegetable growers	2		0	18	0	0	20	13.2
Students	0	7	0	0	0	0	7	4.6
Unemployed	6	9	0	0	0	0	15	9.9

THEME 1: Defining EcoHealth and factors responsible for environmental health

Only a few participants in the discussions gave adequate definitions of environmental health and/or listed the contents of the environment and/or environmental health. For most participants, environment is limited to land; forest, water and air – yet some participants did list relevant issues in their definitions of environment and of EcoHealth. Socio-demographic and economic situations, culture, politics, built environment, air, water, and living and non-living things including human beings were listed as contents

of the EcoHealth and environment definitions in the discussions. In the youth group, a clean – and green – environment, peace and stability, and sense of freedom (opportunity to enjoy rights) were discussed as components of the healthy environment.

A young woman from youth group said, “A healthy environment is the product of a system which allows participation of all stakeholders especially the community to contribute for or to participate in planning, implementation and monitoring processes.”
However the majority listed some of the essential components in their definitions. For instance, a young boy in the youth group said, “Environment is a place where we have sufficient land for housing or farming”, another participant in the same category defined environment as “a place where the community members interact to fulfil the basics needs, market, factories, schools and offices”.

An elderly person in the women’s focus group discussion defined environment as “a place where people are able to produce an income for living and enjoying peace.”
Factors mentioned by the participants were tended to relate to the stakeholders’ behaviours and actions and, in the FGD and in-depth interviews, participants mentioned poor planning and implementation of environment-related projects. Some also mentioned poor monitoring by the designated regulatory offices and experts, private and public owned production and service centres like factories, garages, as well as lack of individuals’ and community members’ awareness of the healthy environment and activities as major causes of environmental health problems.

One participant, an expert in the public sector, remarked, “Failure to comply with the regulations and recommendations of the environmental impact assessment by the new and existing industries and production centres are a challenge to the study area.”

THEME 2: Identifying key environmental/EcoHealth problems and factors contributing the challenges relating to the health of women and youth

In contrast to the quantitative study participants, the majority of the qualitative study participants believed that their environment is not clean and argued that low community awareness and poverty (low economic status of residents) and a weak law-enforcement system are causes of the environmental health problem. Uncontrolled population growth was also viewed as factor in the poverty and poor environmental health status of their locality.

Poor solid waste and household sewerage management, distribution and quality of latrines especially in communal compounds, untreated and toxic discharges from factories and establishments were put forward by the majority of participants as main causes of the EcoHealth challenges in their community. A reason given for these problems was low public awareness which was justified as a basis for individual and group behaviour and actions in their community.

A participant from the expert group said, “Behaviour is constructed by environment (education, participation) and most of the community members’ awareness level is low and it is difficult to shape or monitor their behaviour. In my view, the major challenge in our village is low level of community awareness of the subject of environmental health and ecology.”

An adult woman in the FGD group said, “Most of us are housewives and are not well educated. We manage our houses and the villages in the traditional way. In my opinion the root cause is women’s education level. I clean my house every day, and used to dispose of waste in the back yard where it piled up and bred rodents that became nuisances. Recently the health extension workers form the woreda health office came and taught me to separate the solid and wet garbage. My argument here is that low level of education/awareness is the root cause of environmental health problems in our community”.

A woman participant in the FGD group also cited “weak supervision of the industries, garages, and food and beverage establishments” as a reason for environmental pollution in her community. This reason was often mentioned in most of the discussions and it initiated discussions among the participants.

Both the FGD and in-depth-interview participants repeatedly mentioned failure to economise and to preserve renewable and non-renewable natural resources (plant, animal, social structure) as dominant causes of the unhealthy environment. According to the participants, the environment should be as free as possible of all sorts of pollution and other wrongs (noise, air, physical and social problems/crime, corruption, poor governance). In their view it should be minimised to the level where the eco-system can accommodate it at all levels. They went on to describe how the officials and experts in the public system overrule the standards which would have prevented the range of environmental health problems if they had been followed. Examples include connecting the sewage from factories and establishment to the open drainage system and rivers, as well as letting individuals occupy the river basin.

“For example, in our case, there are many factories along the Akaki River basin. Almost all were established some years back and do not have proper treatment schemes for the by-products and wastes. They let untreated or poorly treated wastes into the rivers and people use the contaminated water to grow vegetables. Metal and chemicals are absorbed through the vegetable root system and carried into households with the vegetables. The contaminated products are consumed by the community and no one knows what happens to the consumers and to those who use the water for urban agriculture.” (Extracted from youth focus group discussions)

Also participants thought the location of their residence (being at vicinity of the city and at the industry zone) makes them unlucky and they believed these factors exposed them for many EcoHealth challenges. They also believed that the area has not been given the necessary attentions.

An old lady from the women's group said, "I have lived here since childhood and remember the farm, grazing land and the forest cover. It was beautiful and we were delighted by nature. Our environment was clean. We used to watch some wild animals and enjoy the green cover. However, now it is hard even to find some useful insects like butterflies today. For me, urbanisation and technology are a threat to nature."

A woman in the FGD said that "the deterioration of our environment is a recent phenomenon. I was told that the city has a master plan but have never seen any attempt to use or implement the standards which guide and instruct us to accommodate the required proper features (environmental health-related features, like safety features) in the recently built-in features like the ones forming part of the new buildings in our subcity and elsewhere in Addis Ababa. Newly constructed multi-story buildings have been erected closer to the busy road, where there is no parking space and no green space. I don't think the municipality engineers are well educated. The condos are too close to the river basin and expose the public to health hazards. For example, living at the Gofa condo is terrible! The smell from the river water is really disgusting . . . Therefore the problem is lack of proper planning in my view."

An expert in the public sector participated in the in-depth interview, saying, "Participatory planning is essential for urban management. No sector should be left behind when the municipality and subcities undertake planning exercises. So, the lack of different actors' participation could be a reason for current environmental health problems in our location".

BOX 1: Synopsis of the environmental health issues posed as the major concern by the FGD participants:

- **Physical Environment:** proper use and care to the natural environment such as land, forest, climate, temperature, rainfall, plants and animals;
- **Sociocultural Environment:** developing and maintaining socio-cultural environment such as norms, customs, process of socialisation, social institutions;
- **Environmental Behaviour:** expected behaviour in the course of using the environment for socio-economic benefits; effective use of resources and conservation, for example, complying with standards and regulations, observing required limits in production process and proper waste management; good conduct while driving, limiting air and noise pollution;
- **Institutional behaviour:** concerned institutes in public or private structures should consider all components of the environment, such as the people in it and the environment itself when effecting/investing in residential or business complexes, factories, schools, or any useful activities.

BOX 2: Synopsis of the stresses to environment and the health hazards listed by the FGD and in-depth-interview participants:

- Air, chemical and toxic pollutants from the factories (e.g. tanneries, cement factories);
- Motor accidents (along the ring road and Addis Modjo highway);
- Noise pollution from bars and restaurants, vehicles, nightclubs, animals; noise from churches and mosques in early morning;
- Land grabbing, clearing of green cover for expansion (expansion of business and residential complexes); Drowning, especially during the rainy season (Akaki and other tributaries).

BOX 3: Synopsis of reasons/factors given by the FGD participants for poor environmental health conditions

- Low economic status of the community;
- Low community awareness of the subject of environment and environmental health;
- The presence of factories which do not have proper waste treatment schemes;
- Low attention on the part of the public sector and all levels of administration;
- Absence of activists and sufficient and strong development partners.

THEME 3: Women and youth awareness of existing environmental health standards, laws and regulations

Few participants in the in-depth-interview category and very few participants from FGDs recalled any commitments made by the country such as the signed conventions and treaties relating to environmental protection (e.g. Copenhagen Summit). Some also referred to the constitution and various regulations that the country promulgated. According to these groups (participants), however, these regulations and codes are neither fully implemented nor widely disseminated. In their view, these instruments are not well known or properly followed by all stakeholders (individuals, community, public and private sectors).

"In my observation, even professionals do not properly know the details of the environmental health regulations. It is because the print media (Negarit Gazeta)[1] is expensive and not widely distributed. Only a few copies are distributed when new regulations are endorsed. It is costly for most of us and difficult to get hold of even if one would like to have private copy." (Extracted from the in-depth interviews)

[1] "Negarit Gazeta" the government newspaper exclusively used to announce such issues (laws, regulations, codes etc.).

Lack of implementation guidelines and absence of proper delegation (the need to designate an office, department or unit at each level to effect and monitor regulations) were also discussed as challenges and as the reasons for poor implementation and follow-up of existing regulations and codes. According to the participants, the country has relatively excellent regulations pertaining to most sectors and issues but these are marred by the absence of proper delegation at each level and an implementation manual for some are the main challenges.

*"*We have a number of regulations, standards and laws but these are not yet properly and widely disseminated and implemented. The system lacks proper a monitoring and enforcement mechanism. For example, households are responsible for and should keep clean an area of about 20 meters' radius from their premises. But it is difficult to observe the proper application of this regulation. For example, if you visit the village closest to this point, you will find nuisances (unattended solid and liquid wastes in roadsides). If the regulations were properly enforced then maybe we would not have to find unattended garbage within the 20 meters' limit of the households in our village or anywhere in Addis Ababa". (Extracted from one of the in-depth interviews)

"I heard from friends that every household is responsible for and should keep clean a 20-to-50 meters' radius from his or her premises. I think someone should take the initiative and disseminate the concept to each household and, for me, the media is the right organisation". (A young woman from the FGD group)

A participant from youth group said he knows a couple of environmental health programmes on "Sheger FM 102.1" radio station. He mentioned "Kebet- eske-ketema"- meaning "from the household to the town and environment" which broadcasts issues related to the environment."

Theme 4: Role of women and youth in the environmental health of the urban and peri-urban environment

Participants underlined the point that women and youth constitute a large part of the population in their community. According to the FGD participants, women, youth and young children are particularly vulnerable to environment-associated risks. In the discussion, participants referred to media reports of incidents such as rape, different form of abuses and the extent of domestic violence towards women, young girls and children, as evidence for their arguments.

In the discussions, the relationship between women, youth and the environment was adequately described. According to the participants in the youth and women groups, women are carrying the greatest burden of household activities in their community. Women and young girls are responsible for cooking and cleaning and, while performing these activities, they are exposed to indoor air pollution and toxic substances at home and in the workplace. In their view, women are the first point for childcare, and care of elderly and sick family members who are unfortunate and exposed to health hazards. Participants in almost all discussions concluded that home and family are significant environments which may have an either positive or negative health impact on women. Participants also stated that occupational exposure to toxins (e.g. pesticides) at workplaces or on farms affect women's reproductive health. Discrimination and all forms of abuse (from supervisors or male colleagues), low wages and combined responsibilities for work at home are concerns reported in the discussions.

"We are everywhere and I think women are the cornerstone for any society. Young boys and girls are a future to individual household, community and the nation", commented an elderly from the women FGD group.

"Let me take you to my village: at the moment you, through your eyes, can see young boys and women who carry bloated sacks with household garbage, and a cart which is

overflowing and push-pulled by a couple of young boys and women. I am certain, in most cases; you would cover your mouth and nose with your hand or handkerchiefs. The technology is not yet changed and is laborious. If we did not have these groups, then our environment would have looked different." (The words of a young boy from an FGD [garbage collectors] group)

"In a cultural society like Ethiopia, women have responsibilities beyond the home and the workplace. Safety is a central concern for women in the community. They are highly engaged in traditional forums in Ethiopia. For example, in traditional associations like "Edir" women are engaged in so many social responsibilities. These therefore expose a woman to stress. She is always struggling to fulfil the family, social and cultural responsibilities". (Extracted from an in-depth interviews report)

"The women who migrated from the rural villages are not well educated and are usually assigned to labour-intensive or unit jobs which have health hazards, like in factories, and busy cooking kitchens in restaurants. Although they are efficient at discharging their duties and responsibilities, they are exposed to toxic substances and indoor air pollution while performing these tasks". (Women, in FGD group).

"It is poor women who work in bar and nightclubs where violence and risky behaviours are common" (a health extension worker's FGD participant's) words.

Participants also said schools are essential for self-development with knowledge and skills, if the school is staffed with good teachers and has monitoring mechanisms for the behaviour of its communities (teachers, other staff members and students). Schools enable women and youth to overcome poverty, and provide them with skills and empowerment to mobilise resources. Participants reiterated their concern that, if the school does not have a system to develop and monitor the behaviour of its community members, both young women and youth will face further challenges. Early pregnancy, illegal abortion, substance abuse including Khat, cigarette smoking and alcohol consumption, and diseases (STDs, HIV/AIDS), were crimes mentioned by participants

as challenges to environmental health which could cut short the future of women and the youth.

However, some participants from the FGD reported that women and youth, including adolescents, contribute negatively to environment.

“Garbage and liquid wastes are generated daily in every household and, because of low awareness and lack of skills, the generated wastes are left unattended at the household and or dumped outside the compound” (extracted from an FGD participant).
“In my understanding, household garbage causes many health problems because we do not give it the necessary attention and leave it unattended. I personally believe, garbage is waste and can be put somewhere far from the main house. No one instructs us or arranges a proper place for garbage in the household and thus the garbage is put anywhere in the household – so my mother or the maid or my sister should not be blamed (spoken by a young boy from the youth group FGD).

“Most Khat chewing takes place close to Khat vendors and is run by young women. The customers, in most cases, are adolescents and young adults. The volume of the waste is massive and, left unattended, sometimes chokes the drainage system.” (Excerpt from FGD participants discussions.).

Theme 5: Participants’ suggestions to improve EcoHealth

Participants suggested or proposed the following:

- Everyone should be aware of his or her responsibilities regarding the environment and the rewards of the healthy environment.
- Concerned bodies should develop and implement strategies to increase the public awareness of EcoHealth.
- Media, workplace and schools should be pro-active and contribute to a healthy environment.

- Guidelines should be developed and implemented for existing regulations and the proper assigning of responsibilities and accountability to concerned departments or offices of the public sector.
- The existing regulations should be implemented and monitored by means of proper and continuous enforcing mechanisms.

4.4 RESULTS PRESENTATION, ANALYSIS AND DESCRIPTION: THE INTERVENTION STUDY METHOD

The participants who reported urban agriculture as their economic activities was interviewed using the survey tools identified for this section (see Annexure 1). Moreover, the respondents were categorised by location, and six clusters with 6 to 8 households who cultivate vegetables were included for the multiple baseline survey. Of these, three sites were selected and provided with a bio-sand filter for use as a hand-washing facility. A total of 53 for the multiple baseline and follow-up study, and 21 vegetable growers to use the hand-washing facilities were included in the survey. The methods included in the environmental health promotion interventions engaged participants in identifying environmental stressors, strategies to curb the problems, the enabling environment and required safety measures when using wastewater. The safety methods communicated to participants included methods of protecting oneself from contamination, creating an earth dam and keeping water for at least five days before using it for irrigation. This method helps the wastewater to settle and leave behind hazardous substances. There was information on the contaminants and possible health hazards, and types of crops recommended for such water sources. A bio-sand filter with effective sand size ranges between 10mm and 2.5mm was introduced. Participants were oriented on use, required materials, standard sizes and skills required for production of the devices. After the devices were installed and water kept for four weeks, samples were taken from both sources of raw and treated water and tested for contents and changes during the course of treatment. The laboratory tests were done on the scene at water and sewerage authorities and environmental protection authorities, and the results communicated to study participants and the leaders of the vegetable growers. The data on selected

indicators of the observed changes, progress of the EcoHealth promotion method (the stress process method) and the multiple baseline survey data are presented, analysed and described in the following section.

4.4.1 Methods and materials

Four distinct methods/steps were employed to collect data for this section: (1) The semi-structured questionnaire (module 2) was used to recruit participants for the follow-up/for the multiple baseline survey and to establish baseline information about the vegetable growers in the study area. Data for this section were collected from participants identified for module 1 and who reported urban agriculture as the primary economic activity or as an additional income source. (2) Respondents of module 2 were listed by location. Seven locations with four and above plots were delineated, of which three clusters (with 6-8 plots) were selected randomly. Polls were conducted in the selected clusters as reconfirmation of the participation of baseline participants, and new participants – in total, 21 vegetable growers (10 new), were willing to participate in the follow-up study.

In this section the ecological model was used to identify ecological stressors and to establish consensus on the intervention. After each discussion, selected information was provided to participants to increase their awareness of eco-health. (3) Simultaneously, before and after each session, participants were interviewed. Module 3, a separate tool, was used to measure changes in awareness of eco-health over time among vegetable growers. (4) In the intervention section, the devices for water treatment (bio-sand filter methods) were adopted and introduced to the three sites with self-protection devices (plastic boots and gloves) to protect the wearers (vegetable growers) while handling wastewater and working on the vegetable farms. Further information was provided to the intervention study participants to prepare earth dams at various points to dam up the water before use and let the river water settle, to reduce the pathogenic and hazardous particles, thus avoiding the growing of contaminated vegetables which are consumed before or without cooking (see Annexure 4).

Step1: Baseline data were collected, using a structured questionnaire to establish consensus and confirm participations and establish baseline information relating to wastewater use among vegetable growers (conducted during June - May 2012).

Step 2: Each discussion was conducted with participants (vegetable growers and key informants). The Stress Process Ecological Model was used to identify eco-health problems (stressors) (June - October 2012).

Step 3: After each session; information, education and communication/behavioural change communication (IEC/BCC) was conducted with print materials and face-to-face briefing to alert participants toEcoHealth, wastewater use and health hazards, hand-washing and harvest-cleaning practices to prevent the workers, their family and consumers.

Step 4: Bio-sand filter devices were produced and erected in the selected location as potential devices for hand washing, farm tools and harvest cleaning. Orientation was given to three sites, during different sessions and at different times. The devices were produced with the support of the research team and by each cluster focal person. The devices were erected close to the river and the farms, in the places the participants recommended.

Participants in each cluster of plots were oriented to the activities (hand washing and harvest cleaning with treated water) and the follow-up observation commenced to document participants' intentions and use of the filtered water for the practice of washing hands and the harvest, and cleaning farm tools. Study participants were also observed for the use of the self-protection devices while working on the farms and handling the wastewater. The observations were done anonymously by trained people (1 September 2012 to 28 February 2013).

The effect of the devices on reducing hazardous particles and pathogenic organisms was sent to a laboratory for testing. The finding was used as a message for the

development of health education. Neighbours (other vegetable growers) were also observed for diffusion of knowledge, to see whether their behaviour showed utilisation of the facility for washing hands and harvest.

4.4.2 Selected socio-demographic characteristics of participants in the baseline and follow-up studies

A total of 53 people who are practising urban agriculture (vegetable growers) in the six study woredas were included for the baseline survey (they were identified during the cross-sectional survey). The ages of respondents ranged between 18 and 75 years with a mean age of 49.53 and ± 13.203 SD and median age of 51 years. The majority, 64.2 percent were females and 73.6 percent were married and 22.6 percent were single. The income of 57.3 percent comes exclusively from the vegetable growing activity, while 42.7 percent use the activity for additional income (Table 4.11).

The majority (86.8 %) of participants use the plot for vegetables, 7.5 percent for fodder production and 5.7 percent for fruit trees. All 11.3 percent of respondents in the baseline group reported that they have been practising urban agriculture for 5 years or less, 66 percent for 5 to 10 years, while 22.6 percent reported doing so for more than 10 years (Table 4.11).

For the follow-up study (multiple baseline data participants) the respondents were categorised by cluster of plots. Three plots, which are close to Little Akaki River, were identified from two woredas in Nefasilke-Lafto subcity, and a head count (census) was conducted to recruit participants. A total of 21 people were identified, 6 to 8 people per cluster of plots, and asked for their consent. Fortunately, the majority of the participants (91%) were interested (Table 4.11).

Table 4.12: Socio-demographic characteristics of the study participants (vegetable growers) of the multiple baseline method EcoHealth promotion Study, Addis Ababa, Ethiopia, April-May 2012

Variable	Baseline survey participants		Follow-up survey	
	Frequency	%	Frequency	%
Sex:	53	100.0	21	100
Female	34	64.2	9	42.9
Male	19	35.8	12	57.1
Age in years:				
≤ 19	1	1.9	0	0
20 to 29	3	5.7	0	0
30 to 39	4	7.5	0	0
40 to 49	12	22.6	7	33.3
50 to-64	25	47.2	9	42.9
≥65	8	15.1	5	23.8
Marital status:				
Single	12	22.6	0	0
Married	39	73.6	21	100
Widowed/widower	1	1.9	0	0
Divorced/separated	1	1.9	0	0
Education:				
Cannot read and write	17	32.1	8	38.1
Grades 1-6	16	30.2	10	47.6
Grades 7-10	12	22.6	3	14.3
Grades 11-12	8	15.1	0	0
Additional economic activities:	-			
Yes	23	42.7	13	62
No	30	57.3	8	38
Plot used for				
Vegetables	46	86.8	21	100
Fodder	4	7.5	0	0
Fruit trees	3	5.7	0	0
Years in urban agriculture practice				
Less than 5 years	6	11.3	0	0
5 to 10 years	35	66.0	0	0
For more than 10 years	12	22.6	21	100
Use of self-protective devices while working/handling wastewater = 21				
Yes	12	22.6	2	9.5
No	41	77.4	19	90.5

4.4.3 Urban agriculture as a benefit for green cover and employment opportunities

Almost all participants (99%) in both groups believed that urban agriculture and recycling wastewater for urban agriculture benefited the community and created employment opportunities. Moreover, all believed that, if properly managed and given sufficient attention, it can contribute to the green cover. This thought is shared by the qualitative method participants and everyone reported that the practice is not yet well understood by the public sector officials and administrators at both higher and local levels. Focus group participants acknowledged that the government has allowed them to create cooperatives but has not given sufficient support and protection for the activity.

A vegetable grower in the FGD group reported that his parents and grandparents practised vegetable growing and said, “Urban agriculture is a profession to me that my family taught me.” He wants the activity to be recognised and supported by the government.

“We supply fresh vegetables to vendors and consumers. You have to recognise us. The practice is the single and only income source to most practitioners. It should be recognised and added to the municipality job lists.” (Extracted from one of the vegetable growers groups [FGDs])

“The income from this activity is supporting hundreds of families and helping children to grow and go to schools. We care for our children and thought the children will choose different sectors. Till then we have asked the administration to let us work in the fields we possess today. Actually most of us are not recognised by the local administration and are not allowed to invest in it”. (Excerpted from the veritable growers’ FGD).

Moreover, the FGD participants (vegetable growers) reported that the expansion of the city is continuing and claiming the river basin for housing and industry. In their view, the expansion has not considered river basins and the contribution of the wastewater users.

“In my understanding, the expansion of the city seems uncontrolled; it occupies the green cover, river basins and cliffs which are supposed to be covered by forest. I really do not know what Addis Ababa will look like after some years. The city is wrongly growing; the condos and new residential areas do not consider the importance of green covers. I am sorry” said an elderly person in the vegetable growing group FGD.

4.4.4 Practitioners’ views on risks related to use of wastewater for farming (growing vegetables)

In their report, all participants (100%) use the wastewater without treating it and 95 percent of them use the wastewater to wash the harvest, the tools and their hands. About 99 percent of respondents reported that they take their harvest and farm tools home and keep them in a place which is accessible to their household members, including children. Only 1 percent of the participants reported that they use pipe water and detergents (soap) to clean their harvest before taking it to the market. Moreover, only 22.6 percent in the baseline group and 9.5 percent in the follow-up group (multiple baseline survey participants) reported that they wear self-protective devices (plastic shoes and gloves) while handling wastewater. Almost all (96 percent) believed that customers know where the vegetables come from and that they do not need to inform customers about where the vegetables are growing.

Figure 4.3: Vegetable growing field, little Akaki river. EcoHealth Promotion Study, Addis Ababa, May-June 2012
(Photograph by courtesy of EcoHealth promotion Study)

"My parents and grandparents practised vegetable growing with Akaki River water, and all enjoyed a healthy and long life. I am using the water for irrigation, cleaning myself and the tools. I am healthy. Look … do I look sick…? You better check the water; many times samples were taken from the river but no one came back to us. I think they haven't seen any harm …. Do not you think so….?" (Reported by elderly person in FGD with vegetable growers).

"I have a daughter and son who went to college. We consume the vegetables and use the income for food and other purposes. I and my family and fellow practitioners are healthy. Of course we sometimes get sick when people in the upper stream let the sewage and toilet scams into the river water. Well, it is not that much serious." (FGD participant, vegetable grower).

Figure 4.4: Vegetable grower in the farm field. EcoHealth Promotion Study, Addis Ababa, May-June 2012
(Photograph by courtesy of EcoHealth promotion Study 2012)

Almost all (94%) from baseline, 92 percent from the follow-up and majority of qualitative study participants (the vegetables grower groups) believed that using the untreated wastewater for such activities and the products of these activities, does not cause any harm on health. In their view, the practice has been there for many years and reported that most of them have learned the skills from their parents. All reported that, so far, neither they nor anyone they know been sick while practising these activities. According to them, their forefathers who engaged in this activity enjoyed a long life and were healthy throughout the course of their life. However, when indirect questions were posed, 90 percent of the participants reported minor skin problems, 75 percent respiratory diseases, 89 percent intestinal parasites and 52 percent diarrheal diseases as common health problems in their community. Few (12%) who live across the Big Akaki River reported malaria as a potential health risk in their locality.

Figure 4.5: Vegetable growers in Little Akaki river basin: cleaning the irrigation canal (barefoot in the wastewater), EcoHealth promotion Study Addis Ababa, Ethiopia September-December, 2012

(Photograph by courtesy of EcoHealth promotion Study 2012)

Participants from vegetable growers, the associations' leaders and experts from the sector offices held a discussion and identified the environmental stressors, possible causes and related health risks. The potential interventions identified by the participants include: capacity building of various sector offices which are directly responsible for environmental health, public awareness programmes, enforcing the existing regulations and policies and follow-up Table 4.12).

Table 4.13: Stressors on EcoHealth situation in urban and peri-urban river basins: listed by the study participants, eco-health promotion Study, Addis Ababa, Ethiopia, August – September 2012

Category	Issues	Causes	Health risks	Interventions proposed by participants
Social and physical environment	There is no legal support for the activity.	No policy or training in wastewater uses.	Acute and chronic health problems (AWD, intestinal parasites, skin diseases etc.) even death	Regulation on wastewater use and promotion
	Uncontrolled toxic and hazardous wastes from point and defuse sources	Weak enforcement and monitoring of actors (factories and residences)		Enforcing existing regulation on environmental protection and waste management
Socioeconomic problems	Traditional and very low production technique	No or low income	Malnutrition and health problems	Training and follow-up
	Low education level (lack-of knowledge and skills)	Exposure to hazardous and toxic substances	Acute and chronic health problems	Training and use of appropriate technology
	Empowerment	Users right to vegetable growing fields not yet provided	Stress	Appropriate policy
	Lack of strong community organisation	Low awareness of use of wastewater and benefits of urban agriculture	Stress	Capacity building activities
Behavioural	Discharging untreated waste into natural environment	Low awareness	Acute and chronic health problems	Training programmes
	Failure to use available and appropriate technology while handling wastewater	Little or no support from concerned institutions		Capacity development and training to
	Failure to protect self, family and consumer from health risks	Low awareness and absence of low-cost and appropriate devices for wastewater treatment		Provision of new technology and health education

4.4.4 Administration and policy support for the practices

Few (7%) of the respondents reported that they had training in the use of wastewater or were informed about the potential health hazards. They had learnt how to protect themselves, their family and customers. They also reported that they were informed about taking the necessary precautions while handling wastewater and products from such an environment. All participants in the qualitative survey and 89 percent from the

interview method (quantitative method respondents) reported that there was no attempt by either the public or the private sector to promote the health of people who engaged in vegetable growing activities. But some from the FGDs and 11 percent from the quantitative method respondents reported that the credit association and cooperative offices tried to make credits available to women and young people who organised themselves into cooperatives.

Almost all (99 percent) are willing to be part of interventions which help them to acquire the water-cleaning skills, and to learn the method for protecting themselves, their family and customers from health risks, the technology to clean wastewater or reduce the concentration of hazardous particles, as well as methods to conserve their environment.

4.4.5 Implementation progress and observed changes in knowledge of possible hazards and practices resulting from selected precautionary methods

Follow-up interviews and observations (multiple baseline surveys) were made by the primary investigator and his assistants every two weeks. In-depth interviews were held with the focal persons/key informants. After each session, sequentially one group at a time was provided with the necessary information and profile of the Little Akaki River and methods to protect themselves from the hazards like metallic, chemical and biological contaminants, and the impacts of these hazards, as well as the necessary precautions (methods to protect themselves and their families – and methods of cleaning the harvest).

Changes in knowledge and any attempt to use the proposed preventive methods is evaluated in subsequent interviews and observation, using pre-defined indicators: (1) changes in knowledge of the contents of the wastewater (2) signing up for the implementation of methods provided to protect oneself, one's family and customers from the hazards relating to wastewater and (3) any sign of knowledge and practice diffusion among neighbours who practice vegetable growing along the Littlie Akaki River basin.

In the first cycle of the baseline survey (14-week period), participants in the six locations were interviewed and observed. Also, every two weeks there was an attempt to ascertain the extent of activities by cross-checking through key informants and in-depth interviews. Although the findings were somewhat encouraging, they were not as high as expected (see the line graph below):

In the first interview only 8 percent of the participants believed that the contents of the Little Akaki River or untreated wastewater could be the cause of health problems. Five percent used pipe water and detergents to clean their hands and the harvest, and only four percent believed that the customers should be informed of where the vegetables are growing in order to take necessary precautions. Although progressing, however, it was only after the fourth follow-up survey that a significant proportion of participants were convinced about the contents of the water sources, and started to acknowledge the importance of necessary care to protect oneself, the family and customers. They also expressed the importance of involving the stakeholders concerned (factories, relevant public offices, administration, the public and any organisation which was directly or indirectly affecting their environment) in their association discussion forums.

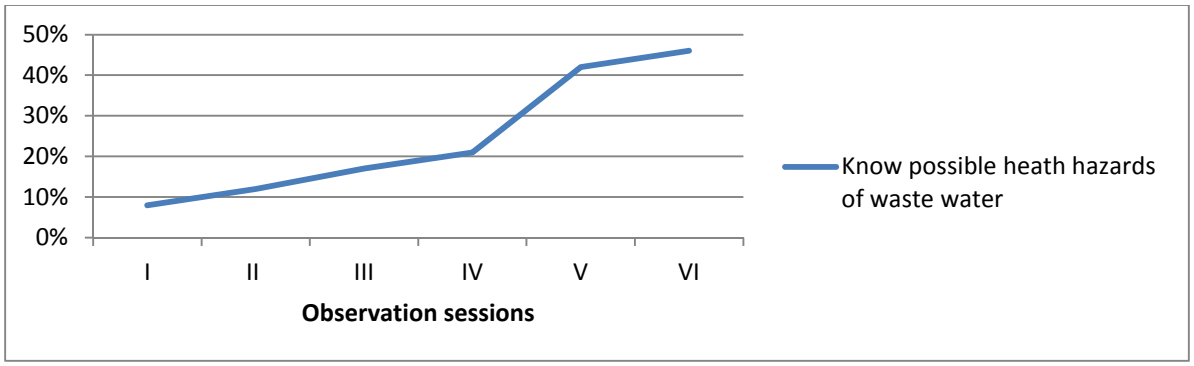


Figure 4.6: Changes in knowledge of possible health hazards relating to wastewater use, EcoHealth promotion Study Addis Ababa, Ethiopia September-December, 2012

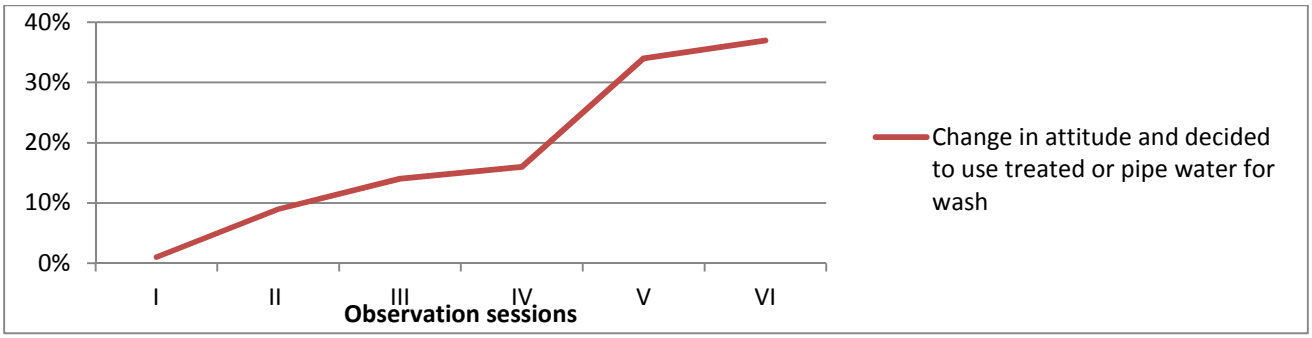


Figure 4.7: Change in attitude and decision made to use treated or piped water for hand, farm tools and harvest wash, EcoHealth promotion Study Addis Ababa, Ethiopia September-December, 2012

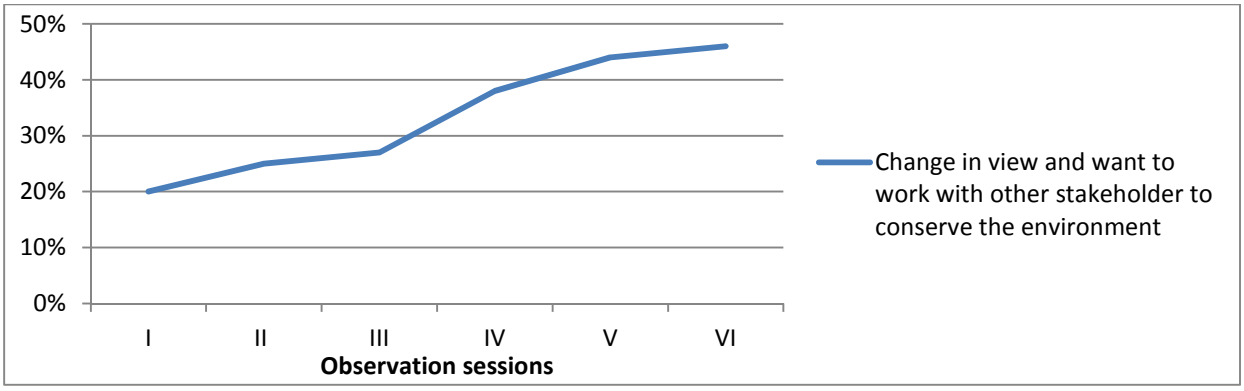


Figure 4.8: Changes in view and interest working with stakeholders on the application of existing and formulation of new regulation on wastewater/ urban agriculture, EcoHealth promotion Study Addis Ababa, Ethiopia September-December, 2012

4.5 METHODS IDENTIFIED FOR FARM TOOLS, HARVEST AND HAND WASHES IMPLEMNTION PROGRESS

A bio-sand filter which functions the same way as traditional slow sand filters was identified because of its efficiency in reducing hazards and production costs. The method uses mechanical tramping, predation, adsorption or attraction and facilitates the natural death of pathogenic organisms.

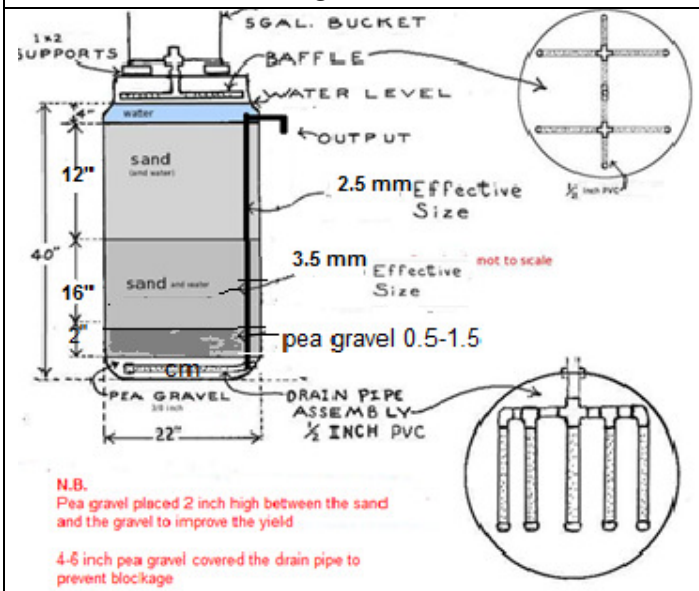
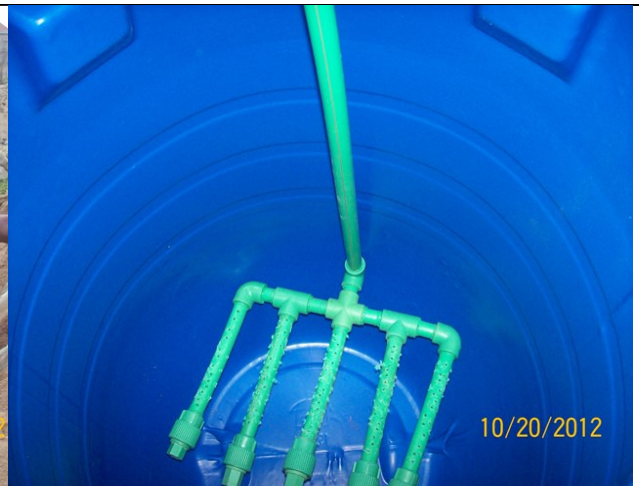
Bio-sand filter, the designee	Bio sand filter: posted at Study site
	

Figure 4.9: Process of bio-sand filter production, the designee and mounted sample on projectStudy site, EcoHealth promotion 2012

The participants in the intervention section were given orientation on the bio-sand filter functions and benefits. Following the orientation, participants selected a focal person and locations to mount the devices. The focal persons were given skills training in production and cleaning/maintenance of the devices and three devices were produced with the help of the trained focal persons, and installed in three study sites where there were clusters of 6.8 farming plots. To grow and form layers of micro-organisms, water from the river

was stored in the devices for four weeks. The devices were intended to trap pathogens.[2] After four weeks, samples from the two sources collected at one-week intervals and tested for physical qualities, chemical contents and biological parameters. Three samples each from the two sources were tested for physical qualities and chemical contents, at the Addis Ababa City Administration Water and Sewerage Authority laboratory. A similar number of samples were collected and tested for the microbiological parameters at the Environmental Protection Authority laboratory.

Cleaning/sorting sand for the device



Installing the pipe

Layering with the sand (top layer)

Bio-sand filter in the vegetable field

Figure 4.10: Process of bio-sand filter production, EcoHealth promotion, 2012
(Photograph by courtesy of EcoHealth promotion)

[2] Both fresh and treated/filtered water have been sent for biological and chemical analyses to Addis Ababa Water and Sewerage Authority laboratory. The result will be used to draft evidence-based IEC/BCC materials,

The physical chemical properties, solid contents, metals, aggregated organics, nutrients levels, industrial and commercial pollutant markers, and counts for faecal bacteria were analysed against the national and the WHO standards for water quality parameters. The facts from study results were used to develop environmental health communication materials and to reach the vegetable growers, vendors and consumers, vegetable growers' association leaders, local authorities and the public office experts.

4.5.1 Physical-chemical properties

The samples were tested for water clarity, electrical conductivity, hardness, suspended solutions (SS), total dissolved solids (TDS) and PH value. The mean turbidity level result was 142.6 NTU for raw samples and 3.38 NTU for treated water. The treated of water turbidity level decreased by 97.6 percent, with 2.57 standard deviation. But the PH and conductivity showed no significant change after treatment: the mean PH was 7.65 for the raw sample and 7.58 after treatment, and the mean value of the conductance test result was 1119 µs/cm for raw river water and 1192 µs/cm for the treated water (Table 4.12).

Table 4.14: Little akaki river raw and treated water physical and chemical properties and solid contents, EcoHealth promotion Study, Addis Ababa, Ethiopia, December 2012 – February, 2013

	Physical and Chemical properties						Solid Contents	
	Turbidity [NTU]		PH		Conductivity [µs/l]		Total Dissolved Solid (TDS) [mg/L]	
Parameters	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Mean	142.67	3.38	7.61	7.57	1,019.33	1,192.00	503.67	579.67
Std. Deviation	41.59	2.57	0.12	0.10	71.01	371.53	38.28	182.15
Minimum	112.00	1.79	7.48	7.48	938.00	976.00	463.00	474.00
Maximum	190.00	6.34	7.71	7.67	1,069.00	1,621.00	539.00	790.00

Total dissolved solid concentrations in raw wastewater lowest value was 463 mg/L and the highest 539 mg/L, whereas the lowest value of the treated sample was 474 and the highest 797 mg/L and mean value were 503.67 and 579.67 mg/L for raw and treated samples, respectively (Table 4.14). Similarly total hardness of the wastewater also increased in the treated water like the total dissolved solid test result.

4.5.1.1 Metals, industrial and commercial pollutants and sulphide contents

The concentration of iron for the two samples sources were 1.49 ppm and 0.14 ppm in raw and treated wastewater respectively. The mean manganese concentration level of the two sample sources were also 1.61 for river water and 2.03 mg/l for treated water with 0.2 and 1.47 standard deviation, respectively (Table 4.15). The mean iron content decreased after treatment by 90.6 percent; however the manganese concentration increased from 1.61 mg/l to 2.03 mg/l (26% increases). Although not significant, the mean fluoride and Sulphide concentrations decreased after the treatment (Table 4.15).

Table 4.15: Little Akaki river raw and treated water, metals, industrial and commercial pollutants and sulphide contents, EcoHealth promotion Study, Addis Ababa, Ethiopia, December 2012 – February, 2013

	Metals				Industrial/commercial pollutants		Sulphide contents	
	Total iron as Fe [ppm]		Manganese as Mn [mg/L]		Fluoride as R [mg/L]		Sulfate as SO4 [mg/L]	
Parameters	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated
Mean	1.49	0.14	1.61	2.03	0.43	0.40	67.57	60.07
Std. Deviation	0.15	0.13	0.20	1.47	0.36	0.16	28.14	4.11
Minimum	1.32	0.05	1.45	0.35	0.15	0.30	49.70	56.60
Maximum	1.60	0.29	1.83	3.08	0.83	0.58	100.00	64.60

4.5.1.2 Nutrients

Five markers for nutrient concentrations were tested, of which the mean concentration of three nutrient markers indicated significant changes between the two sample sources. The phosphate as PO4 level of concentration decreased by 97.1 percent, ammonia as

N by 93.7 percent and the silica concentrations SIO2 by 81.7 percent in the treated sample tests. The nitrite and nitrate levels as N increased in the treated sample tests and the mean values for nitrite were 0.03 for the river water and 0.75 mg/l for treated samples, and the nitrate mean values were 0.10 and 1.48 mg/l for the raw and treated sources, respectively (Table 4.16).

Table 4.16: Little Akaki river, raw and treated water nutrients, EcoHealth promotion Study, Addis Ababa, Ethiopia, December 2012 – February 2013

	Nutrients									
	Ammonia as N [mg/L]		Nitrite as N [mg/L]		Nitrate as N [mg/L]		Phosphate as PO4 [mg/L]		Silica as SiO2[mg/L]	
Parameters	*Before treatment*	*After treatment*	*Before treatment*	*After treatment*	*Before treatment*	*After treatment*	*Before treatment*	*After treatment*	Before treatment	After treatment
Mean	*27.52*	*1.74*	*0.03*	*0.75*	*0.10*	*1.48*	*14.70*	*0.43*	159.90	28.43
Std. Deviation	2.50	0.14	0.04	1.28	0.00	2.19	2.77	0.03	112.27	2.93
Minimum	24.68	1.62	-	0.00	0.10	-	12.35	0.40	50.70	25.20
Maximum	29.38	1.90	0.07	2.23	0.10	4.00	17.75	0.46	275.00	30.90

4.5.1.3 Microbiological tests

Microbiological count was done at three different times for three parameters (counts) for both samples and the result demonstrated changes in concentrations between the two samples for all tests. The five-day Biochemical Oxygen Demand (BOD) mean test reported decreased value in treated samples. The change between the two sample sources was 98 percent (354 mg/l river water and 1.8 mg/l treated water). The mean faecal coliform data for the two sample sources were 440 CFU per 100 ml for raw wastewater and 166 CFU/100 ml for treated wastewater and total coliform mean value 2,109 and 320.67 CFU/100 ml before and after treatment, respectively. The changes in concentration for FC were 62 percent while the total FC was reduced by 85 percent after treatment (Table 4:17).

Table 4.17: Little Akaki River, raw and treated water, faecal bacteria and aggregate organics, EcoHhealth promotion Study, Addis Ababa, Ethiopia, December 2012 – February 2013

Statistics	Faecal Bacteria				Aggregate Organics	
	Faecal coliform [1 CFU/100 ml]		Total coliform [1 CFU/100/ml]		5-Day Biochemical Oxygen Demand (BOD) - [mg/L]	
	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Mean	440.00	166.00	2,109.33	320.67	354.00	1.80
Std. Deviation	455.20	122.40	740.74	122.40	93.30	0.72
Minimum	177.00	97.00	1,254.00	250.00	10.00	1.00
Maximum	966.00	209.00	2,537.00	462.00	172.00	2.40

The concentrations of the metal and biological pollutants levels are higher in most of the parameters compared with the national WHO standards. The increase from the standard ranges was six to above a hundred percent. However, the PH value and the nutrient parameters were found in the standard ranges (Table 4.18).

Table 4.18: WHO and the national water quality standards, EcoHealth promotion Study, Addis Ababa, Ethiopia, December 2012 – February 2013

Parameters	Little Akaki River mean water quality parameter test result		Drinking water standards		Deviation from %	
	Before treatment	After treatment	Federal Ministry water resource standards*	WHO standards **	Federal Ministry water resource standards	WHO standards
PH	7.61	7.57	6.5-8.5	6.0-8.5	Alkaline	Alkaline
TDS (mg/L)	503.67	579.67	1,776	1,000	(15.09)	(98.54)
Hardness	247.33	382.6	392	300	(58.5)	(21.3)
Iron (mg/L)	1.49	0.14	0.4	0.3	90.60	79.87
Sulphate (mg/L)	67.57	60.07	N/A	400	11.10	(491.98)
Fluoride (mg/L)	0.43	0.4	3	1.5	6.98	(248.84)
Ammonium (mg/L)	27.52	1.74	2	1.5	93.68	94.55
Nitrate (mg/L)	0.1	1.48	50	10	(49,900)	(9,900)
BOD (mg/L)	172	2	0.2	1	99.9	99.4
Faecal coliform (cfu/100ml)	177	97	0.2	1	99.9	99.4
Total coliform (cfu/ 100ml)	2,537	250	0.2	1	100.0	100.0

Source:* Federal Democratic Republic of Ethiopia Ministry of Mine and Water resources R ** World Health Organization

4.5.2 Evidence of diffusion: awareness change and observed behavioural changes markers

The bio-sand filters were open for use after receiving the first laboratory test results. The results (since last week of December 2012) were shared with the study participants and the vegetables growers' association management. Then, the study participants, their family members and neighbours, who were practising the vegetable growing, were observed for use of the devices and interviewed for changes in behaviour. The structured questionnaire was used for the interviews, along with the anonymous observations by trained data collectors. The results of the two methods reported that the focal persons

on the three sites were observed using the hand-wash facility. Attempts to use the facility and to help co-workers and family members with filling the bucket or the drain chamber were reported by the study team.

The treated water on all sites was used mainly for washing hands and cleaning farm tools. In this regard, no observations, however, no observations were reported for cleaning harvests and quarries, and respondents declared that they do not wash the harvest in the dry season. The participants, however, reported that they would tell the vendors and customers to clean the vegetables.

Because the devices' yield decreased over time, the baffle was cleaned after the devices had been in use for eight weeks. During the cleaning, an accumulation of silt was observed, which was choking the draining pipes. Since the structure has not been disturbed, the sand layers and the devices kept their functions and the yield returned to its original volume, 1.2 litres per minute.

Moreover, the participants were observed to be using the plastic boots and gloves. However, none of the protective equipment was regularly used and, when asked why, the gardeners claimed that the vegetable beds are crowded with plants which would be damaged if they wore shoes while watering or picking vegetables for sales or household consumption.

CHAPTER 5
DISCUSSION AND INTERPRETATION OF RESULTS

5.1 INTRODUCTION

This chapter discusses the findings analysed and presented in the results section against the study objectives, and triangulates the results from different data sources and methods employed in this study: the results from quantitative, qualitative and intervention methods. Specific implications of the findings for the EcoHealth situation and health promotion progress are also discussed and compared with existing studies/literature to enhance the credibility of the interpretations of the findings.

5.2 ENVIRONMENTAL HEALTH SITUATION OF THE STUDY AREA

The environmental health conditions in the study area were assessed using selected indicators which include solid and liquid waste management, distribution of clean and potable water for household and other purposes, noise and air pollution status and the stakeholders' contributions to the problems and to preventing the environmental health crises in the study areas. Community members' positive and negative influences on their environment, the public and private sectors including women and youth contributions to the EcoHealth situation were investigated using the multiple methods and data sources. The study also examined the different stakeholders' knowledge of existing regulations and the extent of their application. Moreover, the section discusses the contributions of the different communication sources to creating public awareness and promoting the existing environmental health measures of the study areas.

In addition, the section discusses the intervention methods; the ecological health promotion model (health education with and without device provision) used to add perceived benefits and encourage positive actions by the community members.

5.2.1 Solid and liquid wastes

The findings of both the quantitative and the qualitative methods of this study indicated liquid waste from households (defused sources) and by-products and wastes from industries, food and beverage establishments and automotive garages (point source) as sources of the environmental pollution in the study areas. Most households in the study areas connected the drainage from kitchens and toilet facilities into the nearby river basin. Industries, food and drink establishments which are found along the river basins and do not have proper waste treatment devices also allow their by-products and wastes to pour into the river. These actions added chemicals and biological hazards to the ecosystem. These pollution sources similarly reported by Mohammed and Gebresselase confirmed the existence of these sources in the study area (Mohamed 2007; Gebresselase 2007). Moreover, the solid waste landfill of the Addis Ababa City Administration which is found close to the river basin was reported as a source by the qualitative study participants. Mohammed and Kume and Ahmed also reported the landfill as source for air, surface and underground water pollution (Mohammed 2007; Kume & Ahmed, 2005:102;UNDP 2008).

Besides the preceding, the study reported solid and liquid wastes from the informal settlements. Since these settlements are informal, they do not have access to services like water, electricity and are not allowed to construct toilet or any permanent facilities. Thus, qualitative method participants reported that open defecation, and unattended solid and liquid discharges are common phenomena where the informal settlements are located in the study areas. Public sector offices, medical facilities and schools were also reported by this study as sources of environmental pollution. These were also exposed in the study reports by Gebreselasse and Kume (Gebreselassie 2007; Kume & Ahmed 2005: 102).

5.2.2 Air and noise pollution

Sources for air pollution reported by this study included carbon dioxide emission/exhaust fumes from vehicles; smoke from household' energy sources, industries, food and drink establishments. Health facilities were also reported as sources of air pollution when used open burning for medical wastes. The Indian Institute of Management (2010) reported vehicles and industries as a potential source of air and noise pollution in the urban settings. Indoor air pollution in the household and at work places was reported in qualitative study result as the source and a challenge especially to women health. Models presented by Parkes and Schultz justify these sources and reported indoor pollution as environmental stressors and causes of ill-health in households and at workplaces (Parkes et al, 2008; Schulz et al, 2002).

The study findings included vehicles, industries, bars and restaurants, music shops, animals and flour mills as pollutants. Heavy machinery noises from industries, music shops and bars, and restaurants produced noises during the day and at night, and affected the residents and people working in the industries. Similarly, the International Council for Science's interdisciplinary science plan document underlined the carbon emissions from vehicles as sources and challenges for health and urban life (International Council for Science 2011). The qualitative study findings of this research show that the existing environmental health standards and regulations relating to air and noise pollution are neither properly installed in the public system (regulatory body) nor correctly enforced. Irregular monitoring, supervision activities and follow-up of the implementation process of recommending the environmental impact assessment and supervision suggestions were reported as common and longstanding problems with the environmental health care in the country. This report tallied with those of Kume and the FMOH (FMOH 2005 a:23 ; Kume & Ahmed 2005:90).

5.2.3 Sociocultural and economic impacts

The sociocultural and economic situation of the study area was reported as a contributing element to the existing environmental health problems noted in this study. Direct contacts with hazardous substances were also reported as environmental health problems in the community. Irrigation with river water and scavenging for debris and scraps from the river water exposed people to hazardous chemicals and pathogenic organisms. Workplaces were reported as points where workers were exposed to various pollutants during the production processes. Metallic and corrosive chemicals including fertilisers were reported by Lans et al in their study as common contaminates to people using wastewater and practising vegetable growing with contaminated river water (Lans et al. 2011). In addition, this study reported HIV/AIDS and STDs, which are potentially related to socioeconomic conditions and were listed as challenges to the EcoHealth situation in the study areas. This was supported by Pradhan and his colleagues in their research. Pradhan and colleagues reported that people with a low socioeconomic profile fall victim to HIV/AIDS and STDs (Pradhan et al 2006). And then, Mahiteme reported that the social organisation and economic status of the community was influencing the community members' behaviour and actions (Mahiteme 2005). A background paper prepared by WHO on social determinates reflected the low social and economic status, including limited opportunities, which exposed the public to several health-related risks (WHO 2005).

5.3 STAKEHOLDERS' CONTRIBUTIONS TO THE ENVIRONMENTAL HEALTH OF THE STUDY AREA

Wastes generated at household level were reported to be unattended in the study area. Poor management of household sewage and solid wastes were reported in both study methods as a threat to the environmental health of the study areas. Connecting toilet and kitchen sewage to the drainage system was reported in both the qualitative and the quantitative study methods of this research. Industries, food and beverage establishments, automotive garages, schools and health facilities were also quoted as

sources to environmental contaminates. The capacity and the monitoring systems of the public and private sectors were also noted reasons concern in that they manifested poor implementation of the existing regulations. The socioeconomic situation and low awareness on the part of the public regarding existing environmental health regulations were also considered as challenges to the application of existing regulations and the wellbeing of the community. Consequently, the different actors responsible for the environmental health of the study areas and similar locations are discussed as follows:

5.3.1 Perspectives of women and youth

The result of the qualitative method designated women and youth as the joint population group responsible for a healthy environment. They are the prime actors responsible for conserving the EcoHealth conditions. Both qualitative and quantitative methods of this study commended women for maintaining the relatively healthy environment in the households, in the community and at workplaces. The study also greported that youth and women are exposed to environmental hazards in households, workplaces and in the community. Lack of attention and skills to handle the waste generated in households, at workplaces and in the community exposed women and youth to the risk factors which could otherwise be controlled easily.

According to this study, indoor air pollution, contact with hazardous substances while performing assigned tasks at home and workplaces are sources and forms of harmful exposure to women and youth. Furthermore, unattended waste in the household and the community also exposed women and youth to health risks in the areas that were researched. In this regard, the WHO strategy paper reported exposure to pollutants and lack of attention to pollution while discharging duties and household responsibilities and at work places, as risk factors and challenges to women's health in various settings, especially in the urban centres (WHO 2006). The United Nations Department of Development and Social Affairs and WHO (2010) reported cultural influences and social inequality and the special responsibilities which women and youth are obligated to comply with, increase their chances of exposure to health risks. These tasks include the

different cultural and formal tasks assigned to these population groups like household activities, workplace and community obligations (The United Nations Department of Development and Social Affairs 2004; WHO 2010).

Galinsky et al (2011) in their study, reported that, in most societies, the job distributions are constructed according to gender which, in effect means that women are expected to shoulder too many activities and that these expose them to various health risks when performing the assigned duties and responsibilities (Galinsky et al 2011; Reddy 2004).

The qualitative method results of this study, however, designated women and youth as contributors to environmental pollution, especially in households and in the community. For example, they mishandle household garbage and dispose of Khat (green leaves of a shrub which some people tend to chew), food and household garbage into the sewerage lines and leave waste unattended in the community. Tegegn (2012) gives an in-depth discussion of the impact of such behaviour and practices and their effects on the services of the sewerage lines which are meant to prevent flooding, and he also indicates that such actions cause deterioration of and increases maintenance costs of sewer structures, which then tend to become vehicles for disease-causing agents.

5.3.2 The private sector

The private sector (factories, food and beverage establishments, schools, private health facilities) was reflected in the results of the qualitative method as a source of environmental pollution. Failure to comply with the accepted standards (keeping 50-150-meter buffer space along the river basin or keeping the river basin free of any social and economic activities) has contributed to pollution of the river water in the study areas. A similar study done by Weldesilassie (2010) found that most of the factories, food and beverage establishments, including the automotive garages located in the study area, are sources of chemical and biological pollution. Furthermore, in another study report, Weldesilassie claimed that, if the aforementioned challenges to the environment were not controlled by implementing the safety standards issued by the regulatory body, then

they will continue polluting the Little Akaki River basin and the environment around the river basin (Weldesilassie, 2010).

According to the qualitative study method results, the absence of a designated public sector office at woreda level and the incapacity of the next level office to control of environmental health were reported as major reasons for the non-application of the existing environmental related regulations. The irregularity of the inspections by the public sector and weak follow-up procedures encourage the factories and other establishments to release solid and liquid wastes before treatment, as well as creating excess noise and polluted air in the investigated area. Also, the cost of modern waste treatment was referred to as a challenge to the private sector operating in the research areas.

5.3.3 The public sector

Weak enforcement capacity, which is mainly, attributed high attrition of trained staff and the frequently changing structural adjustments were listed as challenges to controlling and monitoring the environmental health of the study areas and preserving the ecosystem. The qualitative study participants highlighted poor monitoring and inspection as factors accounting for the ill behaviour of the private sector in the study area. In addition, the qualitative study participants pointed to the problems of the poor monitoring and reinforcing capacity of the public office and the absence of a designated office for inspection and monitoring the private sector, the public and individual actions at grass roots levels. The frequently changing structure and absence of transition periods between the old and the new arrangements were indicated as challenges to the monitoring of the EcoHealth in urban settings.

5.4 KNOWLEDGE OF EXISTING ENVIRONMENTAL HEALTH REGULATIONS AND THEIR APPLICATIONS

Participants were probed to reflect their level of knowledge of existing environmental health regulations and for any experiences of the application of these regulations. However, only a few of the study participants are well aware of the existing environmental health regulations. The proportion of the community members who reported awareness of the existence of the selected regulations (six selected regulations), the regulations endorsed by the government on environment and health, were very low. The majority in both study methods did not know about the existence of a number of regulations stipulated by the central and regional governments. Of all the selected regulations, only two, relating to construction of housing units and environmental sanitation, were reported by the majorities (54% & 56 % of the participants, respectively). The barriers to awareness reflected by the qualitative study participants included education, income, minimum effort and low media attention to the issue, including the high cost of the print media, “Negarit Gazeta”, the official newspaper which disseminates policy issues, yet not widely distributed. Mass media (radio, TV and print media) were reported by Kume and Ahmed as sources for the regulations (Kume & Ahmed 2005:103). The Federal Ministry of Health stated the use of mass media (radio, TV and print media) for dissemination of construction, usage and maintenance of the sanitary, latrine extension package and environmental health related promotions (FMOH 2005a:26).

5.5 INTERVENTION METHOD: BIO-SAND FILTER FOR ESTABLISHING EVIDENCE AND FOR WASHING HANDS AND HARVESTS

The Stress Process Model which was used for the identification of the problem, selection of health promotion strategies (identification of stressors) and communication with IEC materials during the multiple baseline survey yielded encouraging results. Participants in the multiple baseline survey, the vegetable growers have demonstrated a change in their knowledge and consequently recognise the health hazards of using the wastewater. Study participants and community leaders (vegetable growers’ association leaders)

recognised the risks and showed willingness to change and started discussions with the local administration and environmental protection office (subcity level).

The participants demonstrated awareness of the perceived risks and benefits of the health promotion strategies. Changes in behaviour observed at different cycles of the interventions included appreciating the importance of treated or clean water for hand washing in the first cycle of the intervention. Although a minimal number of participants attempted to comply with the preventive methods employed in the second cycle, they demonstrated interest in working with stakeholders who are functioning in the study areas, such as EPA and local administration. The leaders of the vegetable growers' association started negotiations with EPA and requested assistance for the construction of earth dams at different courses of the river, to keep the wastewater for several days to settle by itself, in order to facilitate biological interactions and reduce contaminates.

Additionally, the bio-sand filter was used to establish evidence of the risks of wastewater use, so that the promoted hand washing gained acceptance. The physical-chemical and microbiological test results for both sources of water, the raw wastewater and treated water, was passed on to the vegetable growers and their families, vendors and consumers of vegetables growing along the Little Akaki riverbanks. The different tests done before and after treatment, and the results showed that the Little Akaki River water was highly turbid and the BOD and faecal coliform concentration was found to be higher in the raw wastewater, and above the WHO standards as well as those of the national quality water standards (Mekonnen A. 2007; Ministry of Water Resources Ethiopia 2008). The standard for any purpose in terms of PH is 6.5 to 8.5; the mean value for both raw and treated Little Akaki River water at the sample collection point was 7.6 and indicates that the water condition in both cases is alkaline (WHO 2006). The maximum concentration of iron for the present study was found to be 1.55 mg/L (the raw wastewater) and the minimum concentration found to be 0.14 mg/L (treated one). Hardness values of raw river water samples varied from 214 to 228 mg/L and treated water samples ranged from 376 to 386 mg/L in as CaCO3, which is fit for drinking and other purpose use (WHO 2006). The total hardness values for both sources were within

the range of the national standards. However, the treated water value was higher than the WHO standard for the parameter and not suitable for drinking but could be used for other purposes (Ministry of Water Resources Ethiopia 2008; WHO 2006).

Although low, when viewed from the national and WHO standards, the total dissolved solid concentrations increased by 15 percent in the treated water and the variation was due to the fact that waste assimilation capacity increases in the treated water which could be due to accumulation of silt and clay particles in the bottom layer of the bio-sand filter.

The changes in the physical-chemical parameters after treatment include by 98 percent for Turbidity; some nutrients (ammonia) by 94 percent; metal concentration by 91 percent; and the biological concentration by 45 to 99 percent. However, the hardness concentration including the total dissolved substances accumulated in the device, and increases the concentration and reported higher test report of the treated samples. Water and Sanitary program reported the bio-sand filter in Cambodia reduced > 97 percent of E. coli. This study reported 86 percent mean reduction (WSP 2010). The test results for the parameters of this study reported that the bio-sand filter could reduce organic and inorganic toxicants by 50 to 90 percent, which is comparable with Doerr & Lehnkuhl (2008:2).

The three biological parameter values (BOD, faecal and the total coliform) are much higher than the national standards and the WHO standards and higher than 99.9 percent for an untreated source at collection point. However, the water treatment device, the bio-sand filter has significantly reduced the physical and chemical pollutants, the faecal coliform concentration, and improved the BOD level, which is comparable with the various study results in the subject (WSP 2010).

5.6 CONCLUSION

Low public awareness on the existing environmental health regulations and weak reinforcement capacity are the contributors to the current environmental health situations

in the study area. Individual households, the community and processing and production centres along the Little Akaki River are increasing the pollution in the river basin.

Use of river water for irrigation exposes vegetable growers and consumers to health hazards (microbiological and chemical contaminants). However, the use of integrated health promotion strategies such as the Stress Process Model are useful for identifying the problem, prioritising, selecting and implementing health promotion interventions. The model encourages the use of local knowledge and encourages the community members to participate.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This section presents the conclusions made to issues examined by the different study methods and proofs/facts from multiple data sources which were analysed and presented in the previous chapters. The presentations are organised by the different stakeholders and implementing partners in the study environment, at individual and community levels, as well as public and private sector and media participants. Furthermore, the section presents recommendations which are intended to yield better EcoHealth situations in the study areas and in similar settings in Ethiopia and elsewhere.

6.2 CONCLUSIONS

As stated above, the following conclusions are drawn from the results of the various methods employed in this study. The conclusions and the recommendations listed below have been organised, considering the different actors at the different structures and levels (see below for the details).

6.2.1 Individual and community level

Defuse sources in the community; unattended garbage and households with improper sewerage system are common sources for environmental health pollution in the study areas.

The public awareness of existing environmental health regulations in the study area is low and education level and assets are found to be reasons for lack of awareness of the existing environmental health, laws, standards and regulations.
Women and youth in the households, workplace and community are performing activities including house-cleaning, cooking and garbage collection, and are exposed to

environmental health risks while handling wastes at households and workplaces in the study area. Low awareness and unregulated actions on the part of women and youth in the community also equally affect the wellbeing of women and youth and the environmental health in the study areas.

The uninformed awareness and perceptions people who are using the Little Akaki River water for irrigation prompt them to deny the potential health risks of using wastewater. But, in the light of the reports from laboratory tests and the related studies which indicated that the vegetable growers and their families, vendors and consumers of the vegetables from this source were exposed to various hazardous substances and at risk, they have had to rethink their positions.

6.2.3 The private sector

The point sources of pollution, mainly the large and small factories across the river basin, are responsible for the environmental health risks in the study area. The problems, which amount to environmental health risks, are partly due to weak monitoring and supervision activities on the part of the public sector. Moreover, the absence of a waste management plan and treatment for industrial wastes were found to be factors giving rise to environmental degradation and health risks in the study areas.

Moreover, industries which were established earlier, do not have proper human resources and the capacity to comply with and function within the standard waste treatment methods, have contributed to the poor environmental health situation in the study area.

6.2.4 The public sector

There is no designated office to regulate and reinforce the EcoHealth regulations at the woreda level.

The promotion and reinforcement of the existing EcoHealth regulations being done by sub-cities is irregular and too weak to prevent the individual and group actions in the community.

The regulations and standards which empowered the Environmental Protection Authority to manage the river basin are barely implemented. Individual households, public offices and industries are built too close to the river basin (within less than 50 meters' radius) and function close to the river basin, thus increasing the environmental health risk to the community.

6.2.5 Media

The media (radio and television programs) attention to the problems is low in the dissemination of environmental health issues. Furthermore, the high cost of print media has partly contributed to the public's low awareness of the existing environmental health regulations and standards.

6.2.6 The intervention method, wastewater use and bio-sand filter for hand washing promotion

The EcoHealth Promotion Model was found to be a viable alternative. The method involved the community and enabled participants to identify the stressors when selecting strategies for change. It facilitates adaptation and implementation of innovative ideas and technologies.

The results of this study show that the Little Akaki River water is certainly unfit for drinking and other household purposes. But it could be used for various surface water purposes if the defused and point sources of river water pollution control systems are properly implemented and the various wastewater treatment mechanisms are used.

The wastewater treatment device, and the bio-sand filter which were used for behavioural change and for hand-washing actions, can decrease the pollution and provide sufficient yield for a limited number of users. However the faecal coliform level is still too high after treatment. The faecal coliform level is above the WHO water quality standard (WHO 2006) and the national standards (Ministry of Water Resources Ethiopia 2008); and further treatment with chemicals is required to increase its safety, and sufficient time is needed to evaluate hand-washing behaviour and use of the devices.

6.3 Recommendations

This study revealed gaps in the behaviour and the policy. The following recommendations arise from this study:

6.3.1 Recommendations to households and community members

- Individual households and community members, guided by relevant sector offices, should reconstruct their household solid and liquid waste disposal systems and thus prevent their environment from contamination.
- Community members, in collaboration with urban health extension programme staff members (the health extension workers), should monitor the behaviour of community members, and food and beverage establishments that have contributed to the environmental health problems in their community.

6.3.2 Recommendations to the Ministry of Health

The Environmental Protection Authority, the Ministry of Health, media and schools should facilitate awareness by creating forums on EcoHealth geared to different audiences (different social and economic groups). This would include community

conversations at workplaces and community venues, discussion forums at schools and out of schools, and use of IEC/BCC materials at workplaces, schools and in community to increase the awareness of women and youth of EcoHealth.

The Environmental Health Protection, Ministry of Health and the Urban Agriculture Bureaus, media at different structures, and other public and private sectors should promote the application of existing eco-health regulations, standards and laws.
The municipality should assign responsible offices at woreda level which regulate and reinforce the eco-health regulations at community level.

Education centres at all levels should properly implement eco-health-related lessons which already exist in the education curricula, and keep updating the school community about environmental changes, and should conduct awareness creation forums when new environmental regulations are issued.

Public sector offices which register asset holding should facilitate transfer of property or assets and issue construction permits. This would properly inform the clients/the public about existing rules and regulations, thus protecting and advising the community about how to keep the environment safe.

An Environmental Impact Assessment (EIA) should be done for all factories, including factories which were established before the endorsement of the current environmental health and EIA regulations.

Factories and establishments should be informed about the potential environmental health risks and the impacts of the behaviours and actions of their establishments, on the environment and the wellbeing of the community.

Factories and establishments, including public service centres, schools, and health facilities, should be oriented to the existing environmental health standards and effective waste treatment methods, and should be supervised regularly.

Factories, establishments and service centres should be supported to develop waste treatment devices and be monitored/ supervised regularly for proper use of the treatment devices.

Urban agriculture is a potential source of green cover and increases access to food and nutrition for the urban population. Thus, the Urban Agriculture Office, the Environmental Health Authority, as well as the private sector, should work closely with the vegetable growers' associations to increase the awareness of practitioners, vendors and consumers.

Sector offices and the private sector should help the vegetable growing practitioners to diversify their income and cultivate products which could have fewer health risks, such as trees for lumbering and other purposes. These enterprises would reduce direct contamination with the wastewater, restore the forest and balance the eco-system at micro-level, as well as increasing the income of the practitioners (vegetable growers/urban agriculturalists).

6.3.3 Policy recommendations

Although the evidence from the laboratory tests and the depth of this study are powerless to advise on policy issues, the provision of regulations on the use of wastewater and urban river basin management are important. According to the findings of this study, the Little Akaki River water should not be used for any social or economic purposes before treatment and, if used, should be closely regulated.

The Environmental Protection Authority and the Urban Agriculture Office should promote the issuing of the stand-alone article which advises the municipality and the public to avoid incorporating any structures with built-in features on the river basin, in the environmental health and environmental protection regulations.

6.4 CONTRIBUTION OF THE STUDY

Previous studies which have been conducted by different scholars, have focused on the levels of contamination and causes of the contamination in urban settings and river basins. These studies discussed the different regulations' historical developments and their impacts on the EcoHealth situation in the urban centres of different countries, including in Ethiopia. This study however, examined the public awareness of the existing environmental health regulation (selected standards), the socioeconomic benefits of waste recycling and attempted to influence the awareness of the public about these issues, and documented the progress of the EcoHealth Promotion Model. The results could provide a baseline to those who would like to promote environmental health in a similar setting as well as to those who would like to engage in environment-related development works in urban areas, especially in river basins which have features similar to those of the Little Akaki River.

6.5 STRENGTHNING AND LIMITATION OF THE STUDY

For logistical reasons, the study was restricted to the districts/sub-districts which are relatively closer to the Little Akaki River basin in Addis Ababa and did not cover districts/sub-districts that are found down the course of the river, Finifine zuria zone, Oromia region. Moreover, although some of the references which are cited at the different points in this study are older than five years, they were considered because of the facts and figures they possessed. The findings of the study can therefore only be generalised to the urban environments which share similar socioeconomic and developmental features.

6.6 CONCLUDING REMARKS

The study results provide evidence that due consideration should be given to the entire ecosystem (physical, biological, socioeconomic, and political systems) when

development stakeholders, the government, partners with the public and precautionary sectors, and individual households are initiating development activities.

Urban ecosystem management also should comply with and integrate the conservation of the ecosystem in order to maintain a healthy community and ensure sustainable development.

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Annexure 1: The study tools (Quantitative Method)

1.0 Module I:

Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia

Questionnaire identification:

001 Region/City Administration ----------002 Zone/Subcity ----------
003 Woreda----------004 Kebele ----------
005 House no.---------- 006 Cluster number ----------
007 Name of interviewer ----------008Date of interview __/___/___signature _____
009 Name of supervisor ---------010 Date of interview __/___/___signature _____
011 Location _____ urban _____ rural (vicinity)

Introduction and consent

Verbal consent form

Good morning/afternoon. My name is _____.
Thank you for taking the time to talk with me. I come from University of South Africa (Unisa), Akaki regional office, an institution of higher education conducting various educational projects. We are asking questions about dwellers/care-takers/parents/individuals such as you, throughout Addis Ababa, and collecting data for a DLitt et Phil thesis entitled "**Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia**". Your house has been chosen to be included in the study. If you agree to be interviewed, I will be asking you questions relating to the environment and the environmental health situation. We are interested in finding out what kind of environmental health-related problems exist, and assessing the public awareness of environmental and related regulations. This information will be used to help design environmental health promotion strategies in Addis Ababa, Ethiopia.

Your opinions and experiences are important to us, so please be honest and truthful in answering our questions. Your answers will be held in confidence. In the future, while the results of this study may be published, your privacy will be protected and you will not be identified in any way. If you agree to be interviewed, we will go to a place where no one can hear us talking. If you are uncomfortable with a question, you do not have to answer it, if you do not want. You may also stop the interview at any time.

It will take about 20 to 30 minutes for us to complete the questionnaire. Do you have any questions about the study? If you have any questions about the study in the future,

please feel free to contact University of South Africa (Unisa) Akaki regional office, and the Addis Ababa Health Bureaus.

_____ _____

Signature of person administering consent Date

If client refuses to be interviewed, please check this ☐ box:

Time interview began: _____: _____

Hours Minutes

Contact Address: Tariku Berhanu, Tel; 0911-60-85-14 (primary investigator-Stu # 47178418)

0114350078/79Unisa, Akaki Regional Office

No.	Questions & filters	Coding category	Cod	Skip to
100	**Socio economic background of the respondents**			
101	Respondent's Gender	1. Male 2. Female		
102	Respondent's age (age in years)	_____		
103	Marital status	1. Single 2. Married 3. Widow 4. Separated 5. Divorced		
104	Education	1. Cannot read and write. 2. Can read and write. 3. Grades 1-6 4. Grades 7-10 5. Grades 11-12 6. College and above		
105	Occupation	----------		
106	Monthly family income in ETHB	----------		
107	Respondent's responsibilities in the household	1. Head of the house 2. Spouse 3. Child 4. Relative 5. House maid 6. Guard 7. Others (specify)-------		
108	Total number of persons in the household	1. All households ____ 2. Under 5 children ___		

Housing condition				
109	Main material of the floor [Record observation.]	**Natural** 1. Earth/sand 2. Dung **Rudimentary floor** 3. Wooden planks 4. Reed/bamboo **Finished floor [parquet or polished]** 5. Wood 6. Vinyl 7. Ceramic tiles 8. Ceramic/bricks 9. Carpet 10. Others (Specify.) _____		
110	Main material of the roof [Record observation.]	**Natural roofing** 1. Thatch/leaf **Rudimentary roofing** 2. Rustic mat/plastic sheets 3. Reed/bamboo 4. Wood planks **Finished roofing** 5. Corrugated iron 6. Wood 7. Calamine/cement fibre 8. Cement/concrete 9. Roofing shingles 10. Others (Specify.) _____		
111	Main material of the walls [Record observation.]	**Natural walls** 1. No walls 2. Cane/trunks/bamboo/ reed **Rudimentary walls** 3. Bamboo/wood with mud 4. Stone with mud 5. Uncovered bamboo 6. Cardboard **Finished walls** 7. Cement 8. Stone with lime/cement		

		9. Bricks 10. Cement blocks 11. Covered adobe 12. Wood planks/ shingles 13. Others (Specify.) _____		
112	Any windows which are well located and appropriate size in each room, that can let in natural light and ventilation? [Record observation.]	1. Yes 2. No		
113	How many rooms are used in the household for sleeping?	_____		
114	How many people sleep in a single room in this household? [Record the number if the HH has more than one bedroom.]	Max _____ Minimum _____		
115	Does this family/ Do you rent or own it, or are they provided with the place you stay in/this house hold?	1. Owned 2. Rented 3. Provided 4. Others (Specify)		
116	Do you know of any laws/regulations that should be followed when constructing residential houses?	1.Yes 2. No 3. Do not know		If "No", skip to Q 119.
117	If yes, for Question number 116, how do you know about them?	1. Issued with construction permit letter (from the administration /Keble, Wereda etc.) 2. Heard from media (radio, print media etc.) 3. I do not remember exactly. 4. Other (Specify.) _____		
118	What are the main issues in housing regulations?	1. Adequate space 2. Ventilation 3. Natural lighting 4. Separate kitchen 5. Regulation regarding waste disposals 6. Distance between toilet /septic tank/main house		Mark/record all mentioned answers

		7. Toilet/septic tank some distance from the water source 8. Roof catchment 9. Maintaining standards for construction materials 10. Observing safety rules at every step of construction process 10. Others (Specify.) _____ 11. Do not know.		
119	Do you think location of residential houses and human interactions impact on the environmental health/ecology of health?	1. Yes 2. No 3. Do not know.		If "No", skip to Q 121.
120	If yes to question number 119, what are some of the impacts?	1. Contamination of the riverbanks if standards are ignored. 2. Forest cover is affected and its inhabitants disturbed. 3. Increases carbon emissions. 4. Waste is dumped, which could contaminate the soil or affect the soil-making process. 5. Others (Specify.) _____ 6. Do not know.		
121	Does the local administration or any public office control illegal construction or violation of regulation during construction activities? Has this ever happened in your area?	1. Yes 2. No 3. I do not know.		
122	In your opinion, can the action taken by the local administration maintain the standards of housing and related operations in your area?	1. Yes 2. No 3. Do not know.		
123	Do you know of any adverse effects or harm due to improper	1. Yes 2. No		If "No", skip to Q 125

	housing environment /substandard housing conditions?			
124	If “Yes” to question number 123, please list some of them.	1. Slides 2. Accident and injury 3. Fire accident 4. Communicable diseases due to overcrowding 5. Communicable diseases due to contamination (water, food, tools etc.) 6. Others (Specify.) _____		
Health conditions				
125	What are the main health problems related to your environmental conditions?	1. Acute respiratory diseases 2. Intestinal parasites 3. Diarrheal diseases 4. Skin problems 5. Malaria 6. Others (Specify.) 7. Do not know.		If you do not know, skip to Q 127.
126	Which age groups are more vulnerable to the health problems you mentioned?	1. Children under the age of one 2. Children under the age of five 3. Children aged 0-15 4. Youth (aged 10-24) 5. Adults (above the age of 24) 6. Others (Specify.)		
127	Did you ever attend a health education forum that helped you to know about health problems related to environmental conditions/ relationships?	1. Yes 2. No		If “No”, skip to Q 129.
128	If “Yes”, who provided this information?	1. The health extension workers 2. Health workers at the community forum 3. Health workers at the health facility 4. Radio		

		5. Television 6. Newspaper/s 7. Books 8. At school/s 9. Employer 10. Others (Specify.) _____		
129	Do you know of any laws/regulations which you and the community should observe to keep your environment clean?	1. Yes 2. No 3. Do not know.		If "No", skip to Q 131.
130	If "Yes" to question 129, what are these regulations?	1. Keep the environment clean. 2. Treat waste before disposing of it. 3. Follow the safety rules at the workplace. 4. Keep clean and preserve the natural environment (river, forest cover). 5. Properly collect and dispose of garbage, waste etc. 6. Follow standards and rules while constructing toilets. 7. Others (Specify.) _____		Mark/record all mentioned answers
Air pollution				
131	What type of fuel does your household mainly use for cooking?	1.Electricity 2. LP gas 3. Natural gas 4. Biogas 5. Kerosene 6. Charcoal 7. Wood 8. Straw/Shrubs/ Grass 9. Animal dung 10. Others (Specify.) _____		Mark/record all mentioned answers.
132	In this household, is food cooked on a stove or an open fire? PROBE FOR TYPE.	1. Open fire OR stove without chimney/hood 2. Open fir OR stove with chimney hood		Mark/record all mentioned answers.

		3. Closed stove with chimney 4. Others (Specify.) _____		
133	Is the cooking usually done in the house, in a separate building, or outdoors?	1. In the main house 2. In a separate building 3. Outdoors 4. Others (Specify) _____		
134	Are there any sources of air pollution other than the households in your environment?	1. Yes 2. No 3. Do not know.		If "No", skip to Q 136.
1135	If "Yes" to question 134, what are these sources?	1. Factories 2. Health facilities 3. Food and beverage facilities 4. Waste disposal landfill 5. Others (Specify.) _____		Mark/record all mentioned answers
136	Do you know any harm to the environment or human beings due to smoke/carbon from the household?	1. Yes 2. No 3. Do not know.		If "No", skip to Q 138.
137	If "Yes", are these ill effects/problems due to smoke/carbon from the households?	1. Carbon from the environment 2. Respiratory tract infections 3. Others (Specify.) _____		
138	Do you know any standards/safety helpful measures to avoid or reduce these problems?	1. Yes 2. No 3. Do not know.		Mark/record all mentioned answers.
139	If "Yes", what are these safety rules?	1. Separate kitchens from the main house 2. Use energy which produce little or no smoke. 3. Ventilation 4. Others (Specify.)_____		Mark/record all mentioned answers.
Noise pollution				
140	Do you feel that the place you are living in is quite or normal to you?	1. Yes 2. No 3. Do not know.		

141	What are the main sources of high sounds (noise pollution) in your area?	1. Music shops 2. Bars and restaurants 3. Nightclubs 3.Grinding mill 4. Factories 5. Animals 6. Others (Specify.) _____		
142	Do you know the levels of sounds that human beings should be exposed at different times and places?	1. Yes 2. No 3. Do not know.		
143	Are there different sound levels for day and night in your residential area?	1. Yes 2. No		
144	Do you know any standards/regulations regarding noise levels that everyone should follow for different situations, locations?	1. Yes 2. No		
145	Is there a difference in noise levels during the day and the night in your residential area?	1. Yes 2. No		
146	What do you do if there is noise pollution around your residence?	1. Apply to concerned body 2. Approach the person or group and ask them to reduce noise or use materials/methods to reduce the excess noise/sound. 3. Do nothing. 4. I do not know. 5. Others (Specify.) _____ _____		
Water and sanitation				
147	What is the main source of drinking water for members of your household?	1. Piped into dwelling 2. Piped into compound 3. Piped outside compound 4. Tube well or borehole 5. Protected well 6. Unprotected well 7. Protected spring 8. Unprotected spring 9. Rainwater		

		10. Truck 11. Surface water (river/dam/pond /stream/canal/ irrigation channel) 12. Bottled water 13. Other (specify.)-------		
148	What is the main source of water used by your household for other purposes such as cooking and hand washing?	1. Piped into dwelling 2. Piped into compound 3. Piped outside compound 4. Tube well or borehole 5. Protected well 6. Unprotected well 7. Protected spring 8. Unprotected spring 9. Rainwater 10. Truck 11. Surface water (river/dam/pond/stream/canal irrigation channel) 12. Other (specify)-------		
149	Where is the drinking water source located?	1. In own dwelling 2. In own compound 3. Elsewhere		If the answer is 1 or 2, skip to question 152.
150	How long does it take to go there, to get water and comeback?	Minutes _____ 1. Own premises 2. Do not know.		
151	Who usually fetches water for this household?	1. The mother 2. The father 3. Girls in the household 4. Boys in the household 5. The housemaid 6. Others (Specify.) ---------- _____		
152	Do you treat your water in any way to make it safer to drink?	1. Yes 2. No 3. Do not know.		If the answer is 2 or 3, skip to 154.
153	What do you do to the water to make it safer to drink?	1. Boil. 2. Add bleach/chlorine. 3. Strain through alcohol. 4. Use water filter (ceramic sand/composite etc.).		Mark/record all mentioned answers.

		5.Solar disinfection 6. Let it stand and settle. 7. Others (Specify.) _____ _____		
154	Are there standards to follow while installing the water line or constructing the community water points?	1. Yes 2. No 3. Do not know.		If the answer is 2 or 3, skip to 156.
155	If "Yes", who would investigate whether these rules/standards are observed or not?	1. The water and sewerage authority 2. The urban development and works office 3. The local administration (kebele) 4. The local (wereda) health office 5. Others (Specify.) _____		
156	What kind of toilet facility do members of your household usually use?	1. Flush to piped sewer system 2. Flush to septic tank 3. Flush to pit latrine 4. Flush to somewhere else 5. Flush, do not know where 6. Pit latrine (vip) 7. Pit latrine with slab 8. Pit latrine without slab/ open pit 9. Composting toilet 10. Bucket toilet 11. Hanging toilet/hanging latrine 12. No facility/bush/field 13. Others (specify.) _____		
157	Do you share this toilet facility with other households?	1. Yes 2. No		
158	How many households use this toilet facility?	_____		Write number in the pace provided
159	What are the standard rules to be followed when constructing toilet facility?	1. Location 2. Some distance from the water sources		

		3. Wind leeward of VIP 4. The structure 5. The construction materials 6. Size in relation to number of users 7. Others (Specify.)		
160	Did you observe any toilet facilities that allowed discharges into the open drainage system in your environment?	1. Yes 2. No		
161	What establishments are sources of this discharge?	1. Individual households 2. Food and beverage establishments 3. Schools 4. Offices 5. Factories 6. Others (Specify.)		
162	Who do you think is responsible for inspecting, applying laws/regulations to correct such action?	1. The wereda/kebele health office 2. The wereda/kebele administration 3. The community organisations like associations 4. Environmental protection authority 5. I do not know. 6. Individuals 7. Community members 8. Others (Specify.) _____ _____		
Liquid and solid waste management				
163	How do you collect the garbage and the waste generated in the household?	1. Place garbage containers (proper containers with lids) at different places. 2. Put it into plastic or any used containers. 3. Put it wherever convenient in the house e.g. kitchen etc., and then clean up every morning or at night and		Mark/record all mentioned answers

		put the collection in the dedicated container. 4. Dump it whenever generated, in backyard of the house. 5. Dump it whenever generated, in the street. 6. Others (Specify.) _____ __		
164	What is the primary method of liquid waste and sewage disposal in your household?	1. All waste outlets (hand basin, shower, and kitchen zinc) are connected to the collection chamber (septic tank). 2. All lines are fitted to the main road/municipal sewerage line. 3. Collected with bucket and dumped outside the compound. 4. Collected with bucket and dumped into the nearby river. 5. Pumped into the street. 6. Pumped into the river. 7. Others (Specify.) ------- _____		
165	What is your primary method of household waste (garbage etc.) disposal?	1. Collected by municipality. 2. Collected by private establishment. 3. Collected by organised group: youth/women/ associations. 4. Dumped in street/open space. 5. Dumped in river. 6. Others (Specify.) ___ _____		
166	Who is the primary handler (collector and disposer) of the garbage in your household?	1. Adult in the household. 2. The women (the spouse or the daughter/s.)		

		3. The housemaid. 4. Others (Specify.) _____ _____ _____		
167	What kind of threat could be caused by improper waste management?	1. Promotes breeding of flies and other insect and facilitates transmission of diseases e.g. diarrheal diseases 2. Feeds and hides rodents which are and vehicles for transmitting diseases. 3. Causes respiratory diseases. 4. Has nuisance value (visual, smell etc.). 5. Others (Specify.) __ _____		Mark/record all mentioned answers.
168	How do you rate your environment (your household, street outside the compound and neighbouring households)?	1. Clean 2. Somewhat clean 3. Not clean		
169	Who is responsible for keeping the environment clean?	1. Everyone in the community 2. The municipality 3. Local administration 4. Other (Specify.)		
170	What is the extent of the area outside your compound for which you and your family are responsible, if is found to be contaminated?	1. About twenty meters from my compound 2. Fifty meters from my compound 3. I do not know. 4. Others (Specify.) _____		
171	Do you know of any regulation/laws that control the households and the community actions?	1. Yes 2. No		
172	Have you ever been charged for disposing of and pumping waste (liquid, solid waste and etc.) out into street or outside your compound?	1. Yes 2. No		If “No”, skip to Q 174.

173	If “Yes” to question 172, what was your feeling?	1. I felt guilty for my action/my family member’s action. 2. I did not agree, but paid the fine anyway. 3. I do not remember.		
174	What kind of waste materials do you think affect your environment?	1. Chemical wastes 2. Plastic and non-degradable materials 3. Toxic substances 4. Dead animals 5. Food and related wastes from local establishments 6. Waste from households 7. Radioactive wastes 8. Medical wastes 9. Faecal matter 10. Others (Specify.) _____		Mark/record all answers given.
175	Which hazardous wastes do you think are common in your area (woreda/subcity)?	1. Chemical wastes 2. Plastic and non-degradable materials 3. Toxic substances 4. Dead animals 5. Food and related wastes from local establishment s 6. Waste from households 7. Faecal matter 8. Radioactive wastes 9. Medical wastes 10. Others (Specify.) _____		Mark/record all answers given.
176	Do you/your family members ever dispose of waste into the Little Akaki River?	1. Yes 2. No		
177	Who else do you know who is depositing waste into the river bank in your area (Little Akaki)	1. Neighbours /households 2. Factories along the riverbanks 3. Public offices		

		4. Private/ nongovernmental offices 5. Others (Specify.) _____ _____		
178	What kinds of damage do you think these wastes could do to the environment?	They do the following: 1. Add metals and toxins. 2. Create a nuisance (olfactory (smell) and visual). 3. Harbour pathogenic organisms. 4. Destroy aquatic (plant and animal) life. 5. Cause illness to those who have contact with the water. 6. Others (Specify.) _____		Mark/record all mentioned answers.
179	What is expected to alleviate the problems mentioned above?	1. Reinforcing the available environmental, industrial and residential laws/regulations/policies 2. Identifying gaps in the available laws/regulations/policies and formulating a convenient one to fill the gaps 3. Promoting the laws and regulations relating to environment 4. Mainstreaming environmental and ecological issues in every sector 5. Other (Specify.) _____		Mark/record all mentioned answers
180	What will you do if you are asked to suggest any actions relating to the environment?	1. Share my expertise. 2. Make a Labour contribution. 3. Make a financial contribution. 4. Others (Specify.) ____ _____		Mark/record all mentioned answers.

Land use				
181	Does any member of this household own any land that can be used for agriculture?	1. Yes 2. No		If “No”, thank the respondents and finish the interview here.
182	For what kind of production do you use this land?	1. Vegetables 2. Grain 3. Fruit trees 4. Keeping animals 5. Forestry 6. Others (Specify.) _____		
183	Which water source you are using to grow vegetables?	1. Rain water 2. Well 3. Reviver water 4. Other (specify)		
184	What do you do to purify/make clean the water you are using for irrigation?	1. Constructed dam and keep to settle 2. Let it flow/circulate long distance 3. Wash the harvest with clean water 4. Other (specify) __		
185	Do you wash the harvest and farm tools with water and detergent before you take home	1. Yes 2. No		
186	Do you inform the customers where and with what you grow the vegetables	1. Yes 2. No		
Thank you for your time and willingness				

2.0. Module II

Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia

Questionnaire Identification:

001 Region/City Administration ----------002 Zone/ Sub-city ----------
003 Woreda----------004 kebele ----------
005 House no. ---------- 006 cluster number ----------
007 Name of Interviewer ----------008Date of interview __/___/___signature _____
009 Name of supervisor ---------010 Date of interview __/___/___signature _____

Introduction and consent

Verbal consent form

Good morning/afternoon. My name is _____.

Thank you for taking the time to talk with me. I come from the University of South Africa (Unisa), Akaki regional office. Unisa is an institution of higher education that conducts various educational projects. We are asking questions of people such as you, throughout this Kebele, and collecting data for a DLitt et Phil thesis entitled "**Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia**". You have been chosen to be included in the study. If you agree to be interviewed, I will be asking you questions relating to the environment and the environmental health situation. We are interested in finding out what kind of environmental health-related problems there are and in assessing the public awareness of the environment and related regulations. This information will be used to help design environmental health promotion strategies in Addis Ababa, Ethiopia.

Your opinions and experiences are important to us, so please be honest and truthful in answering our questions. Your answers will be confidential and secret. In the future, while the results of this study may be published, your privacy will be protected and you will not be identified in any way. If you agree to be interviewed, we will go to a place where no one can hear us talking. If you are uncomfortable with a question, you do not have to answer it if you do not want. You may also stop the interview at any time.

It will take about one hur for us to complete the questionnaire. Do you have any questions about the study? If you have any questions about the study in the future, please feel free to contact University of South Africa (Unisa) Akaki regional office, and Addis Ababa Health Bureaus.

_____ _____

Signature of person administering consent Date

If the client refuses to be interviewed, please check ☐ this box:

Time interview began: _____: _____

Hours Minutes

Contact Address: Tariku Berhanu, Tel; 0911-60-85-14 (primary investigator-Stu # 47178418)

0114350078/79 Unisa, Akaki Regional Office

No.	Questions & filters	Coding category	Cod	Skip to
200	**Socioeconomic background of the respondents**			
201	Respondent's gender	1. Male 2. Female		
202	Respondent's age (age in years)	_____		
203	Marital status	1. Single 2. Married 3. Widow 4. Separated 5. Divorced		
204	Education	1. Cannot read and write. 2. Can read and write. 3. Grades 1-6 4.Grades 7-10 5. Grades11-12 6. College and above		
205	Source of income (Occupation)	----------		
206	Monthly family income in ETHB	----------		
207	Respondent's responsibilities in the household	1. Head of the house 2. Spouse 3. Daughter 4.Son 5. Relative 6. Employee 7. Other (Specify.)-------		

208	Total number of persons in the household	----------		
	Agricultural practice and land use			
209	Does any member of this household own any land that can be used for agriculture?	1. Yes 2. No		If “No”, thank the respondent and finish the interview here.
210	For what kind of production you use this land?	1. Vegetables 2. Grain 3. Fruit trees 4. Keeping animals 5. Forestry 6. Others (Specify.) _____		
211	Is this land close to the riverbanks?	1. Yes 2. No		If “No”, thank the respondent and finish the interview here.
212	What is the name of riverbank or source of water close to this land?	1. Aba Samuel River 2. Big Akaki River 3. Little Akaki Rver 4. Others (Specify.) _____		
213	Do you use this river water for irrigation or dripping onto or to pouring into your farm to grow plants/vegetables/grain?	1. Yes 2. No		
214	Do you use the Little Akaki River water for irrigation?	1. Yes 2. No		
215	Do you treat this water before use?	1. Yes 2. No		
216	If “Yes”, how?	1. Let the water circulate through sand and gravel. 2. Let it stand until settled. 3. Others (Specify.) _____		
217	How do you clean yourself after finishing work on the farm?	1. Wash, using the river water. 2. Bring piped water every time from the house and wash with soap.		

		3. Wash myself with soap at home. 4. Others (Specify.) _____		
218	Do you take farm tools to your home?	1. Yes 2. No		
219	If “Yes”, how do you clean the tools before taking them home?	1. Wash them, using the river wate.r 2. Bring piped water every time from the hose and wash with soap. 3. Wash the tools at home. 4. Others (Specify.) _____		
220	Do you take home any harvests you have bought from sellers?	1. Yes 2. No		
221	If “Yes”, do you clean the harvest before taking it home?	1. Yes 2. No		
222	If “Yes”, how do you clean it?	1. Wash it, using the river water. 2. Wash the harvest at home. 4. Others (Specify.) _____		
223	Where do you store the harvest in your home?	1. In the house 2. In a separate building 3. Outdoors 4. Others (Specify.) _____		
224	Who has access to the harvest?	1. Only the person who works on the farm 2. All the adults 3. Everyone, including children 4. Others (Specify.) _____		
225	How do you rate the Little Akaki river water condition?	1. Clean 2. Dirty 3. Very dirty		

226	In your opinion, what are the main causesof the Little Akaki River's water contamination?	1. Factories' residuals and wastes 2. Wastes form big establishments (hotels, food-processing plants, etc.) 3. Wastes from the households 4. Other (Specify.) _____		
	Health problems			
227	What are the main health problems in your environment?	1. Diarrheal diseases 2. Respiratory tract infections 3. Skin problems 4. Intestinal parasites 5. Malaria 6. Others (Specify.) _____		
228	How would you describe the Little Akaki River, the water and its environment over time (changes you have observed during the 10 years)?	1. It has become clear and clean. 2. Its condition has worsened from time to time. 3. I do not know. 4. Others (Specify.) _____		
229	Do you think theLittlie Akaki River water could be a source infection?	1. Yes 2. No 3. Do not know.		
230	If "Yes", what are the main health problems that could arise from the condition of this water?	1. Diarrheal diseases 2. Respiratory tract infections 3. Skin problems 4. Intestinal parasites 5. Malaria 6. Others (Specify.) _____		
231	Is diarrheal disease a problem in your area?	1.Yes 2. No 3. Do not know.		
232	Is malaria a threat in your area?	1. Yes 2. No 3. Do not know.		
233	Are cases of malaria progressing or decreasing?	1 Increasing. 2. Decreasing.		

		3. No changes 4. Do not know.		
234	If progressing, when did it start to increase?	Since_____ 2. I do not remember.		
235	Do you do anything to control the breeding of mosquitoes?	1. Yes 2. No		
236	If “Yes”, what are the activities?	1. Drying stagnant water 2. Cleaning irrigation cannels 3. Providing residual spray to households 4. Others (Specify.) _____		
237	Was there any training regarding using the river water for irrigation and ways of preventing possible health problems?	1. Yes 2. No 3. Do not know.		If no skip to Q 340.
238	If “Yes”, who organised/provided this training events?	1. The urban agricultures cooperative 2. Agriculture bureau 3. Local health office 4. Private NGOs 5. Others (Specify.) _____		Mark/record all mentioned responses.
239	What did you learn from this/these forum/s?	1. How to protect myself and the harvest from contamination 2. How to recognise the signs and symptoms to be followed for some of the diseases, and the recommended actions 3. Others (Specify.) ----------		
240	Did you use these skills or lessons to protect yourself and your family from possible contaminationfrom this river water?	1. Yes 2. No		
241	Is there any organisation or group which assists the urban agriculture activity in your area?	1. Yes 2. No 3. I do not know.		If “No” or “I don’t know.”, skip to Q 342.
242	If “Yes”, what are the main activities?	1. Providing tools and seeds		

		2. Conducting awareness creation activities on ecology, environment and health 3. Providing training in urban agricultural activities 4. Others (Specify.) --------		
243	Are you willing to participate in awareness creation on health, ecology or environmen-related programmes?	1. Yes 2. No		
244	If “Yes”, where would you like these programme officers to contact you or meet you?	1. At work place 2. In my home 3. Anywhere convenient to the officers 4. Others (Specify.) _____		
300: Follow-up questions for multiple baseline data				
301	Proper and continuous use of hand-washing device Washing hands with soap	1. Yes 2. No		Observed this while visiting the site.
302	Observed respondent washing the tools while visiting the respondent.	1. Yes 2. No		
303	Observed respondent washing the harvest while visiting the respondent.	1. Yes 2. No		
304	Ask probing questions, e.g.: Is she/he convinced about the proposed solutions to the problems regarding wastewater use?	1.Yes 2.No		
305	Would you like to work with other stakeholders, with the local administration, NGOs etc. who are responsiblefor and willing to improve your environment?	1. Yes 2.No		
	Thank you for your time and willingness			

Annexure 2: The study tools (Qualitative Method)

Module III

In-depth interview/FGD guide for actors in environmental situations in the study area (officials and experts from public offices, industries/factories/establishments, associations and NGOs)

Introduction

Good morning/afternoon.

My name is _____

Thank you for taking the time to talk with me. We come from University of South Africa (Unisa), Akaki regional office, an institution of higher education conducting various educational projects. We are asking questions of people like you, in this Kebele/facility/, and collecting data for a DLitt et Phil thesis entitled "**Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia**". If you agree to be interviewed, I will be asking you questions relating to the environment and environmental health promotion. This information will be used to help to design environmental health promotion strategies in Addis Ababa, Ethiopia.

If you decide not to participate in the study now, or if you want discontinue at any time in the future, you are free to do so.

If you agree to be interviewed, it will take about 30 to 60 minutes to complete. We shall be recording the discussion/interview and taking notes. This is mainly for report writing purposes and we would like to assure you that your name will not be revealed. Please be honest and truthful in answering our questions. Your answers will be confidential and secret. Please remember that, in this interview, there are no right or wrong answers. If you are uncomfortable with a question, you do not have to answer it.

As I mentioned above, it will take about 30 to 60 minutes for us to complete the discussion and questionnaire. Do you have any questions about the study? If you have any questions about the study in the future, please feel free to contact University of South Africa (Unisa) Akaki regional office, and Addis Ababa City Administration Health Bureau.

I. Defining EcoHealth and factors responsible to environmental Health

1. What is the environment? What is environmental health? What are the basic components of environment?
2. How do you describe a healthy environment? Discuss the factors that are conducive to a healthy environment?

II. Identifying key environmental /EcoHealth problems in your area?

3. Do you think your village /environment/ is clean? Is this woreda clean? If the response is “Yes” or “No”, probe for detailed explanations /reasons/examples etc. How do you rate your environmental cleanliness (clean, somewhat clean, not clean)?
4. What are the main environmental health problems in your locality/ woreda/the villages around you?
5. What are the main sources of these contaminants and who is responsible for thelack of cleanness? Why are these groups/individuals causing these problems?
6. If your environment is not clean, who are the most affected in your environment? Probe/ ask what about women, children, youth, the elderly . . .

III. Awareness of women and youth of existing environmental health standards, laws and regulations

7. What are the main strategies and activities which contribute to a clean environment/the environmental health condition of your village, woreda, city etc.? Who is responsible for keeping the environment clean?
8. Who is reinforcing the environmental health-related regulations? Do you know any regulations/standards to be followed (air, noise, solid and liquid waste management, regulations regarding the initiation of building etc.)?

IV. The role of women and youth in the environmental health of the urban and peri-urban environment

9. As we discuss the responsibilities and actions of women and the youth in the environment, please give us examples of how you think women and youth contribute to or affect your environment?

10. Do you know of any activities related to environmental health which should be done by women and youth? Which of the activities you mentioned are best suited to youth/women?

V. Participants suggestions for improving EcoHealth

11. What should be done to improve the environmental health condition in your area? Probe please . . .
12. What is/are your contribution/s . . . (Probe.) . . . as an individual and member of this community or group?

Do you have any questions? If not,
thank you very much for your time and the information.

Module IV

In-depth interview/FGD guide for urban agriculturists and actors in environmental situations in the areas of the study, for example, members of youth and women's groups, people engaged in solid waste management

Introduction

Good morning/afternoon.
My name is _____
Thank you for taking the time to talk to me. We come from the University of South Africa (Unisa) higher educational projects. We are asking questions of people like you, in this Kebele/facility/, and collecting data for a DLitt et Phil thesis entitled "**Urban and peri-urban EcoHealth markers and health promotion interventions in Addis Ababa Ethiopia**". If you agree to be interviewed, I will be asking you questions relating to the environment and environmental health promotion. This information will be used to help design environmental health promotion strategies in Addis Ababa, Ethiopia.

If you decide not to participate in the study now, or if you want discontinue at any time in the future, you are free to do so.

If you agree to be interviewed, it will take about 30 to 60 minutes to complete. We shall be recording the discussion/interview and taking notes. This is mainly for report writing purposes and we would like to assure you that your name will not be revealed. Please be honest and truthful in answering our questions. Your answers will be confidential and secret. Please remember that, in this interview, there are no right or wrong answers. If you are uncomfortable with a question, you do not have to answer it.

As I mentioned above, it will take about 30 to 60 minutes for us to complete the discussion and the questionnaire. Do you have any questions about the study? If you have any questions about the study in the future, please feel free to contact University of South Africa (Unisa) Akaki regional office, and Addis Ababa City Administration Health Bureau.

1. What do you think about your environmental situation? What are the main environmental problems in your locality? Is your environment clean? If not, why?
2. What are the causes of environmental health crises in your locality? Who is responsible?
3. How can these problems be prevented? (Probe for regulation, structure and responsibilities at different levels – individual, group, public and private sectors responsibilities, etc.).
4. What is your role as individual and group in the prevention and control of the environmental health conditions of your locality?
5. Are you living too close to the Akaki River? Can you describe the phases the river has passed through? (Probe by asking about the river condition today and before, for a period of about 10 to 20 years.)
6. Are you using the river water? If so, for what purpose? Can you tell us about any health hazards you observe or know to be due to wastewater use?
7. What are the challenges?
8. Are you willing to participate in the urban health promotion activities? (Explain the follow-up project objective and activities and take note if the response ”Yes”).

Thank you very much for your time and the information.

Annexure 3: The study tools (Intervention Method)

Module V

Date: _____ Site ID _____ Focal person's name _____

1. Inspect the hand-washing facility: Is it clean? Yes: ___ No:_____
2. Check the yield: _____ litres per _____minutes.
3. Check whether used recently: Yes _____ No _____.
4. Check if protective devices, the gloves and plastic boots are used by the study participants: Yes: _____No: _____.
5. Document if there has been any attempt to use the hand-washing facility: Yes: _____ No: ___
6. If "Yes", who uses the hand-washing facility The study participant _____ the study participant's family: _____ Others: (specify)_____ _____
7. Observe if the harvest is washed:_____ Yes: _____ Not:
8. If "Yes", which water source is used for cleaning: the river water:_____ pipe water: ___
9. If the vegetable worker is found to be working with the wastewater without protection devices, the gloves and plastic boots, ask "Why"? ___
10. Document any observation useful to the project.

Annexure 4: Examples of the transcribed/translated Focus Group Discussion (full text)

Focus Group Discussion

Akaki Kality Subcity Date: 09/03/2012

Woreda (01) Time: 3:40-5:10 PM

Group: Youth (1) **Healed at:** the Woreda Admin office

Moderator: Tariku Berhanu (primary investigator)

Note Takers: Nestanet Birrhanu and Gemechu Kebede

Participant ID	Sex	Age	Profession/education	Occupation
P1	M	18	Grade 12	Student
P2	M	19	10+2	Unemployed
P3	F	20	10+2	Unemployed
P4	F	19	10+2	Unemployed
P5	F	19	10+2	Student
P6	F	18	Grade 11	Student
P7	F	23	BSc	Exert on Environmental health
P8	M	18	Grade 12	Student

N.B.: Participant ID assigned, based on the participants' order of siting.

Introduction, purpose and use of audio records discussed before recording. Consensuses and consent ware also made by the participants before the discussion.

Q1. What do you think about your environmental situation? What are the main environmental health problems in your area/community?

P7. It is somehow disorderly. There are industries which generate various by-products and wastes that have negative impacts on human health. And then, although there are regulations that advise the production centres to install appropriate waste-processing devices and to contain the hazardous wastes, reinforcing these regulations is not yet well implemented.

P4. The area has both urban and rural characteristics. The town has expanded towards this side and it has mix of rural and urban culture. Informal and formal settlements are advancing. It is going to be crowded very soon any way.

P1. The Big and Little Akaki Rivers pass through the Akaki Kality subcity, join up and empty into the Aba Samuel River. The river carries huge volumes of wastes and causes many problems.

P4. The new construction is progressing and taking over the green cover. The highway is also a challenge to us.

P5. I agree with my friends but to me my village is fairly clean and convenient for living. As she (P4) explained the construction is advancing towards The Akaki and other parts of Addis Ababa but anyway, our environment is quite spacious and not like the central part of Addis Ababa. Even Akaki town is overcrowded and noisy but yet clean in my view.
Laughter ….
Moderator: What else?
Long silence …..
Moderator: What else would you like to tell us about your environmental situation? What is your opinion about your environment (encouraging the other participants)?

Moderator: OK. What are the main environmental health problems in your area/community?

P1. If we start with the existing roads in the village, they are dusty and cause respiratory diseases such as the common cold/'flu. When animals die in the village or on the roadside, they are not picked early and properly. Recently the new hospital inaugurated (regulated) otherwise. The Akaki health centre was the only hospital which provided health care to the community for decades. The private health instructions are providing limited health services and have established themselves in sub-standard buildings. They are poorly equipped and offer limited services.

P7. The community is poor and suffers from many problems. Women are using "Fagulo", the by-product from oil-pressing industries, that exposes them to smoke, and therefore this causes tuberculosis and other respiratory diseases. Most of the women are poor and are working in the factories. During the day or duty hours they work in the factory but then again they are supposed to work at home every day. There are no nursery services for pre-school children or any convenient situation for working women.

P6: As explained by my colleagues, the majority of our community members are poor and live in a harsh environment, with substandard housing structure, poorly constructed and unprotected latrines – or some do not have a latrine. There is a market close to the rural community and people just defecate on the roadside and dump or throw solid waste away improperly.

Recently the water and sewerage authority conducted an inventory and found that there is a water shortage – and no water and electric services in the informal settlement areas.
Moderator: What else…..is your environment clean? If it is not clean, why?

P7. As we all mentioned above, it is not clean and we are unfortunate to be found in a place where the liquid waste from almost all the villages in the upper stream, and considerable volumes of solid waste from the factories are carried in by the river water.
P3. To a relative of mine and for me, it seems clean somehow, compared to Merkato, Kera and other subcities in the city.

Q.2. what are the causes of environmental health conditions in your locality? Who is responsible?

P2: The houses are close each other and when the toilets are full then the outflow goes into the nearby field and contaminates children who are playing around.

In rainy season, households connect their latrines to the river and sledge the scum into the river, and people also dump solid wastes and dead animals into the river and at the roadside. It also creates a bad smell and exposes children and elderly to diseases. Typhoid was a problem during such seasons and affected people living around this river.

Factories around and close to the Little Akaki River are also dumping the by-products and wastes into this river.

P4: Even the health facilities do not have convenient waste management, water supplies and toilets. I observed similar kinds of problems there. And there is no recreational provision for young people.

People from rural villages often visit Akaki. The reason, for example, is a need for includes medical service, and buying and selling goods and services in the market. But since there are no public toilets around most of these just defecate on the roadside. The absence of the toile is one reason but the public awareness/ the education level is another reason for this act.

Shelter is a problem and people rent service quarters or share rooms but the available facilities such as toilets and potable water are not sufficient. Thus people in such an arrangement use plastic bag for defecation and then dump it or openly defecate at the roadside.

P3: As my colleague explained, households along the upper stream have connected their toilets to the river, and factories also let their residuals flow freely. People, who are using the water in the lower stream, and children who are swimming, as well as some village communities make use of the contaminated river water when coming to Akaki. The road is substandard, which also causes car accidents. The dust from the road is another health hazard.

P7: The vegetable growers use the river water for gardening and grow vegetables such as tomatoes, cabbages and other vegetables. Some of them are consumed uncooked (raw) and become the causes of typhoid, one of the common health problems in our community.

Animal-driven carts are the main means of transport in our community but the owners leave sick or dead horses on the roadside and this causes fly breeding and bad smells. Even the scavengers like hyenas do not eat the dead animals sometimes because of the smell. There are homeless dogs, and the municipality sometimes kills the dogs when

they become overpopulated but do not pick up the dead animals in time. The community therefore burns them openly. The public do not know the proper and required precautions.

Q3. How can these problems be prevented? (Probe for regulation, structures and responsibilities at different levels – individual, groups, public and private sectors etc.)

P5. The general public is primarily responsible. For example, a women (housewife) cleaning her house and the compound. Because most of the women in our community do not know the impact of the waste on health, usually they dump the wastes at or close to their compound, the area available to the children for playing. Her children are playing outside but she does not think about her actions anyway.

P3: Grinding mills grinding are here and there in our village and close to households, and the noise and dust disturbs the community.

Lack of awareness is another problem. I and my family were trained in waste management by the health extension worker. We tried to demonstrate the skills we gained but our neighbours teased us about our action. The house-to-house teaching by the health extension workers should continue in order to change the awareness of the community and to impact on their behaviour and actions.

Moderator: Who else do you think is responsible for your environmental health problems?

P1. To me, the public and the administration at various levels are responsible for these problems. They have a contribution to make and a stake in the problem, as well as in improvement. For example, defecting at the roadside causes illness and this is a clear case where individual households and the public should take responsibility. But, for wastes such as animal corpses and sold waste to be collected in the neighbourhoods then the public and the administration should play their part to provide means to handle these offenses. The administration should work on an awareness creation and should

also find ways to correct those who are guilty of misconduct. The health facilities and line offices in the woredas should also take responsibility.

Long silences ……

Moderator: What else … ?

Moderator: Are there any government/administration mechanisms to control violations or improve the environmental health situation?

P1: There is regulation in these regard and there was a programme run by health office to create awareness. One health extension worker (HEW) is assigned to assist 500 households, and she is supposed to visit the households and teach environmental health. Three rounds of training are conducted and this is one of the methods that the government is using to protect the public health.

Whenever outbreaks of waterborne diseases are expected, then the government provides water treatment for free to the community to prevent the outbreak. It is provided through the woreda administration, with instruction (education).

P7: The government provision is diverse and many of our problems are solved. The health extension workers' (HEWs's) efforts to use the NGOs as partners also created opportunities for such prevention (fighting poverty).

Moderator: Do you know any regulation relating to environmental health?

P2: A public announcement is made whenever there are memorial days like World Health Days, and the activities include cleaning the environment, collocating garbage and clearing bushes. Environemntal health promotion is also one of the environmental health initiatives and the youth are encouraged to take part.

Q.4. What are your roles as individuals and groups in the prevention and control of the environmental health problems of your locality? Are there any contributions (or roles) that youth and women can make in protecting/maintaining the environmental health of your community?

P2: Our forefathers and parents were/are not well educated and thus there is limited understanding of the problem/environment. But now education is widely disseminated/

implemented and most of youth in the contemporary Ethiopia are educated. So it is easy for present youth to understand and be aware. If given the chance, we can identify the problem and engage in the prevention activities. We can help the community and can sort out strategies and clean the environment. The same is true for women and are in a process of change.

P6: Women have many tasks in the community. ….. Whether she has awareness or not, it is she who makes a difference. We should nurture her and assist her to change. We women have a big responsibility in protecting the public health and we should stand as one. Each woman should be educated and skilled in how to care for her children and should be provided with easy and affordable technology to decrease the burden.

Moderator: What is your role as individual?

P3. I am responsible for my behaviour and actions. I should be an example and if I can be then I can influence my peers and neighbors. I should keep up my personal hygiene, household environment and care for the community.

P4. We are the strong force and proportionally constitute over 50 percent of the population. Imagine this number; watch the working force while walking around: the garbage collectors and street sweepers are women and youth. Women and youth are working on constructions.

Moderator: Do you know any group or personality (youth and women) who have contributed to environmental health in your community?

P4. About 300 women were trained in health issues in our community recently. Most of the participants were women and especially for the environmental health training (managing solid and liquid wastes). This implies that we women are key players in household and environment health protection. The community members (women) comply with the health extension (HEW) call and take time to learn and assist the HEWs. The HEWs teach women about child care, waste management especially liquid waste management (digging ditches in the compound and using sand and stone for treatment). But this effort has stopped for some unknown reason. It would be good, if continued.

P5: For example “Hidar 12” is culturally celebrated every year. In our woreda, youth and women are encouraged to take part and to clean the sewerage lines, and clear bushes.
Long pauses

Q5. Are you living close to the Akaki River? Can you explain its situation? (Probe for the river current condition for today and over the last 10-to-20-year period)

P2: I know some of the participants and we are not close to the river but there are people who cross my place and use the river water.

P5: We have an informal plot, and grow fodder for animals.

P4: My friend’s family has and uses the river for growing vegetable but I’m not sure their plot is in this woreda. It is a few kilometres from here and may be closer to the Big Akaki River.
Moderator: How do you compare the river condition now with how it was some years back?
P7: The city is growing and the volume of waste is increasing. The river water used to be clear somehow before, but now . . . it is terrible and disgusting.
P1. I find it hard to describe the changes over time; it is in a very bad condition today.

Q6. You have told us (P5) your family has plot and is growing fodder. Is there anyone who has plot closer to the river or in the river basin for agricultural practice?
All except P5 replied, “No”.
Moderator: This question is for P5 and anyone who has an opinion. Can you tell us about any health hazards you or your family could have faced when using the river water?
P5: I do not remember. Well, the smell is bad in the dry seasons; otherwise nothing happens due to the river water.
Q7. Are there any challenges?

P5. We do not know what kind of rights we have over the land. We cannot develop or claim any asset to the land. This is the challenge in most of my parents' and our neighbours' discussions.

Q8. Are you willing to participate in the urban promotion activities? (The moderator explains the details.)

P7: Yes, but we want to discuss it in detail later.

P5: Yes, it will not affect my schedule.

P4. We all want you and you are welcome. But you should not be like most researchers who took our opinion and lost it, without giving us the feedback**.**

Moderator: Our promise is that, if the project is successful then it will be published and available on the website or in the university library. Since the project involves many people, it is difficult to make a copy for each of you.

Thank you for your participation and the time that you have given to these discussions. Thank you very much.

Annexure 5: Health Promotion Material

*Facts on wastewater use and **strategies for managing health risks***

Socioeconomic benefits of wastewater use

Irrigation with wastewater is a widespread reality, especially in low-income countries. It is a resource, particularly in urban and peri-urban agriculture. Wastewater is used for crop production, which includes fodder grasses, vegetables, cereals, trees and flowers, timber crops and fruit trees, as well as for aquaculture and is often the only source of irrigation available.

Wastewater use for irrigation generates livelihoods for farmers, agricultural labourers, and vendors. Consumers also benefit by obtaining access to fresh and cheap produce due to low transportation costs.

Sources of pollution and associated health risks

Municipal and industrial wastewater is a major source of chemical pollutants that could affect human health. These cause a number of health problems and affect mainly agricultural field workers and their families, crop-handlers, consumers and people living near to the river or the irrigation field.

Wastewater can have direct and indirect health impacts. Direct contact with untreated wastewater through flood or furrow irrigation can lead to increased helminthes infection (mainly Ascaris lumbricoides [roundworm], Trichuris trichiura [whipworm], Ancylostoma duodenal and Nector americanus [hookworm]). Sometimes it can be linked to acute water diarrhoea and typhoid, as well as to faecal

bacterial diseases, bacterial diarrhoea and dysentery among consumers of wastewater-irrigated produce.

Strategies for Managing Health Risks

Although there is no single solution to the problems mentioned above, combinations of the following different strategies can reduce the health risk to humans:

- ***Wastewater treatment:*** Most conventional domestic wastewater treatment plants focus on the removal of environmental pollutants (e.g. suspended solids, BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand, etc.) but not on pathogens, as the latter are more difficult and more costly and therefore not easy to undertake in developing countries. For the quality of treated water to meet the WHO standards, secondary treated water needs to be supplemented by tertiary treatment (disinfection) or retained in a maturation pond for five more days.

  Choice of irrigation techniques: Farmers using wastewater for irrigation need to take some precautions during irrigation. Sprinkler/spray irrigation has the highest potential to spread bacterial and viral diseases and hence a buffer zone of 50 to 100 meters from houses or roads should be maintained to prevent health risks to local communities.

- ***Crop selection:*** Water of poorer quality can be used to irrigate non-edible crops such as cotton or flowers, or crops that are cooked before consumption.

- ***Human exposure control:*** Irrigation field workers are the most exposed to wastewater. The health risks faced by these individuals can be reduced by using appropriate irrigation techniques such as bed and furrow cultivation and protective clothing in the form of boots and gloves. They should also be provided with sanitation facilities and drinking water. Provision of safe water in vegetable markets to wash produce is important to prevent further contamination of agricultural products irrigated with wastewater. Consumers should wash fresh produce thoroughly and cook it before use.

Annexure 6: Ethical clearance copy – From UNISA

Tariku Berhanu Desalegn	Mixture – triangulation For feasibility, minimise combination, triangulate population with specific consideration for aims and sample size, to add value in terms of knowledge development **OUTCOME: Conditionally accepted**

Annexure 7 : Copy of the ethical clearance from Addis Ababa Health Bureau

Reference AA/HB/5447/227
Date Jan 12, 2012

Nefas silk Lafto sub city
Woreda 05
Woreda 10
Woreda 11
Addis Ababa

Akaki Kaliti sub city
Woreda 01
Woreda 04
Woreda 09

Subject; Request to access Community to conduct approved research

This letter is to support Tariku Berhanu to conduct research, which is titled as "Eco–Health and Promotion in urban and peri-urban environment; a study on urban and peri-urban environmental health situations and promotion in Addis Ababa and its vicinity".

The study proposal was duly reviewed and approved by UNISA IRB, subsequently reviewed and approved by Addis Ababa Health Bureau IRB, the Principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical committee as required.

Therefore we request the Community to provide support to the principal investigators.

With Regard

Alemu Hallomariam
Head, Ethical Clearance Committee

Cc:-

To
Nefas silk lafto sub city
Akaki Kaliti sub city
Tariku Berhanu
Addis Ababa
Ethical clearance committee
Health Bureau