EiABC

Ethiopian Institute of Architecture, Building Construction and City Development

Addis Ababa University

RECREATIONAL ECOSYSTEM SERVICE OF CEMETERIES IN ADDIS ABABA UNDER DIFFERENT MANAGEMENT

M.Sc THESIS IN ENVIRONMENTAL PLANNING AND LANDSCAPE DESIGN

BY-ZEBAD ALEMAYEHU

ADVISOR- DR. KUMELACHEW YESHITLA

ETHIOPIAN INSTITUTE OF ARCHITECTURE, BUILDING CONSTRUCTION AND CITY DEVELOPMENT

April, 2014

Addis Ababa, Ethiopia

RECREATIONAL ECOSYSTEM SERVICE OF CEMETERIES IN ADDIS ABABA UNDER DIFFERENT MANAGEMENT

M.Sc THESIS IN ENVIRONMENTAL PLANNING AND LANDSCAPE DESIGN

BY-ZEBAD ALEMAYEHU

ADVISOR- DR. KUMELACHEW YESHITLA

ETHIOPIAN INSTITUTE OF ARCHITECTURE, BUILDING CONSTRUCTION AND CITY DEVELOPMENT

April, 2014
Addis Ababa, Ethiopia

This thesis is submitted to the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) and to the School of Graduate Studies of Addis Ababa University in partial fulfillment of all requirements for the degree Masters in Environmental Planning and Landscape Design.

Title of Thesis- Recreational Ecosystem Service of Cemeteries in Addis Ababa Under Different Management

Author: ZEBAD ALEMAYAEHU

Date: April , 2014

Approved by Board of Examiners

Kumelachew Yeshitla (PhD)		
Advisor	**Signature**	**Date**
Internal Examiner	**Signature**	**Date**
External Examiner	**Signature**	**Date**
Chair Person	**Signature**	**Date**

Declaration

I declare that this thesis which I hereby submit for the masters degree of Environmental planning and landscape design at the Ethiopian institute of Architecture, building construction and city development is my own work and has not been previously submitted by me for a degree at this or any other institute. I further declare that no part of my thesis has already been submitted to any other degree or diploma.

Furthermore I declare that substantially my own work, where reference is made to the work of others has been fully acknowledged in the text and list of reference.

Addis Ababa

April, 2014

_____

Zebad Alemayehu

Confirmation

The thesis can be submitted for examination with my approval as an Institute`s advisor.

Advisor : Kumelachew Yeshitla (Phd)

Signature:_____ Date of Submission_____

ACKNOWLEDGEMENT

First and foremost, I would like to thank God for his guidance in my every turn. Next I want to give appreciation to my Advisor Dr. Kumelachew Yeshitla for his constructive suggestions especially, his invaluable and prompt advices, comments, suggestions, and encouragements. without his assistance and guidance this study would not have been completed.

Also my sincere gratitude to the managements of the different cemeteries in this study that are willing to cooperate by understanding my needs. Would also like to thank the people who were kind enough to spare their time to give me their frank response to my interview, questions and questionnaires without which this paper would not have come to life.

In addition my heart felt acknowledgment goes to my friend Selamawit Fetene for coming to my aid during the data collection stage which was very long and tiresome due to the numbers of the study site. Also my classmate Setgn Berihe for providing the necessary equipment (GPS) which was needed for this study.

Finally, my special appreciation goes to my parents, for being there with their unconditional love, patience, and encouragement. Even though words are not enough, I would like to say thank you from the bottom of my heart I wouldn't be who I am without your shoulders to lean on. I am in bliss to have such supports.

Abstract

The cemeteries of Addis Ababa which are under different management give different kind of ecosystem services. Among these services recreation ecosystem provision is a possibility for the cemeteries. But there are problems that they face such as absence of proper management and appreciation for recreational ecosystem service value, lack of specific regulations and knowledge for cemetery tree plantation and species diversification and recreational usage, seeing burials as the only income generator or profits by the management for sub-cities rather than considering the benefits of recreational ecosystem services and being under budgeted for the management of cemeteries. So this study specifically provides an assessment of recreational ecosystem service of nine cemeteries under different management which are the Municipality , Catholic Church, Italian Catholic Church, Italian & British Embassy, the Holy Trinity Church, the National Spiritual Assembly of the Baha'is of Ethiopia and the Municipality & the Muslim Administration. In order to currently some of the cemeteries that are found in the city of Addis Ababa have already commenced giving recreation ecosystem service. This recreational ecosystem service data was collected by questioners that are semi structured and unstructured ones. Those the first semi structures were used for two cemeteries only namely the Millennium and Holy Trinity. The study also describes the diversity of tree species in the cemetery. Field studies of tree diversity in these cemeteries were carried out between January and April 2013. Within a cemetery, of 20 m by 20 m square shaped sample plots were used to record information on tree diversity. A total of 756 stems were recorded in 18 plots. The composition is overwhelmingly dominated by exotic species. Of the 23 species encountered 12 were indigenous and only 11 were introduced species. In terms of abundance, 44 % of the trees belonged to exotic species, while only 56% of the trees belong to indigenous species. In addition the study gives solutions for exploiting recreational potential and makes cemeteries relevant. And taking these into consideration the study formulates on how both the living and the dead could exist in the same space harmoniously.

Keywords: Cemetery, recreational ecosystem service, management, tree and diversity

Table of content

List of figures

List of Tables

Chapter One : Introduction

1.1. Background

Cities have many issues that need to be addressed but among these issues quality of life in a city takes proceeding. In cities existence of sufficient and attractive urban green areas for people and wildlife to flourish are becoming a major concern. So the current urban place needs to cope with the ever growing population of cities and demand for spaces for recreation. The case being so, cemeteries can be excellent recreational place since they are a necessity so far and have potential to give these services that cities desperately needs. Though most green spaces in urban places that specially provide recreational ecosystem services are easier to understand and mange, cemeteries need a bit more work and managing skill due to their unique nature.

The word of cemetery derived from the Latin term ―sleeping space". The main purpose of cemeteries is the dignified disposition of human remains in accordance with provincial status and municipal by-laws. Urban cemeteries have an important role in urban environments. Urban cemeteries also play a role in understanding of urban environments (Uslu, 2010).

Cemeteries and church yards provide many opportunities for climate and environmental agglomeration, together with wildlife habitats, in the urban context because of the usually high level of vegetation that exist in such space. In addition it is clear that by providing opportunities for grieving and relaxation they can help with the mental health of individuals and families (Woolley, 2003). Furthermore in cities, vegetation generates a variety of ecosystem services, e.g. noise reduction, air filtration, and micro climate regulation. The latter is due to modifications in incoming and outgoing radiation fluxes, including the fluxes of latent and sensible heat, air temperature, wind conditions, and air humidity. These effects contribute to mitigating the urban heat island on a local scale **(**Endlicher *et al*., 2007).

And designing the cemeteries as parks is among projects with priority for many countries in different locations with diverse religions. There are some projects in different countries, which varies, religions in all over the world in these projects. There were expected that park-like public cemeteries would improve the overall environmental quality, provide dignified environment for worship and offer pleasing outdoor spaces for recreational use (Huang, 2007). And that being said the full potential of recreational ecosystem services that cemeteries could provide hence must not be discarded in Addis Ababa.

1.2. Problem Statement

Addis Ababa has a number of cemeteries scattered all over the city in different sub cities under different managements. These cemeteries occupy large plot of land with different kinds of plants and wildlife and if managed properly could provide the recreational ecosystem services that the urban resident‘s need. Generally cemeteries can provide basic ecosystem services, such as filtering, air purification, reducing noise, purifying water, buffering climate extremes like heat waves and recreational activities. But most cemeteries that are in existent are neglected and left to the dead repelling the living by their unfriendly environment in total disregard for recreational ecosystem service provision. When it comes to providing a recreational ecosystem service that people require, the cemeteries mostly face different challenges hence; it becomes doubtful whether they are providing the ecosystem service to their maximum potentials. These challenges are the drawbacks that are related to problems from different corners such as planning, management, lack of awareness, regulations, policy, and religious issues.

Eventhough there are standards and regulation for Addis Ababa cemeteries these regulations don‘t have any guidelines for recreational activities that could be practiced in cemeteries. And that gap has made the cemetery management in a dilemma of how to go about it .In addition the implementations of the already set rules are somewhat questionable. These implementation short comings can be related to being under budgeted or management problems. A typical example is the regulation of shade provision, pathways, and toilet that are totally ignored among these cemeteries.

Furthermore, though there are no specific or detailed type of regulation for cemetery tree species plantation and diversification which suggest a great flow in the current regulation that serves as a key guide to the cemeteries of Addis Ababa. This study has selected various types of cemeteries under different management regime in an attempt to evaluate the provision recreational ecosystem service among others.

The problems can be summarized as follows

- Absence of proper management and appreciation for recreational ecosystem service value
- Lack of specific regulations and knowledge for cemetery tree plantation and species diversification and recreational usage
- Seeing burials as the only income generator or profits for sub-cities rather than considering the benefits of recreational and other ecosystem services.
- Being under budgeted for the management of cemeteries.

- Lack of cemetery plot layout map that can guide the management for establishing burial arrangement and plantings and future planning.
- No inclination of adaptation from best practices by the management from other cemeteries.

1.3. Objective

1.3.1. General objective

To assesses recreational ecosystem services provided by the selected cemeteries in Addis Ababa and how they varies under different management.

1.3.2. Specific Objective

- To assess the recreational ecosystem service provision of cemeteries under different management.
- To make Tree inventory in the cemeteries that are under study.
- To assess the problems of the management of cemeteries understudy regarding provision of recreational ecosystem services.

1.4. Research Question

- Is there recreational ecosystem services provided by the cemeteries that have been selected?
- What types of tree diversity are found in the cemeteries?
- What type of problems does the management of cemeteries understudy face regarding recreational ecosystem services provision?
- What planning solutions are there for the commencement or continued service of recreational ecosystem service by the cemeteries understudy?

1.5. Limitation of the Study

There are different kinds of challenges that arise when doing a specific study. And on this particular study one of the challenges was shortage of adequate budget for soil testing that is needed to analyze tree related problems. There was also limitation of accessibility to the Kolefe Muslim cemetery. Lack of instruments diameter tape and also there are no clear layout maps for all the cemeteries which were under study.

1.6. Significance of the study

The study contributes to the understanding of Addis Ababa‘s current situation of recreational ecosystem services provision by the cemeteries understudy. And provides solutions to manage cemeteries in provision of recreational ecosystem services in respect to the funeral service.

1.7. Organization of the Study

The study is categorized into five chapters.

Chapter one deals with introducing the study, the problem statement, the research questions, research objectives, limitation, and significance of the study.

Chapter two reviews some of the major theories and researches related to types of ecosystem services, ecosystems services and functions of urban green spaces, recreational ecosystem services, cemetery types , tree inventory and cemeteries standards for Addis Ababa.

Chapter three deals with the Study Sites such as Kechene Medhanialem cemetery , Millennium Park cemetery (Bitewar cemetery), Petros We - Paulos cemetery, Italian military cemetery, Foreigner Catholic Cemetery ,Ethiopian Catholic cemetery, Evangelical cemetery , The Baha‘i cemetery , The Holy Trinity Cathedral cemetery and The Kolfe Muslim cemetery describes the research methodology such as primary data, tree inventory, social and management aspect, secondary source, documents and software used.

Chapter Four deals with result and discussion on each study site. It includes recreational ecosystem service , tree inventory and cemetery management.

Chapter Five comprises the conclusion and recommendation. The recommendations are all site specific.

Chapter Two : Literature review

2.1. What are ecosystem services?

An ecosystem can be defined as the interaction of living things (animals, plants, and micro-organisms) and their physical environment. The living and non-living elements function together as an interdependent system – if one part is damaged it can have an impact on the whole system. Ecosystems can be terrestrial or marine, inland or coastal, rural or urban. They can also vary in scale from the global to the local. At the continental level examples include rainforests, deserts, and coral reefs. Closer to home we might think more in terms of different types of habitats (e.g. woodlands, grassland, marshes, heath land, rivers, peat bogs) though this can also extend to the urban environment (e.g. parks and gardens, rivers and streams). In many cases, ecosystems overlap and interact (Price, 2007).

Core to the application of an ecosystems approach to conservation and sustainability is an understanding of ecosystems' contribution to human well-being via the services that ecosystems provide (Glaves, *et al*., 2009). The Millennium Ecosystem Assessment defined ecosystem services simply as ‗the benefits people obtain from ecosystems' and identified four main types of services:

• **Provisioning Services:** which cover material or energetic outputs from ecosystems, including food, water and other resources.

• **Regulating Services:** which cover factors that affect the ambient biotic and abiotic environment, such as flood and disease control.

• **Cultural Services:** which cover non-material (intellectual/cognitive/symbolic) uses, such as spiritual, recreational, and cultural benefits

• **Supporting Services,** such as nutrient cycling and primary productivity that maintain the conditions for life on Earth (MEA, 2005).

For ease of understanding, the MEA considers all these benefits together as ‗ecosystem services' because it is sometimes difficult to determine whether a benefit provided by an ecosystem is, in fact, a ‗good' or a ‗service'(Haines-Young and Potschin, 2010).

2.2. Ecosystems Services and Functions of Urban Green Spaces

Trees in urban systems provide a variety of ecosystems services including biodiversity conservation, removal of atmospheric pollutants, oxygen generation, noise reduction, mitigation of urban heat island effects, microclimate regulation, stabilization of soil, ground water recharge, prevention of soil erosion, and carbon sequestration (Bolund and Hunhammar ,1999).

Trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with inner-leaf surfaces. Trees also remove pollution by intercepting airborne particles. Some particles can be absorbed into the tree, though most particles that are intercepted are retained on the plant surface. The intercepted particle often is resuspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall. Consequently, vegetation is only a temporary retention site for many atmospheric particles (Nowak, 2002).

As urban green spaces and urban forests increase, evapotranspiration rate increases .Thus, a common measure to mitigate urban heat island effect is to increase urban green spaces. Studies on microclimate formation through built-up morphology and urban shade trees have clearly established the importance of urban trees in alleviating the heat island effect in a hot and humid summer (Shashua-Bar *et al*., 2010). Reduced air temperature due to trees can improve air quality because the emission of many pollutants and/or ozone-forming chemicals are temperature dependent. Decreased air temperature can also reduce ozone formation (Nowak, 2002).

Urban trees in the coterminous USA store 700 million tonnes of carbon ($14,300 million value) with a gross carbon sequestration rate of 22.8 million tC/yr ($460 million/year). The national average urban forest carbon storage density is 25.1 tC/ha, compared with 53.5 tC/ ha in forest stands (Nowak & Crane , 2002).

2.2.1. Recreational ecosystem services

Cultural ecosystem services are non-material benefits obtained from ecosystems, among these the recreational pleasure that people derive from natural or managed ecosystems is defined as recreation service (Paracchinia *et al.,* 2011).

Simply defined, recreation refers to experiences and activities chosen and pursued by the individual in his/her free time; the basis being that the experience sought and activities pursued, in the real sense of the word, 're-creates' the individual so that he/she may be refreshed to enable him/her to resume daily obligations, whatever those may be (John, 1983).

Recreation is an emotional condition within an individual human being that flows from a feeling of well-being and satisfaction. It is characterized by feelings of mastery, achievement, exhilaration, acceptance, success, personal worth, and pleasure. .. It reinforces a positive self-image. Recreation is a response to aesthetic experience, achievement of a person's goals, or

positive feedback from others. It is independent of activity, leisure, or social acceptance (David and D. Pelegrino, 1973).

Recreation can be viewed as personal experience (what it does to a person), as activities (the forms it takes) or as an institution (the structure in which it is made available to the community). Taken yet another way recreation can be viewed as a process (what happens to an individual) and as a structure (the framework in which recreation is practiced) (George, 1986).

Urban green space is becoming increasingly important for residents in a socio-cultural respect – for recreation, or as a source of peace and inspiration (Tyrva¨inen *et al*., 2003). Visiting urban green areas and particularly ‗favorite places' provides urban residents with an important opportunity for self-restoration and relaxation (Korpela *et al*., 2001). Furthermore, urban residents increasingly choose their area of residence based on the existence of green areas and easy access to such environments (Grahn and Stigsdotter, 2003).

Green spaces are also psychologically very important. One example is a study on the response of persons put under stress in different environments (Ulrich *et al*., 1991). This study showed that when subjects of the experiment were exposed to natural environments the level of stress decreased rapidly, whereas during exposure to the urban environment the stress levels remained high or even increased. Another study on recovery of patients in a hospital showed that patients with rooms facing a park had 10% faster recovery and needed 50% less strong pain-relieving medication compared to patients in rooms facing a building wall (Ulrich, 1984).

A city is a stressful environment for its citizens. The overall speed and number of impressions cause hectic lifestyles with little room for rest and contemplation. The recreational aspects of all urban ecosystems, with possibilities to play and rest, are perhaps the highest valued ecosystem service in cities. All ecosystems also provide aesthetic and cultural values to the city and lend structure to the landscape (Bolund and Hunhammar, 1999).

So Perhaps one of the most important, and therefore highly valued, ecosystem services in cities is recreation, which includes the provision of recreation opportunities by natural and semi natural landscapes to urban residents and the need by urban residents to relax. There is a range of studies on analyzing and measuring the recreation function or the recreation ecosystem (Ulrich,1984).

Table 1. Amusement and recreation service in Ethiopia (Icon Group Ltd., 2002)

Amusement and recreation services (US $ mln): Ethiopia 1995 - 2005

Year	Ethiopia	% of Region	% of Globe
1995	160	1.38%	0.00%
1996	166	1.38%	0.00%
1997	169	1.38%	0.00%
1998	172	1.38%	0.00%
1999	175	1.38%	0.03%
2000	178	1.38%	0.00%
2001	186	1.38%	0.00%
2002	194	1.38%	0.00%
2003	203	1.38%	0.00%
2004	212	1.38%	0.00%
2005	222	1.38%	0.00%

2.3. Cemetery

A cemetery is a spatially defined area where the remains of deceased people are buried or are otherwise interred. The term "cemetery" (from Greek κοιμητήριον: sleeping place) implies that the land is specifically designated as a burial ground. Cemeteries are also defined by their having a number of distinctive characteristics, the first of which is particular physical features. Perhaps the most marked of these is location. Cemeteries are generally located close to but not necessarily within settlements. When cemeteries were first introduced in number in the second half of the 18th and first half of the 19th century, many were laid out perhaps half a mile away from the more populous areas of town. This trend reflected a conscious attempt to relocate the corpse which by the 18th century was increasingly deemed to be a danger to public health from inner-city churchyards to a site at the edge of town (Rugg, 2000).

In the past, before official parks came into being, cemeteries were the principal manicured greens paces for cities. As parks arose, the recreational use of the open areas of cemeteries diminished in importance. But today some cities have hundreds or thousands of acres of public cemetery lands, both with and without gravestones, which could theoretically help with the parkland shortage (Harnik, 2010).

Despite the fact that cemeteries are often located within communities, a limited 20th century regarding appropriate activities and use has often relegated them to the periphery of community activity. While cemeteries fill an obvious need in their provision of a place for burial and grieving, ranges of physical and cultural factor are fueling a gradual shift in attitudes regarding their role within the community. Within contemporary urban densification and related need for green space, the potential of cemeteries to play an important social and environmental role in their communities is becoming clear. Rather than place appropriate only for solemn reverence, cemeteries are increasingly viewed as park-like landscapes appropriate for passive recreation

and cultural activities. With this transition has come a range of programs that capitalize on cemeteries unique social, ecological and material provenance (Davis, 2011).

While the most enthusiastic nature lovers tend to regard cemeteries as ~~-of~~ course" parkland, the average urban dweller isn't so sure. Interestingly, the few economic studies of cemetery proximity show that they neither raise nor lower nearby property values— the number of people who would love to live near their calm beauty seems to be balanced by the number who find them upsetting. Is a cemetery a park? It certainly qualifies as pervious ground and visual relief, but whether it does any more than that depends on its rules and regulations. The more one can do there—walk, walk a dog, cycle, picnic, play music, throw a ball, sit under a tree (does it have trees?)— the more it's like a park. The more restrictive, the less justifiable it seems to pretend it's a park (Harnik, 2010).

2.3.1. Types of Burial Places

A) Churchyards

Churchyards can also be given a particular definition, in which some similarities with cemeteries are evident. Much of the resemblance rests with physical characteristics. Like cemeteries, churchyards also have boundaries and a distinctive entrance gate that declares their purpose. Within churchyards, further distinctions emerge. The sometimes regimented nature of cemeteries is rarely reflected in the landscape of the churchyard. Paths and roadways ease movement around the churchyard, and graves often have markers, but the sense of each grave having a particular address is far less obvious than in a cemetery. Unlike cemeteries, churchyards have not been bounded by regulations on the registration of individual graves, and the unfettered reuse of ground is reflected in the landscape. The inability of churchyards to protect the physical integrity of the deceased and provide a permanent place expressing their identity was one reason why there was a shift towards cemetery burial (Richardson, 1989).

B) Mass graves

This term is used to deifne a location in which burial has taken place on a large scale, but where the bodies lack individual identity. This situation may arise for a number of reasons, the most obvious of which being that death has taken place on such a scale that it becomes impossible to deal with each set of remains as a separate entity. Instances include the mass burial sites that follow tragedies such as famine, disease, disaster, or war. The characteristics of mass graves become more marked in cases where they are located within existing cemeteries, churchyards, or burial grounds (Swint, 2010).

C) Natural Green cemeteries

A "Green Burial" is when a loved one is laid to rest in the following manner: The body of the deceased is not embalmed in any way; The body of the deceased is not placed in any type of burial vault; The body of the deceased is only draped in a biodegradable burial container that is free of any toxic dyes, glues and metals; The body of the deceased is placed in a hand-dug grave located on a natural burial site with a forever commitment to its care and preservation. There is much debate about the size and depth of a Green grave, but the consensus seems to suggest that it be 3-1/2 to 4 feet in depth and approx 40" wide (Swint, 2010).

2.3.1. Tree inventory

Without plants cemeteries will look like parking lots for grave stones. Trees and plants in cemeteries provide environmental, ecological and amenity benefits by strengthening and helping in the creation of a recognized identity by augmenting the particular area‘s aesthetical value.

The selection or designing of an inventory system should be developed with the overall objective to provide essential information to help managers in the decision making process. Both time and costs need to be considered when designing the inventory system. In considering a tree inventory system one should continually remind oneself of the primary objective of an inventory, which is to provide decision making information that cannot otherwise be made available (Wood,1999).

There are two different types of information that can be collected, transitory information and permanent information (Miller 1997). Transitory information describes information that can change; for example, pruning needs of a tree or a specific trees condition. Permanent information includes items such as the species and location. The species will remain the same as long as that tree is there. The objectives of tree inventory again determine the type of information that will be collected, whether it be transitory, permanent, or a combination of both types of information. If the primary objective of the inventory is to schedule maintenance activities, transient information such as where maintenance needs are greatest may be the most important to collect. Knowing which information is going to be collected will determine whether transient or permanent information is needed. Again, depending on the objectives, decisions have to be made on which data will be collected and most relevant, remembering that the data to be collected must relate to overall goals of the inventory (Wood,1999).

2.3.2. Tree Inventory Uses

A. Management Programs

There are several different uses that a tree inventory can serve. Tree inventories can be used to determine the need for a tree management program. Trees that are publicly owned must be properly maintained to avoid hazardous conditions. Negligence regarding tree maintenance may result in a lawsuit. The defense costs of a judgment against a community or municipality, or the defense costs in a lawsuit could easily pay for a tree care program for many years Data can be organized and presented in a neat and concise manner illustrated with graphics, to indicate the importance of a well maintained urban tree population. There are three items that should be included: planting needs, maintenance requirements, and potential hazard to life and property (Tate 1985). Collecting these data can help achieve a long term management plan.

B. Budgets

Funding has always been a problem for urban forestry. Little recognition was given to urban forests until Dutch elm disease (Ophiostoma ulmi), introduced from Europe in the 1930s killed so many urban trees, costing local governments millions of dollars for removal and replantings. Quantitative information is essential to have when proposing a budget. It is very difficult to compete for funding with other departments in a municipality when they have concrete data to support their funding needs and you do not. Knowing tree values or the total value of the forest resource can be used to justify the need for, or the existence of, a tree management program (Smiley and Baker 1988).

The use of inventory data can show the need and importance of the amount of routine maintenance that is required of urban trees. The lack of funding for urban tree programs is not usually seen by the residents over the short run, but has a tremendous effect over the long term (Tate 1985). Tree inventories can provide information on how the current budget was spent and help predict how much money will be needed in the future to sustain a healthy tree population. Information pertaining to the number of trees that were planted and need to be planted in the future, trees that require maintenance, and dead and dying trees that should be removed can be used to demonstrate accomplishments with the current budget. Also, data describing the conditions of the trees vigor, for example age classes, the ratio of newly planted trees compared to trees that are removed or the established tree population, insect and disease severity and extent, can be used to justify the future need of funding and the detrimental effects that would occur should the required plantings, maintenance and removals not be accomplished (Wood,1999).

C. Work Efficiency

The ability to efficiently dispatch work crews minimizes travel time by knowing which trees in a particular area need work. Also, one can reroute crews to other types of work if weather becomes a factor. For example, if tree climbers are unable to climb trees due to inclement weather the crew can spend their efforts pruning or shaping small trees from the ground or any other tasks that will not put the crew in danger. Inventory data can be used to determine the number and size of a crew that will be needed to perform certain tasks. Existing and future work can also be determined with the use of an accurate inventory system. The ability to update the inventory system after the completion of a task is essential. The tree inventory will only be effective if it is updated on a regular basis (Wood,1999).

Urban trees consist of a mixture of native and exotic species. For this reason, Urban forest often shows greater diversity of species than that found in more natural areas. The increase in biodiversity can minimize the impact (or destruction) by a specific insect or disease on a particular species or genus, but it can also involve a risk to native plants if any of the introduced species behaves as an invading species, as these can come to compete with or displace the autochthonous species (Chaparro and Terradas, 2009).

A broader diversity of trees is needed in our urban landscapes to guard against the possibility of large-scale devastation by both native and introduced insect and disease pests. Urban foresters and municipal arborists should use the following guidelines for tree diversity within their areas of jurisdiction: (1) plant no more than 10% of any species, (2) no more than 20 % of any genus, and (3) no more than 30 % of any family. Strips or blocks of uniformity (species, cultivars, or clones of proven adaptability) should be scattered throughout the city to achieve spatial as well as biological diversity (Santamour, 2002).

Table 2. List of some of the plants that are found in cemeteries around the world (Joel, 2007)

Common */Botanical name*	Meaning, Reason, or Representation	Remark
Acacia/ Acacia greggii	Representing rebirth and eternal life	
Bamboo/ Poaceae	This is an amulet for good luck, and the Chinese see that it has an explosive quality that it demonstrates when on fire, that to them shows hope that it will scare off evil spirits and	

	demons.	
Birch/ Betula pendula	The ancient Celts would cover their dead with birch branches hoping to infuse them with the things they would need for a successful afterlife.	Prone to major insect pests, very susceptible to storm damage.
Cherry (Sakura)/ Prunus serrulata	Represents the Japanese idea of The Perfect Death. Also perfection of virtue and existence.	
Daisy/Bellis perennis	Daisies recall us to the sun, to figure the presence of God and the hope of resurrection.	
Fig / Ficus religiosa	Some African people see the fig as a way through which the dead can grant fertility to the living.	
Holly/ Ilex aquifolium	Some people used to believe that the holly bushes would protect tombstones from lightning strikes.	
Ivy/ Hedera helix	In England, ivy shows up naturally to cover the tombs, but some Americans trans- planted ivy to their graveyards decided that it represent friendship and immortality.	Difficult breathing and coma can be fatal
Lily/ Smilax herbacea	The virgins flower and also the symbol of resurrection and purity.	
Oak / Quercus verginiana	Oak leaves on tombs can represent power, victory, or authority (especially military).	
Pine/ Pinus strobus	This also represents immortality. The cone represents the perpetuity of life renewal.	
Poplar/ Populus deltoids	Instead of immortality (like many other trees) the poplar gives us memories and the sorrows that accompany them.	Susceptible to storm damage, excessive sucker growth, invasive roots.
Rose/Rosa	Roses signify completion, the achievement of perfection.	

Willow/Salix alba	Willows allow anyone a perpetual mourner.	Weak wood, poor branch structure, very susceptible to storm damage, invasive roots.

Careful plant selection is the key first step in developing a balanced and self-perpetuating landscape. However, plant survival with minimal maintenance is not the only issue in sustainability. There is more difficulty with invasive exotic plants which have escaped from managed landscapes, displacing native plants and disrupting natural ecosystems. The use of these potential invasive cannot be seen as sustainable except in very controlled situations. The key to sustainable planting is matching the plant and the conditions of the planting site. The best planting procedures will not save a plant that is poorly suited for the site. Plants vary naturally in their ability to tolerate site conditions such as extreme heat or cold, wet, or dry soils, sun or shade. The plant also should not outgrow its allotted space. Plants should be healthy and vigorous when planted. The condition of the roots in particular affects transplant success. The roots should be white and numerous; brown or black roots indicate a health problem. (Bureau of Natural resource, 1999).

There are different types of planting technique and selection criteria for different people. One of these people is London who lived in the 19th century.

Loudon names three requirements for a cemetery tree.

1) Must be hardy and able to survive with the minimum of maintenance.

2) Must grow well in turf and must not have roots growing above the surface (pinus spp). Long complex root systems will disturb the stonework.

3) Must have a long life span. Loudon's greens habit.

four preferences for cemetery trees with .needle leaves and a vertical are ever branching

1) Cupressus sempervirens. The Italian Cypress. This tree grows would have cost to a height of 20-30 feet and in 1843 one shilling and sixpence. In his opinion, this is the number one tree.

2) Taxus baccata 'fastigiata'. The Irish Yew grows to about 30 feet and is to be found in cemeteries throughout New Zealand. This is ·listed as the second best tree, it is extremely hardy· and has been known to live over 500 years.

3) Taxus baccata 'erecta'. The upright tree is Loudon's third preference.

4) Juniperus communis 'suecica'. The Swedish Juniper grows to approximately 12 feet and is light in color (Loudon, 1843).

Other people from this time are DeGroot and Faloon who classifies plants for cemeteries into two categories.

A) Perennials

Perennials will be a better choice for the cemetery because once established, they will come back year after year with less need for ongoing maintenance. Keep in mind that while perennials will be easier than annuals, they will not produce flower all summer long (DeGroot,1998).

Lily-of-the-valley, violets and Johnny jump-ups are old-fashioned, low-growing flowers that will return year after year. Vinca is an evergreen flowering plant that can be used in rocky or tree-lined areas where graves cannot be placed. Spring flowering bulbs, such as hyacinth, crocus, tulip, daffodil and jonquil, are bright additions in front of a large headstone. The stone can be flanked with iris plantings which will bloom when the spring flowers fade away. Short lily plants are summertime perennial blossoms that add beauty to the lot. The chrysanthemum can be planted and may winter over as a perennial in some areas (Faloon, 2011).

Roses, azalea, rhododendron and spirea flowering shrubs can also be planted in a cemetery that receives landscaping care. However, the bushes can grow out of control if they are not attended to. Summer hydrangea plantings that reach a maximum height of 1.5 to 1.8 meter will beautify a cemetery. Lilac bushes that are kept trimmed to a height of 1.5 to 1.8 meter can be located at the edge of a cemetery or in a location where there is a communal sitting area for visitors (Faloon, 2011).

B) Annuals

Flowers that grow to a height of 46 to 61 cm are the maximum length for annuals on a grave. Taller plants could overpower a small headstone or cover the wording on it. Geraniums are hardy annual plants that work well at a cemetery. When potted, they can be set into the ground in the spring and lifted out when the fall frost sets in. Geraniums can also be planted with blue lobelia and white petunias for a patriotic appeal. Marigolds, zinnia, impatiens, alyssum, ageratum, cockscomb, salvia and pansies all add color and texture to a grave plot (Faloon, 2011).

Table 3. Example of Suitable plants for cemeteries (DeGroot, 1998)

Type	Name	Remark
Perennial	Boxwood, Dwarf Alberta Spruce, Achillea (Yarrow), Euphorbia (Spurge), Aurinia (Basket of Gold), Tiarella (Foam Flower), Digitalis (Foxglove), Geum, Iris, Perovskia (Russian Sage) and Armeria (Thrift). For areas in shade, consider Hosta, Asarum (Wild Ginger), Barrenwort, and Galium (Sweet Wroodruff).	All are slow growing broadleaved evergreens growing easily in shade, sun, clay or sandy soil. Boxwoods have no insect or disease issues, are slow growing, and will never get too large. To keep Boxwoods tidy, prune once a year. Boxwoods are hardy and have dependable staying power. Dwarf Alberta Spruce is pyramidal evergreen. looks like a miniature Christmas tree and will remain cute and tidy for several years. In due time however, the plant will grow to over 5 or 6 feet, which is probably too big for the small space allowed. Dwarf Alberta Spruce is also difficult to prune, and is vulnerable to Red Spider Mite.
Annuals	Portulaca, Zinnias, Cosmos, Marigold, Million Bells, Verbena and Strawflower	Annuals that are drought tolerant. For locations in full sun, Portulaca is a very good choice because once it is planted and watered it will likely not need additional water through summer. Other easy care annuals are. Keep in mind that annual flowers need to be planted every spring, and cleaned up in the fall. Through summer months, one has likely need to check the flowers every week or two to make sure they are doing fine.

To those unfamiliar with how trees grow and respond to stress, managing them may seem challenging. Fortunately, trees tend to do most of the difficult work. A few simple guidelines can help make cemeteries safer and more functional and attractive:

- Never top any tree. This unfortunately common pruning technique shortens a tree‘s life, makes it inherently unsafe, and irrevocably damages its appearance.

- Avoid bumping or cutting the base of the tree with a lawnmower or weed whacker. This inhibits the flow of water and nutrients from the roots to the leaves. It also opens a pathway for diseases.
- To lessen the possibility of newly planted and existing trees being struck at the base, all trees should be properly mulched two to three inches. ―Volcano" mulching should be strictly avoided.
- Depending upon its size, newly installed trees should receive between 10-15 gallons of water per week for the first two growing seasons.
- When sighting large trees, make sure there is ample room for them to expand. Never place large growing trees under utility wires (Bonner, 2010).

2.4. Cemeteries Standards

All around the world, there are different types of standards and guide lines for cemeteries regulation and designs. For example in Britain the space requirement is approximately 40 hectares, including paths and open spaces, per 100,000 inhabitants although many existing cemeteries are smaller than this particularly in city. Of this 50-65% is purely for graves and urns, the rest for buildings, paths and gardens. The size and length of use of graves specified in cemetery regulations vary greatly (Neufert, 2000).

Table 4. Example of cemetery regulation (Neufert, 2000)

Type of grave	Size (Cm)	Space between Grave(Cm)	Period of use
1)Row for adults	210 x 75 x – 250 x 120	30	20 - 25
2) row for children up to 20 yrs	150 x 60 – 150 x 75	30	20
3) row, for children up to 3 yrs	100 x 60	30	15
grave with hedges	300 x 150 - 350 x 150	-	40 - 100
Crypt	300 x 120 – 350 x 150	-	50 - 100
Urn places	100 x 100 – 150 x 100	60	10 - 100
Main places	150 x 150	100	30-100

2.4.1. Gravestones

In any section of graves surrounded by hedge, the grave stone should all be flat or standing and as far as possible of uniform color and size.

Table 5. Example of Gravestones (Neufert, 2000)

Type of Grave	Height(cm)	Width(cm)	Thickness(cm)
Simple	100 -105	40 – 45	9 - 10
Double with Plants to rear	120 – 125	50 – 55	10 - 12
Triple, at appropriate Places	120	150	13 - 15

The hierarchy of roads in the cemetery includes the entrance road as a divided two-lane road leading into the system of primary and secondary roads and service drives. The design of all the roads should accommodate anticipated traffic volume at a design speed of 24 km/h (15 mph). The preferred road design includes curbing. Roads designed without curbing will have edge reinforcement. Traditional parking lots are not provided for cemetery visitors (Neufert, 2000).

2.4.2. Site Furnishings

The components of the site furnishings system should coordinate with and complement each other, the cemetery architectural design, and the site as a whole. Site furnishings, including signage, benches, trash receptacles and flower container/ water receptacles, shall be simple, standardized, and properly scaled with the function and character of the site (Neufert, 2000).

2.5. Cemeteries Standards for Addis Ababa

2.5.1. Preparation for Cemeteries

The surface area of a cemetery must be a minimum of 2000 sq.m and during the preparation of grave holes the markings for them should be placed according to these standards.

A) Burial space for a person should be 2.2 m by 0.80 m.
B) The depth of the hole has to be minimum 2 m.
C) the space between holes has to be minimum of 60 cm all around.
D) markings of graves shoud be with 40 cm by 50 cm hight and could be made of materials such as stone and metal (Getu *et al.,* 2011).

2.5.2. Preparation of grave hole

A) the four side of the grave hole must be laminat with concert.
B) The closing end of the grave hole must be closed or laminated with great care.

C) The soil that has been dig out by the process from the grave must be removed on the same day (Getu *et al.,* 2011).

2.5.3. Depot for skeletons

A) In the cemetery there should be a place set up for deposition of skeletons and the depot must have a depth of 3 meters, width, and length of 10 meters.
B) According to need there should be a mass grave prepared.
C) When a depot it‘s depth must be prepared in such a way as not to interfere with ground water.
D) The depot must be constructed in a way a person can access it with entrance stairs that allow light to pass through and its seal must be impermeable to water (Getu *et al.,* 2011).

2.5.4. Other construction standards

A) The cemetery should have a footpath and its route should not be less than 4 meters.
B) There should be a route prepared for the transportation car of the corps which shouldn‘t be less than 7 meters.
C) The parking space should be able to accommodate on average 20-30 cars in the cemetery.
D) For both sex there should be a toilet constructed.
E) For users of the cemetery there should be a shade for rain and sun protection provided that has a width of 2m and length of 6m (Getu *et al.,* 2011).

2.5.5. Standard for cemetery vegetation

A) In the area where there won‘t be any service held 10% of it must be left for plantation and 4% of it, must be covered with indigenous plants.
B) The four sides of a grave‘s must be covered by grass.
C) Along the pedestrian paths there should be a tree plantation every 5 meters.
D) In the greenery found in the cemetery there should be benches placed at selected locations that are made of wood or stone.
E) The cemetery must have a fence. (Getu *et al.,* 2011).

Chapter Three: Research Methods and Materials

3.1. Study Sites

Addis Ababa is located almost in the center of Ethiopia and it is found in the plateau range of mountain ranges at height of 2000 to 5000m above mean sea level (Yetnayet 2012).The average maximum temperature ranges between 17 and 22^{o}C and the average minimum temperature varies between 11 and 14^{o}C. The average rainfall is c.1200 mm per year, with the major rain season occurring between June and September (Eyob, 2011). Its administration extends over 540 sq .Kms with 10 sub cities (Yetnayet 2012). The study site encompasses nine different cemeteries that are found in five different sub- cities located in Addis Ababa. The sites were chosen according to their management difference, service provision and location. Kechene Medhanialem was chosen because it is under the municipality and it gives service only to Christians, the Millennium is under the municipality which gives burial service to unidentified people and a successful cemetery to combine recreational ecosystem services and cemetery funeral services. The Petroes we paulos was chosen since it has many different cemeteries under different management in close proximity, the Baha'i at Nefasi seleke was chosen because there is no other Baha'i cemetery, the holy trinity cemetery is a prominent place that gives both recreation and funeral service among the other orthodox church managed cemeteries and the Kolefe Muslim cemetery is because of its nearness to the city.

Table 6. Study site description

Name of Cemetery		Sub city	Area in m^2	Administered by
Kechenae Medhanialem		Gullele	130,000	The municipality for Christian community
Millennium		Addis ketema	41,701	The Municipality
Petroes We - paulos	Ethiopian catholic	Gullele	13,739	Catholic church
	Foreigner catholic		12,811	Italian Catholic church
	The Italian		6662	Italian Embassy
	Evangelical		6255	British Embassy
The Holy Trinity Cathedral		Arada	25,940	The holy trinity church
Baha'i		Nifas-Silk-Lafto	1582.8	The national spiritual assembly of the Bahá'ís of Ethiopia
Kolefe Muslim Cemetery		Kolefe Keraneyo	80,400	The Municipality & the Muslim Administration

Figure 1. Administrative Units of Addis Ababa (Yetnayet , 2012)

3.1.1. Kechene Medhanialem Cemetery

Kechene Medhanialem cemetery has an area of 130,000 m^2. From this area 3,991 m^2 is soft scape and 126,009 m^2 is hard scape. This cemetery is separated from the church compound and is found in close proximity independently from the church. It is currently under the management of the Gullele Sub city. It is established during Emperor Hailselasi era but since there is no written document for the exact date of establishment it is believed to be around the year 1973 .The burial service is limited to Christians and unidentified people.

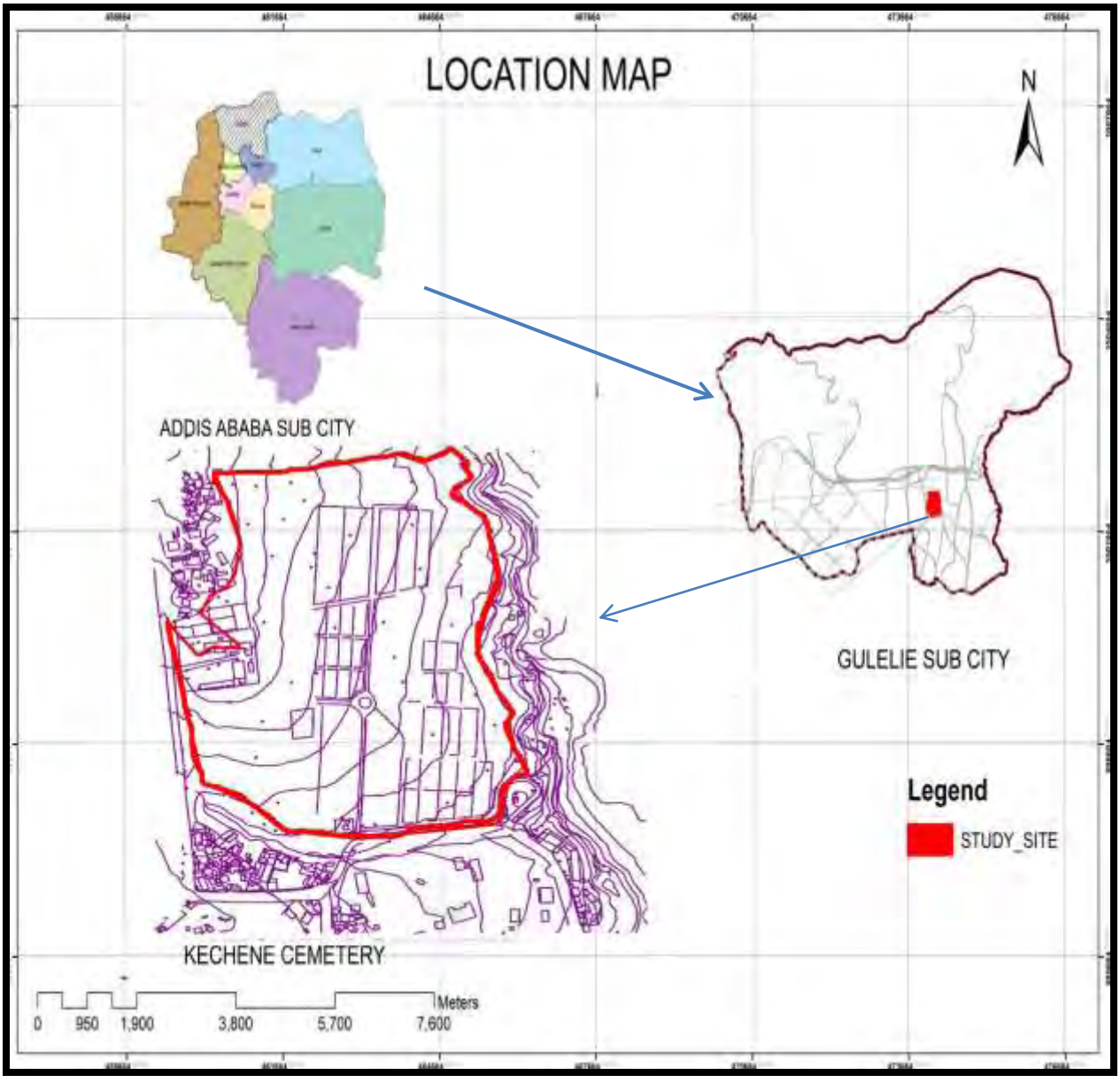

Figure 2. Location map of Kechene Medhanialem cemetery

3.1.2. Millennium Park Cemetery (Bitewar cemetery)

This cemetery has been established during Emperor Hail Selasi era. It was under the management of workers association since 2002 - 2010. Then under kolefe keranio, currently it is under the management of Addis Ketema sub city starting from 2011.The cemetery does not have any plan or blue print for burial. Though the plot of land is divided into 2 parts namely the park or green area which occupies an area of 3791 m^2 and the cemetery which has an area of 37910 m^2. It has not been officially acknowledged as a park. The cemetery used to give service to all Addis Ababa but currently it gives to sub cities of Kolefay Keranio, Ledeta, Addis Ketema, and Mission of charity and from Oromia region to Gefersa for mentally ill people.

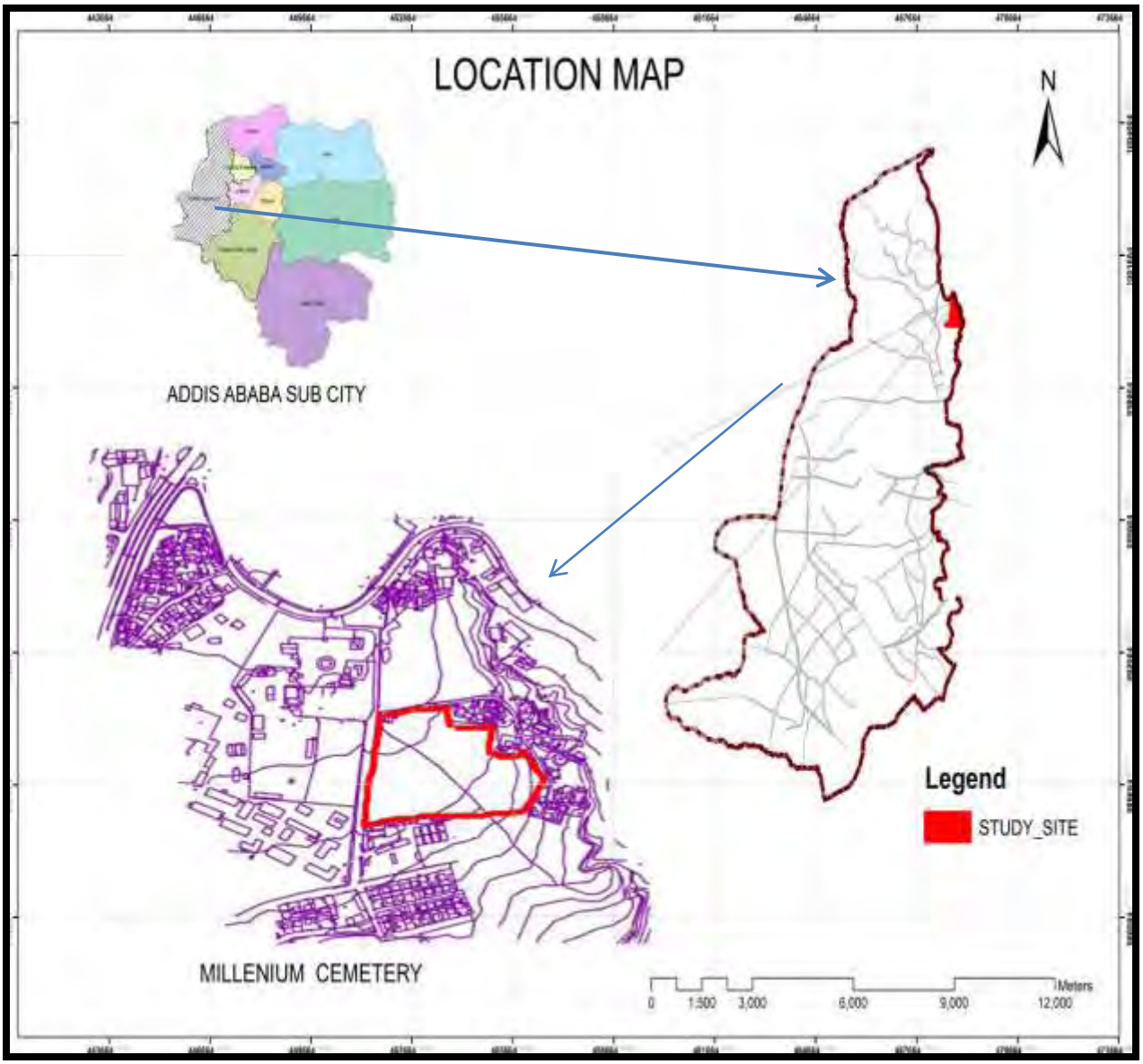

Figure 3. Location map of Millennium Cemetery

3.1.3. Petroes - We Paulos cemetery

The cemetery is located in the Gullele sub city. The study area includes the Italian , Foreigner Catholic , Ethiopian Catholic and the Evangelical cemetery which is found in Petroes we Paulos compound which make up an area of 39467m^2. The Italian cemetery was established in April 1941 for fallen Italian soldiers and is under the management of the Italian embassy. It is divided in to four plots for mass and individual graves. The Foreigner Catholic cemetery is under the Catholic Church administration and is also supported by the Catholic community. The burial ground has its own design done by Sinore Bastian Neno who is also found resting in this cemetery. The Ethiopian catholic cemetery is under the Catholic Church administration and the Evangelical cemetery was established from 1939-1945 by his Imperial Majesty Haile Selasi Emperor of Ethiopia to serve as the perpetual resting place of soldiers who are buried there. It is under the management of the British Embassy.

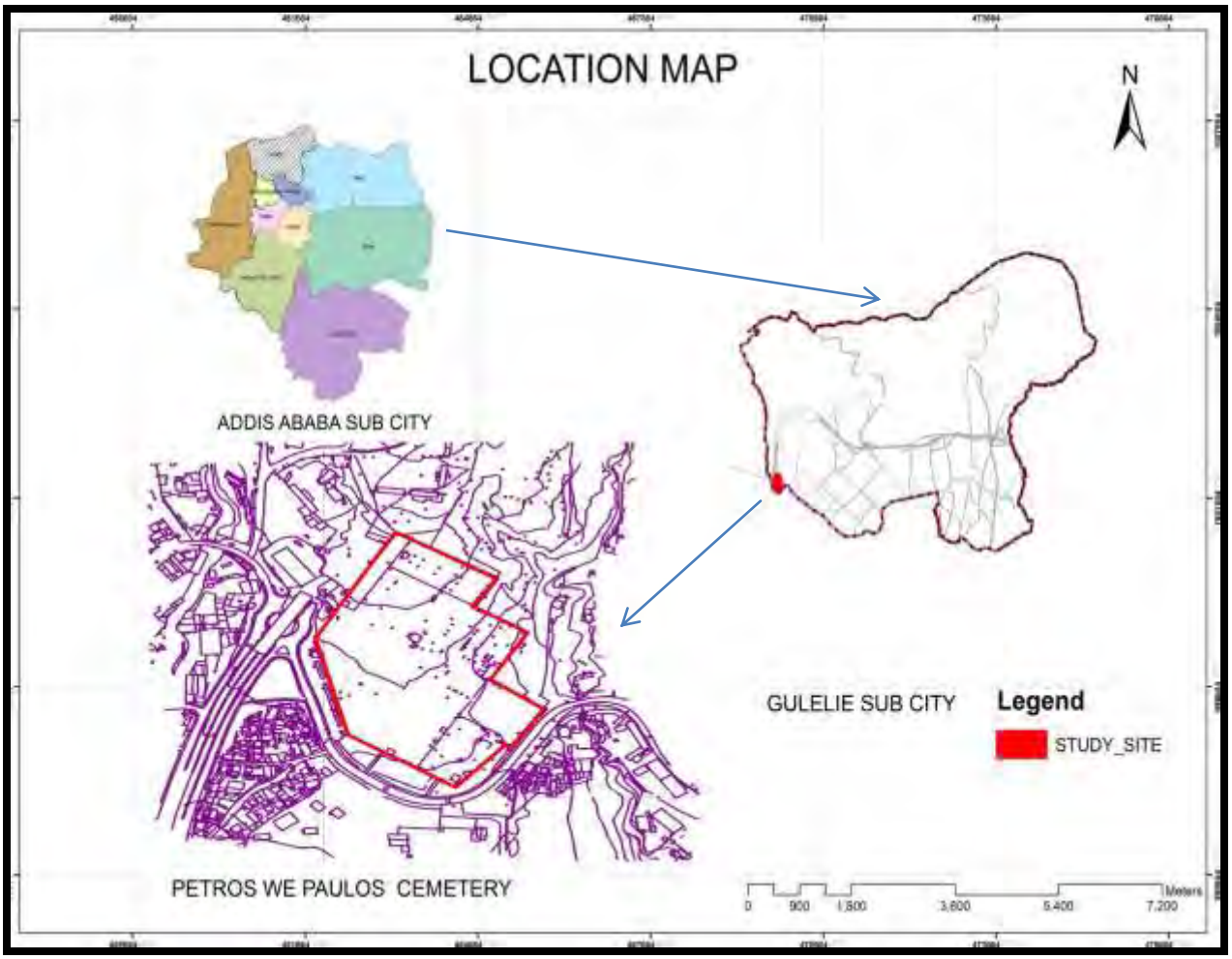

Figure 4. Location map of Petros We Paulos (Italian, Foreigner catholic, Ethiopian catholic and Evangelical) cemetery

3.1.4. The Baha'i Cemetery

Baha'i cemetery is located next to the St.Yosef church compound. Currently it is estimated to have a total area of 1582.8 m^2 and 1510 m^2 is soft scape area. The first person buried in the cemetery was in 1970 so it is established around that time.

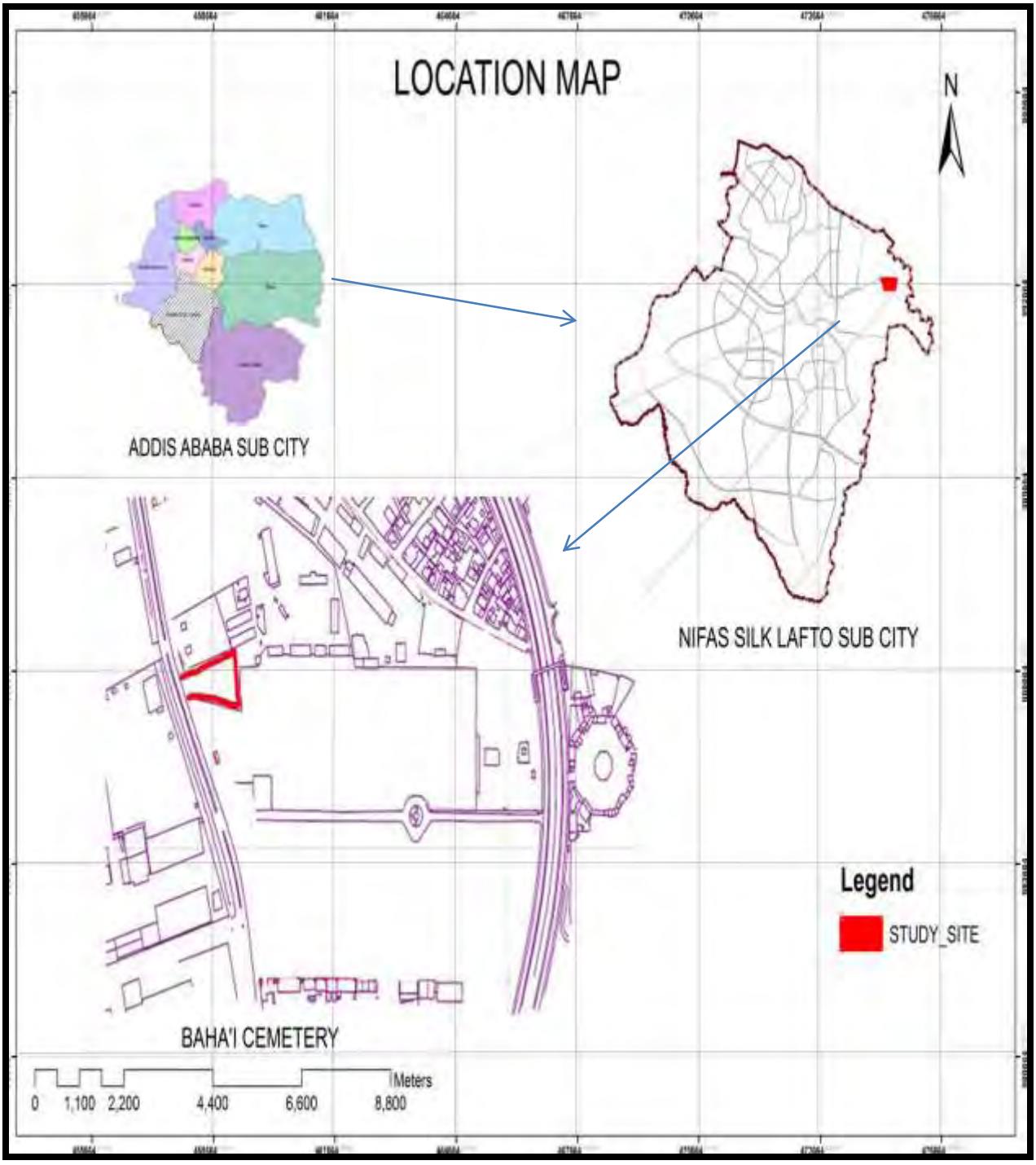

Figure 5. Location map of Baha'i cemetery

3.1.5. The Holy Trinity Cathedral Cemetery

The Holy Trinity Cathedral was founded in 1931 under the auspices of his Imperial Majesty Haileselassie I according to the cemetery's management. It is located at ‗Arat kilo' in the vicinity of the parliament building. It has an area of 25940 $m^{2.}$. After the completion of the Cathedral, it was dedicated in the memory of those who had faithfully fallen in combat during the war against occupation. In connection with this, there are memorial monuments within the compound of the Cathedral.

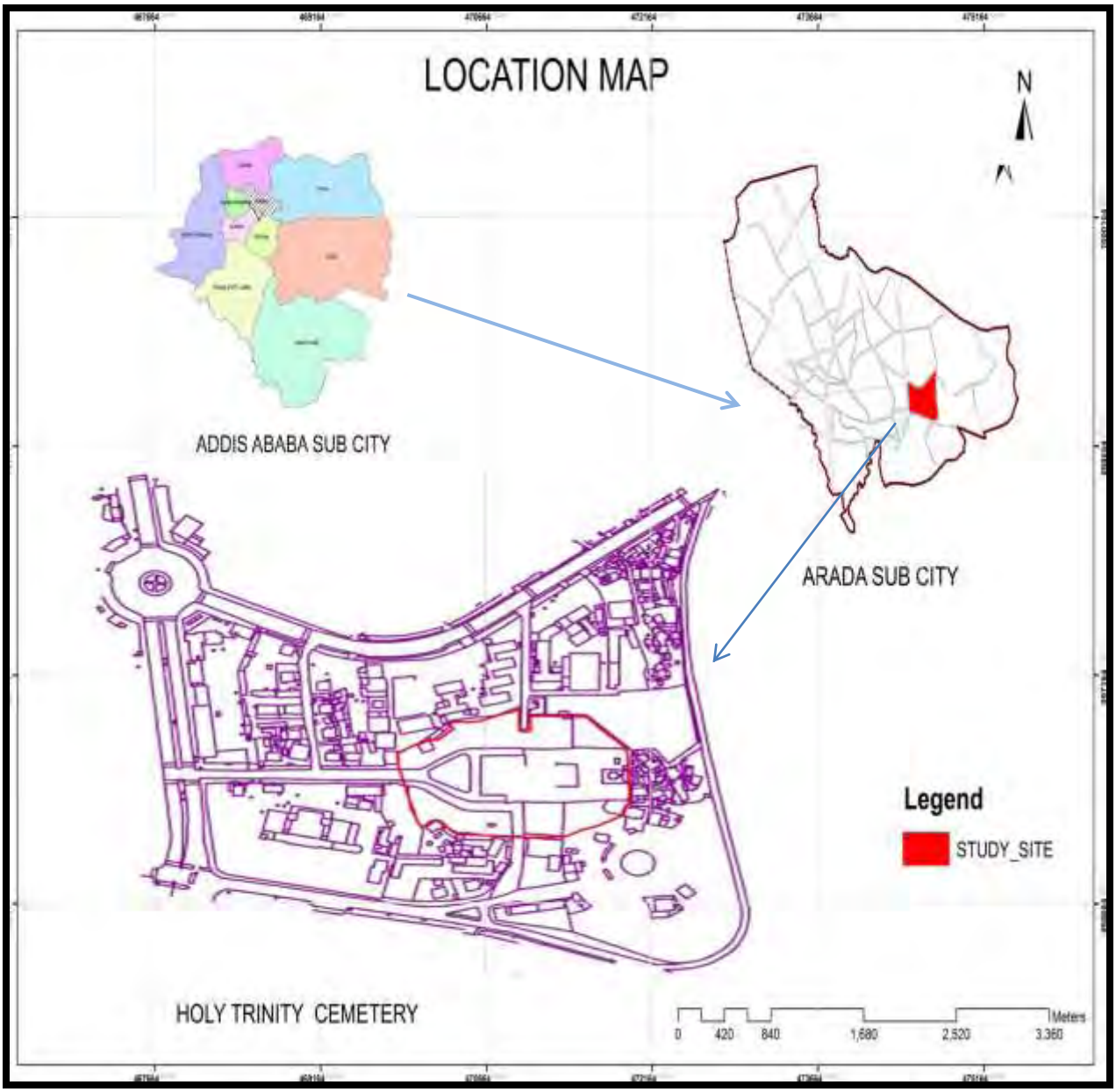

Figure 6. Location map of Holy trinity cemetery

3.1.6. The Kolfe Muslim Cemetery

The Cemetery is located adjacent to the Al Hassan Mosque. It has an area of 80,400 m^2 according to the newly issued map .It is believed to be established in between the year 1971-1973 according to the cemetery management. Previously the cemetery was managed by the Muslim association but it was officially taken over by the sub city of Kolfe Keranio since 1990. But the cemetery is currently managed by two managements namely the sub city and the Muslim association which are at odds against each other.

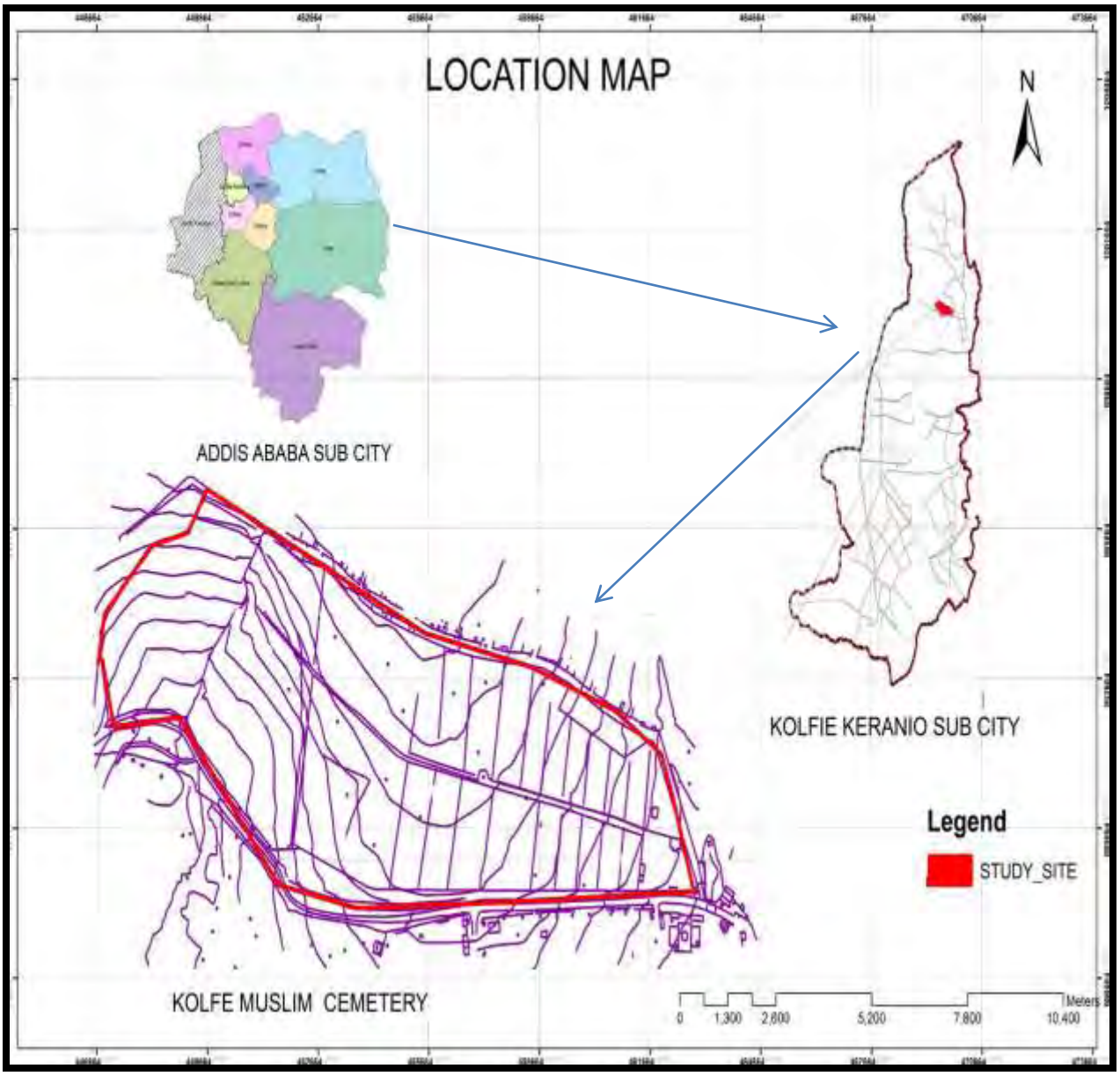

Figure 7. Location map of Kolfe Muslim cemetery

3.2. Methods of data collection

Field studies of tree diversity in these cemeteries were carried out between January and April 2013. Within a cemetery, of 20 m by 20 m square shaped sample plots were used to record information on diversity. Since the two cemeteries namely the Baha'i and the Evangelical cemetery were small in area coverage 100% of their areas were sampled and for the Italian military one sample plot and for the Foreigner Catholic and Ethiopian Catholic two sample plots were taken considering their size. For the remaining cemeteries, which are the Holy Trinity three sample plots, for Kechene Medhanialm and Millennium cemeteries four sample plots were taken within a cemetery in proportion to their total area. For all the cemeteries plots were delineated by random sampling method taking care to ensure that a minimum distance of 100 m was maintained between sample plots. A total of 18 plots were surveyed and their location identified using a Global Positioning System. For the Muslim cemetery tree inventory couldn't be done due to religious and inaccessibility of the area.

In a plot, all trees were identified to the species level and during the recording trees were classified into seedlings, sapling, poles, and post. Within a plot, all pole and post trees were identified and their diameter at breast height (DBH) and height were recorded. Stem diameter (D) at breast height at the standard of 1.37 m above ground level was taken by measuring the circumference (C) of the stem by measuring tape. Circumference at Breast height is also taken 1.37 m from the ground in consideration of slops and tree growth. And then the stem diameter was calculated as follows:

$C = D \times \pi$

$D = C / \pi$. where $\pi = 22/7$

Table 7. Tree size classification (Patrick *et al*.,2004)

Growth Stage	Diameter	DBH
Seedling	<5 cm	
Sapling	5–9.9 cm	
Poles		10–19.9 cm
Post		>20 cm

Tree condition was recorded by visual observation and assigned into one of the four categories which are good, fair, poor and dead /dying. Tree condition and damage was also observed in which crown condition was visually assessed by considering branch dieback, sunlight penetrating through crown, density of foliage and crown density. Damage was assessed by examining the tree and noting physical damage to the crown, branches, and any evidence of decay or disease. And accordingly the trees were graded as follows.

The condition (1-4) of each inventoried tree was recorded as a number that corresponds with the following condition classes:

1 = Good = Healthy tree. No signs of insect, disease, or mechanical injury. Little or no corrective work required.

2 = Fair = Average condition and need corrective pruning or repair. Tree that showed minor insect injury, disease or physiological problem.

3 = Poor = On the process of health decline. These trees are that showed severe mechanical, insect, or disease damage, but death not imminent.

4 = Dead or Dying = A tree with no live green foliage above 1.3m or death imminent from disease or other causes (Maco, 2009).

The origin of tree species, whether exotic or native, was assessed with reference to Useful Trees and Shrubs for Ethiopia (Azene *et al.*,1993) and Trees of Ethiopia (Kebede, 2012). Herbarium vouchers were collected and Plant identification was done in the National Herbarium, Addis Ababa University.

For recreational and management assessment in cemeteries structured questioners and semi structured interviews were used and the structured type questionnaires were forwarded to the cemetery recreational users .The Holy trinity Cathedral and Millennium Cemetery are the two cemeteries which were chosen for the structured type questioner due to the fact that both the cemeteries provide significant amount of recreational ecosystem services. The structured questioner contains close ended questions and was selected for the recreational users because it is easier for the respondents to answer and get easier cooperation as well as quantitative output.

And a simple random sampling technique was used to select respondent for recreational users and the sampling intensity of 10 % was used to guide the selection of respondents for Holy Trinity Cathedral recreational users which amounts to 360 individuals since its estimated 30 people per day come on average around the cemetery area according to the cemetery‘s management. Finding the Millennium cemetery park recreational users were a bit of a challenge

since it is closed currently for recreational function. So for this cemetery a different kind of sampling which is called snowballing was used. But it was only possible to find some of the pervious users after they were recruited by other previous user respondents. Thus it was possible to locate respondents numbering to 24 individuals around schools and residents around the area who were willing to answer the questioners. For both sites the questioner was given to people from different age, sex and religious groups for both study areas. The semi structured interview was forwarded to the managing team starting from the manager to the grave digger to get a whole understanding of the cemetery managing system. Their occupational year in working in the cemetery was seen as a great asset since it can be an illuminating light for the past and present state of the cemetery recreational provision. And the semi structured interview type was chosen for the management of the nine cemeteries and contained open ended questions since they enable the management to express general attitudes and opinions which can help in interpreting their responses without any restriction.

3.3. Data analysis

The data that was collected was analyzed by using different programs. For mapping the cemeteries location points that has been collected by Global Positioning System (GPS) was feed to the software Geographic information System (GIS) to delineate the area .Hence, the data that was interpreted was verified with various data from Addis Ababa Beautification, Parks and Cemetery Development Administration Agency as well as with the most complete dataset currently available, indicating the location and names of all the cemeteries under investigation.

The data collected from the recreational user interviewees were analyzed by Microsoft excel.

And tree diversity was assessed by the Shannon index of diversity at the species level per plot. The Shannon index of diversity (SHDI) is one of the most popular indices used in community ecology to quantify biodiversity, and is defined as The formula is as follows:

$$\text{Shannon Index } H' = -\sum_{i=1}^{s} pi \ln pi$$

The Shannon index is an information statistic index, which means it assumes all species are represented in a sample and that they are randomly sampled. In the Shannon index, p is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), ln is the natural log, Σ is the sum of the calculations, and s is the number of species.

The index indeed assumes that individuals are randomly sampled from an independently large population. The index also assumes that all the species are represented in the sample. Log2 is often used for calculating this diversity index but any log base may be used. It is of course essential to be consistent in the choice of log base when comparing diversity between samples or estimating evenness. The value of Shannon diversity is usually found to fall between 1.5 and 3.5 and only rarely it surpasses 4.5. It has been reported that under log normal distribution, 105 species will be needed to produce a value of Shannon diversity more than 5. Expected Shannon diversity is also used (Exp H‘) as an alternative to H‘. Exp H‘ is equivalent to the number of equally common species required to produce the value of H‘ given by the sample. The observed diversity (H‘) is always compared with maximum Shannon diversity (Hmax) which could possibly occur in a situation where all species were equally abundant. Shannon diversity is the very widely used index for comparing diversity between various habitats (Clarke and Warwick, 2001). So the Shannon index was used to analyse the species diversity among each cemetery.

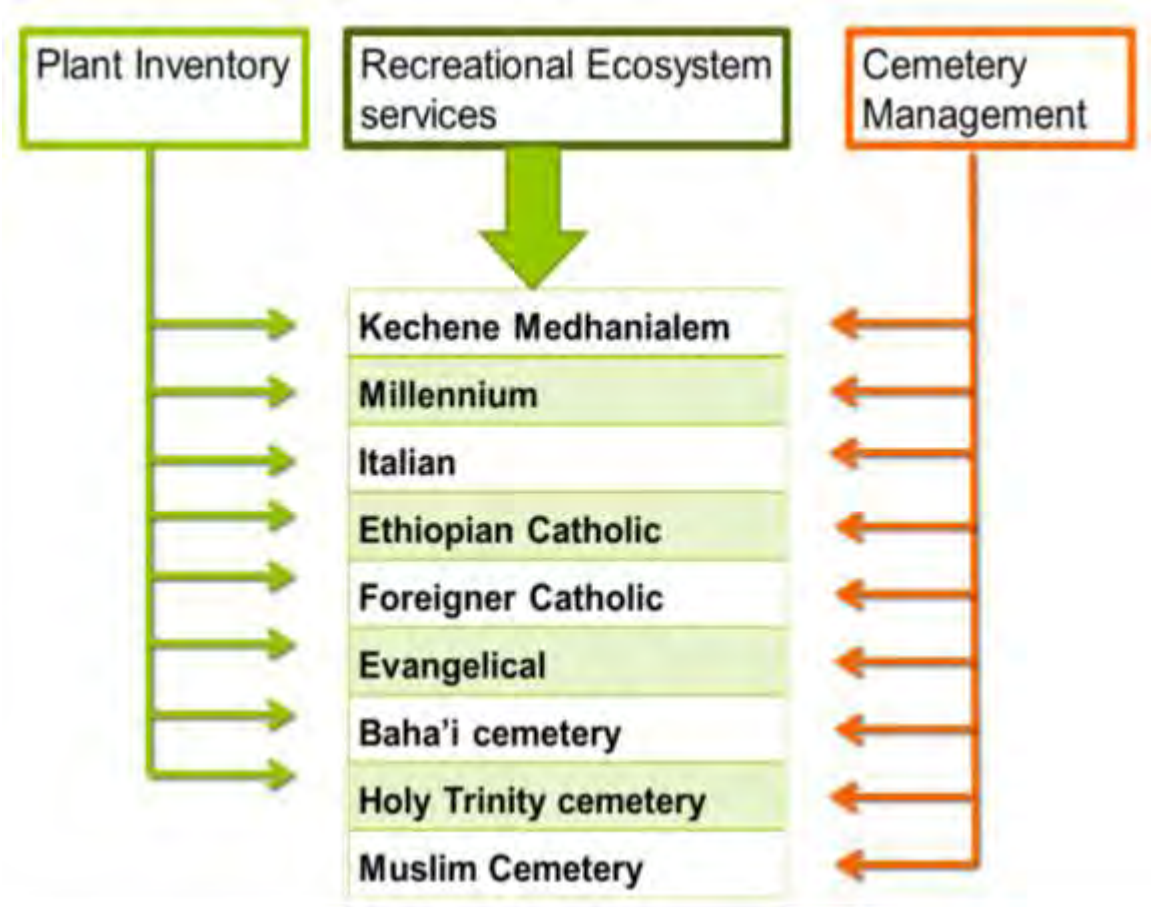

Figure 8. Conceptual frame work

Chapter Four : Result and Discussion

4.1. Recreational ecosystem service

4.1.1. Kechene Medhanialem

The cemetery currently doesn‘t provide any kind of recreational ecosystem service. But the cemetery area in front of the main entrance already shows signs of turning into a park which in very recent time the sub city is planning to prepare that space to a recreational one. And from information gathered from the management, employees, and funeral attendees there is great acceptance of the idea. These people are rooting for the idea thinking the cemetery has great potential to serves as a park in addition the residents of the area has been asking the cemetery administration for years if that kind of arrangement was possible. For example the Elmwood Cemetery in Charlotte, North Carolina, USA, which has been home to many prominent residents since the 1850s, has for years been a place for people to walk, run, and take their dogs. People in the surrounding neighborhoods of Sheffield Park, Eastway, and Medford Acres used the un-developed parts of Evergreen for hiking and bird watching (Harnik and Merolli,2010). Possibly Kechene cemetery can be used as Elmwood cemetery is being used. But when it comes to adapting the idea for recreation to Kechene cemetery modification such as prohibition rules that could be compatible to the society must be added here. In addition according to the management of the cemetery there are many wild animals and birds harboring in the cemetery. Namely Hamster, Hyena, Fox, Tortoise, Raccoon and Civet cat and the existence of these animals will in the future have the potential to attract recreational users to the cemetery.

Figure 9. Summer and Winter Season in the Kechene Medhanialem

The cemetery is more attractive for recreation during the winter season than the summer season due to shortage of water during the summer season.

4.1.2. Millennium Cemetery

The Millennium cemetery has a park and it is located in front of the entrance. Though it has been dysfunctional since June 2012.The landscape is attractive and was done by the worker association of the cemetery. Though there is a burial depot at the middle of the park its surrounding is covered with grass and its upper part is cemented and flower pots are integrated in to it that one fails to notice the depot. One of the services that the park used to provide customers was weeding ceremony. And its going rate was 200 birr for the bride and groom but the daily payment for occasional recreational service provision was 1 birr for entrance. The profit that was generated by the park from the recreational service used to go to the cemetery employee hence the ticket was bought from a local shop and sold for park users until August 01, 2009. But then the government intervened and the profit generated became the sub city's property. This brought a great dissatisfaction among the employees.

Millennium park cemetery is currently still closed due to simple administration problems such as printing entrance thickets. This cemetery has a great potential for recreational ecosystem provision hence some activities such as weddings and theatrical performances could be held in the future. In another part of a world in Lincoln, Nebraska, a group called Flatwater Shakespeare has developed an enthusiastic and loyal following over the past decade by staging theatrical performances in the carriage house of Wyuka Cemetery (Harnik and Merolli, 2010). This performance can also be replicated in Millennium cemetery. According to the result found from the interviewees the cemetery was used for recreation by different people who vary in age and gender. The sex group was more or less balanced which indicates there is no sex group dominancy from the previous recreational users and cemetery management observation.

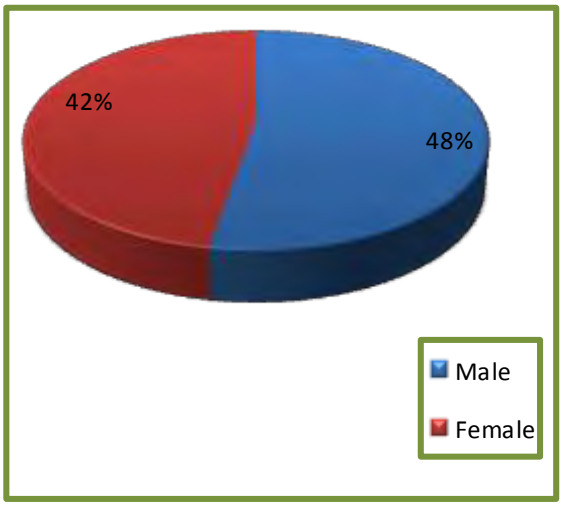

Figure 10. Sex group of recreational users

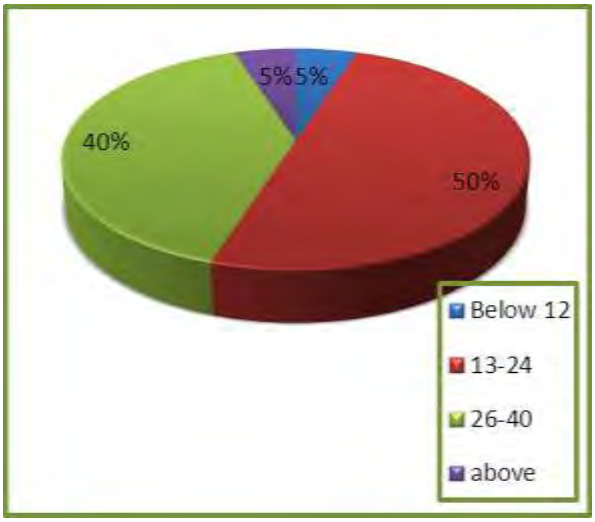

Figure 11. Age group of recreational users

This output was collected from the recreational users who used to go to the park for recreation purposes. And questions like do you know that the park also serves as a cemetery? , will you continue to use it after this knowledge ?, Is the location of the cemetery park convenient for transportation ?, do you consider the entrance fee affordable ?, are you satisfied with park cemetery design for disabled, elderly, and pregnant women and are you satisfied with park cemetery design for disabled, elderly, and pregnant women were generally asked.

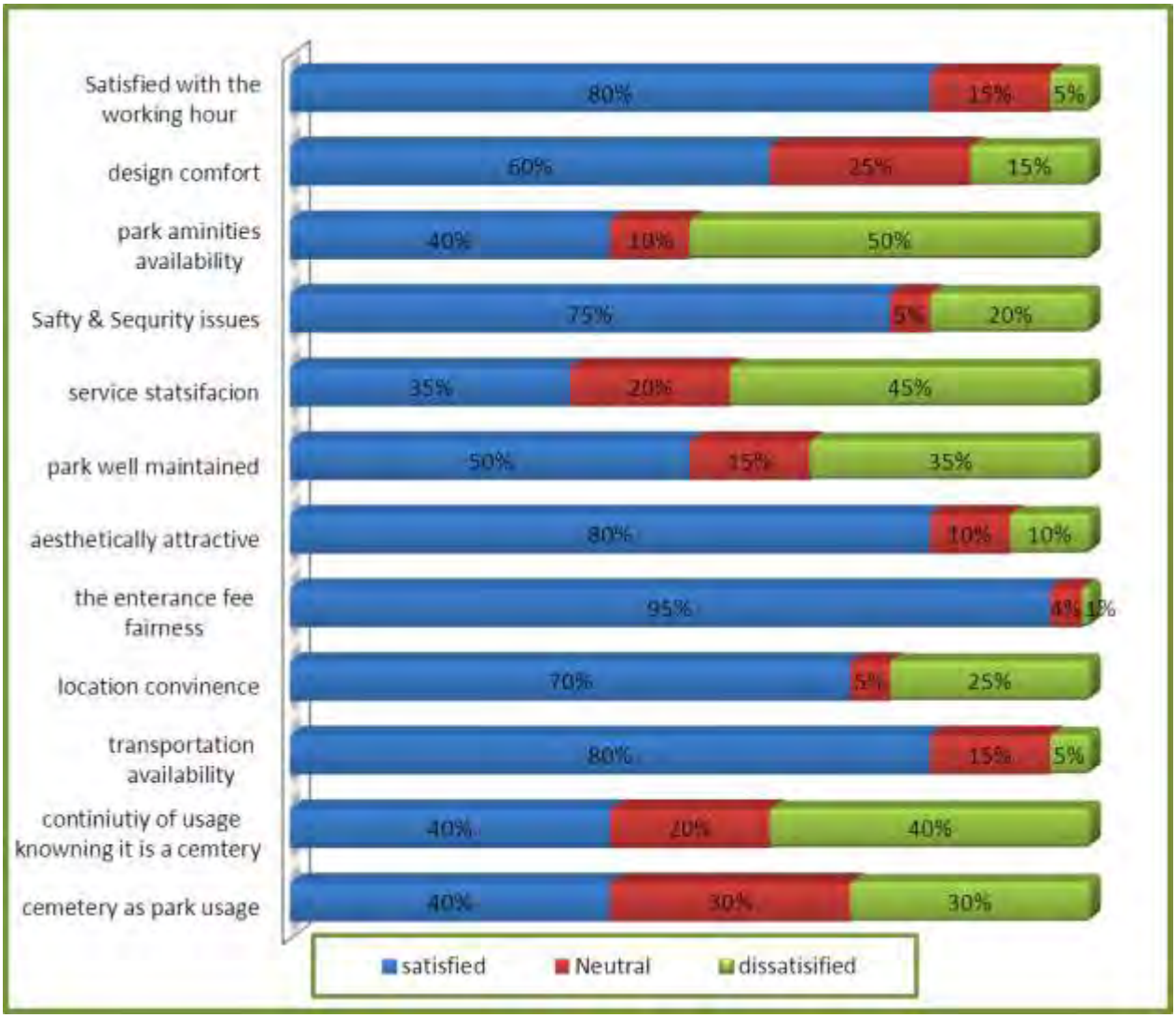

Figure 12. Answer Summery of recreational users of the cemetery in percentage

In the above figure the result gotten from recreational users indicate that service that was given by the cemetery is somewhat satisfactory like the working hours, security and attractiveness. And most of the users are also satisfied of by the entrance fee and agree that it is fair.

Correspondingly the figure is also a good indicator that about 40% of the users continued using it after they found out it was also a cemetery and it is shown that 20% don‘t have any problem if it gives the recreational service and the rest 40% are dissatisfied and terminated their usage when they knew the park was also a cemetery. But it could be a hopeful sign that the majority didn‘t find it to preposterous idea and in the future more people will welcome the recreational ecosystem service provision around cemeteries.

In addition its location being near to the road , Petros we paulos of the Orthodox Church ,General Wingate College and Asertu Hawariat schools was also convenient for 70% of the users and transportation availability made it an ideal place for 80% of the recreational users. But 20% respondents feared that the woodland adjacent to it might be a hide out for people who want to vandalize unsuspecting park customers.

When the design of the park came up only 15 % of the users found it disagreeable because there is a grave and a depot in the park that is made of concrete but 60% found it agreeable. Because both the grave and the depot were hardly recognizable since it has been well fenced by decorated bamboo and has handmade sitting furniture inviting recreational users. The park had a great potential and is a very good success example how a cemetery can function as a park. In addition since the cemetery doesn‘t have headstones like other cemetery its features are rather park like. This interesting fact can be seen as a plus point for gaining additional space for recreation activities. In the future when the park is opened again the different wild life living in it according to the cemetery management like, Civet cat and Hamsters as well as birds might be useful in enhancing the recreational activities.

These responses from the Millennium park respondents it is understood that people go to park for recreation if the right environment is created and the solutions for the problems are compliant with users need. It can be seen that Millennium has a fair chance of attaining its full potential since people are interested in it. And 45 % of the respondents were dissatisfied by the service provision and indicated that if some improvements on toilet, shades ,speakers and other items are made to it will a place where people come to do different recreational activities.

Figure 13. Millennium Park amenities

Respondents that had visited the park during the past years were asked what activities they participated in while visiting the park. The following summarizes key findings.

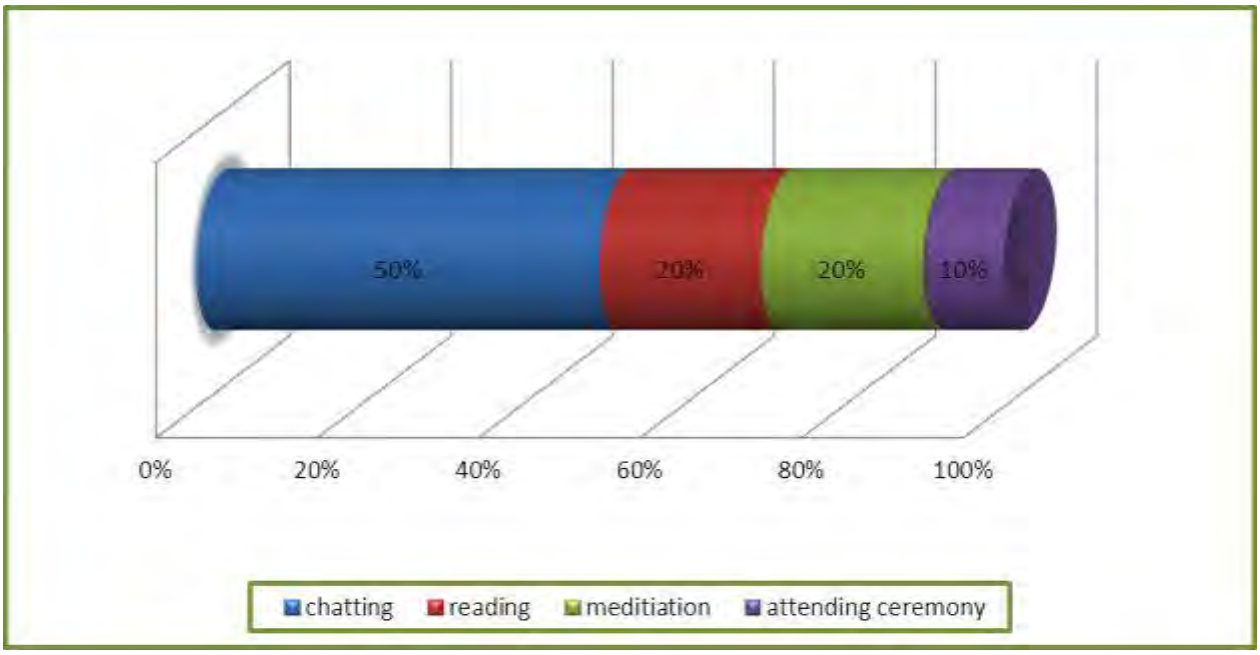

Figure 14. Types of recreational activities by users in the Millennium cemetery park

There are about four activities that they took part in while visiting the park 40% of respondents participated in chatting, reading (20%), meditating (20 %) and attending ceremony such as wedding (20 %).

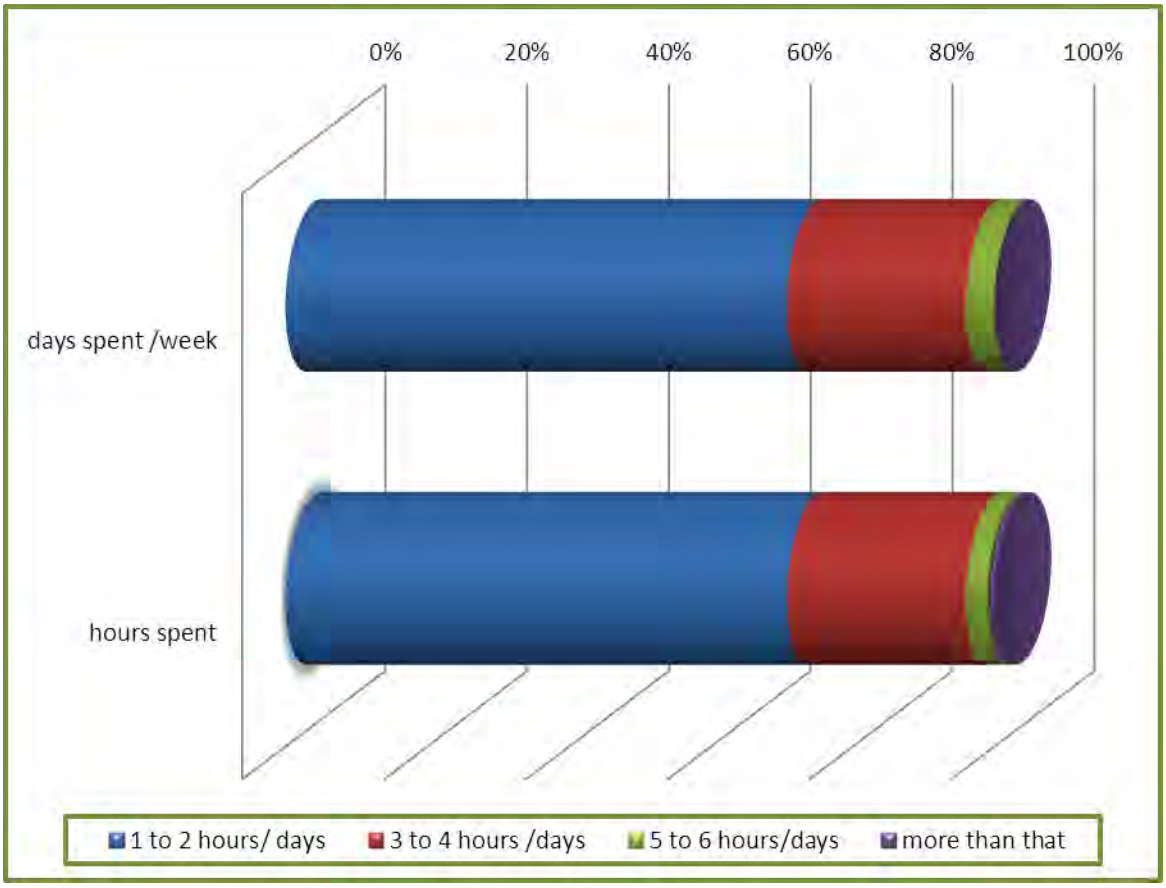

Figure 15. Days and hours spent by recreational users of the park

From the data collected it is indicated in figure 15 that 60 % of the recreational users at least spent 1 up to 2 hours in the park and 1 up to 2 days they used to visit the park for recreation purposes. And more than 80% of recreational users used to visit it 3 to 4 hours a day and go to the park 3 to 4 days a week .The respondents furthermore indicated that almost equal sex group use to come and enjoy and 50% of the users as far as they observed were above 15 age group. And they also recommended that some services like speakers for music, refreshment drinks and food service should be included or upgraded. Furthermore the questioners answer revealed that the previous users of the park since the park was closed ,they spent their time and money in another park called Mulugeta Park which is located almost 200 meters away from the Millennium park.

Figure 16. Summer and Winter Season in the Millennium Park

Figure 17. Summer and Winter Season Millennium Cemetery

The cemetery is more attractive for recreation during the winter season than the summer season due to water shortage which creates a sense of dryness to the place for recreational ecosystem user.

4.1.3. Italian Cemetery

The cemetery has four distinctive plots which are well designed. The soft escape is greater than the hard escape which the cemetery has mastered in the appearance of naturalness. Thus the cemetery has an attractive view and its topography is suitable for people who have disabilities. There are no new funerals taking place which will not be an obstacle in the recreational activity.

The cemetery area is used for recreational activities such as festival once a year by the Italian embassy to honor the deceased soldiers. The cemetery area also serves for other recreational activities such as bicycle riding. In addition according to the cemetery management the cemetery is a habitat for raccoons, birds and insects for one who is interested in nature will be a great spectacle.

This cemetery is a promising space of recreational activity like other known cemeteries such as Oakwood in Hartford, Connecticut, United states which allows residents to run, walk dogs, and ride bicycles, but also programs the space with jazz concerts and other events and even allows residents to bring food and wine (Harnkin, 2010). Its nearness to both Petros we paulos of the Orthodox Church and General Wingate College and Asertu Hawariat schools can insure for regular users. The Italian military cemetery will reach its maximum potential if the management makes the space open to public.

Figure 18. Summer and Winter Season In Italian Cemetery

The cemetery looks more inviting to recreational users during the winter season due to the greenness of the grass since there is no shortage of water.

4.1.4. Foreigner Catholic

The burial ground landscape is attractive with high contours and the designer of the cemetery ground has made a design that complements each other. The cemetery is not accessible to people with disabilities. The cemetery is not full of cemetery plots but has rather interesting places left for sightseeing and doing different kind of recreational activities. Due to its sloppiness the place can only serve as for reading, meditation and other recreational activities which are sensitive to its landscape. Perhaps this Cemetery can be used as the Atlanta‘s Oakland Cemetery, which is owned by the city‘s parks department and run by a foundation, which is one of the city‘s oldest public spaces that offer a fascinating glimpse of the possibilities of a well-rounded cemetery park. Naturally, it features roads, walkways, and gravestones, as well as benches, gardens, and a small central building for events. An impressive collection of specimen trees, some dating back to the 1880s, make it much like a park (Harnik and Merolli, 2010). And since the catholic cemetery is under the Foreigner catholic community management the idea of recreational ecosystem service won‘t be as strange as it sounds and might have great acceptance. In addition its nearness to both Petros we paulos of the Orthodox Church and General Wingate College and Asertu Hawariat schools can insure for regular users. Since the Millennium cemetery park is also found at the south west of the cemetery it can be in harmony with the surrounding land uses.

4.1.5. Ethiopian Catholic Cemetery

Its location being adjacent to the road is good for people who want to come and spend some quality time. The burial ground is free and accessible to anyone who wants to come for recreational ecosystem service. The Centerpiece cross is also an attractive one giving the place a sense of identity. The cemetery has different artistic statues on the tombs on the west side of the cemetery which are expensive. There are many cemeteries scattered around the world that has an intriguing statues such as the Staglieno Cemetery in Genoa, Italy, Kensal Green Cemetery in London and La Certosa, Bologna, to name a few (Worpole, 2003). However the Ethiopian Catholic Cemetery resembles in some ways the Rose Hill Cemetery which is found in City of Bloomington, Indiana which has tombs that are decorated with symbolic images and that some of its artistic and historic and maintenance was made by the management of the cemetery (Bachant-Bell, 2004). When we come to the case of Ethiopian Catholic along the way the cemetery‘s great assets had been overlooked. So an intervention must be done by the cemetery management starting at the earliest point as possible before all the statues and toms are lost forever. Currently the Ethiopian catholic cemetery due to its tree abundance there is good micro

climate condition. And recreational activity like riding bikes is a recreational activity that is already happening in the burial ground which implies the suggestion of a recreation might not be so preposterous under supervision of the cemetery management. In addition since the Millennium cemetery park is also found at the south west of the cemetery the recreational activity can be in harmony with the surrounding land uses.

Figure 19. Centerpiece of the Ethiopian Catholic Cemetery

4.1.6. Evangelical Cemetery

The cemetery has a very landscape attractive design. There is more soft escape than hard escape on the burial ground. The space is also a very pedestrian friendly space. There are almost no burial happening in the cemetery which makes it is eligible place for recreational ecosystem service provision. This place can be used in a way Copperfield Street Community Garden, in Southwark, London, a modern urban sanctuary created from an old churchyard by the Bank side Open Spaces Trust. This space is used by people who do different kind of recreational activities such as reading, studying and meditating. In Newham, an inner-city district in East London is said to be in the book of the Last Landscapes 61 % of the recreational activities are done on the public open space which is made up of cemetery land and in Boston, Massachusetts, it is 35 % (Worpole, 2003). So the Evangelical cemetery which has few burials going on seems an ideal place to give recreational ecosystem service. Around the cemetery both Petros we paulos of the Orthodox Church and General Wingate College and Asertu Hawariat schools are located which consists of students who can be regular users.

Figure 20. Summer and Winter Season in Evangelical Cemetery

Though the cemetery has underground water it is very aesthetically during the winter season which suggest the groundwater is not efficiently utilized to manage the place.

4.1.7. Baha'i Cemetery

The topography of the area is flat and even though the place is not designed for disabled people it is accessible. The cemetery has an attractive view and landscape design and centerpiece which is used for putting the body before the funeral is unique structure worth looking. The place is also pedestrian friendly area. The cemetery has much soft space than landscape so it has a natural. In the cemetery the number of burial is very low to the extent of none it makes it an ideal place for recreational ecosystem service provision. The parking space should be able to accommodate on average 20-30 cars in the cemetery (Getu *et al*, 2011). But the Baha'i cemetery has no parking space. Its location being on the main road it is accessible to many people who want to use it as a recreational space. But since it is located adjacent to the main road it could be an excellent rendezvous place for people. In addition its location being adjacent to the St. Yosef cemetery which is currently under demolition and to convert it to a green cemetery can help it be integrated in to the adjacent land uses. Baha'i cemetery is a cemetery that has a constant well-kept place throughout the seasons.

Figure 21. Baha'i Cemetery During Both Summer and Winter Season

This cemetery has no problem of water shortage so it is attractive for recreational users during both seasons.

4.1.8. The Holy Trinity cemetery

The holy trinity Cathedral is one of the busiest churches in Addis Ababa. In the compound there seem to be lots of activity which one of them being recreational activities around cemetery areas.

And the recreational ecosystem service users are found to be from different sex, age and religion groups according to the interviews held with the users and the management of the Cathedral.

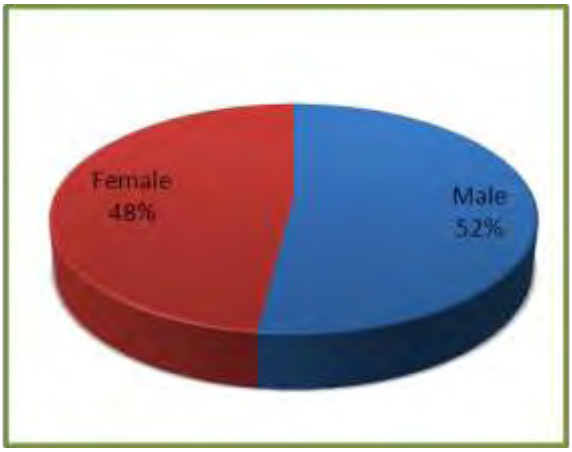

Figure 22. Indication of sex group

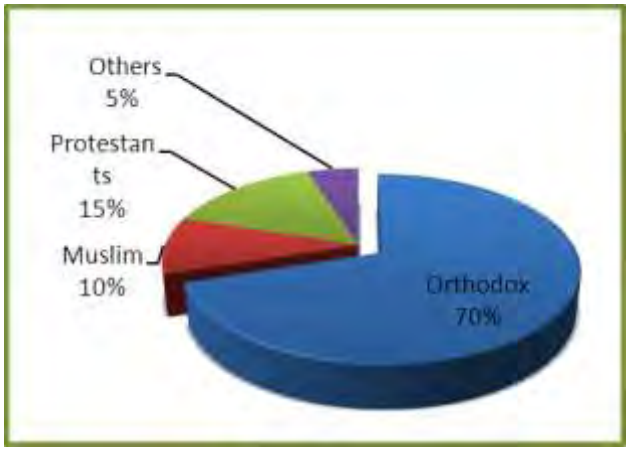

Figure 23. Indication of religious group

The age group of the recreational ecosystem service users seems not to vary by great percentage the data collected shows that people from different age group come here to engage in different recreational activities.

Eventhough the cemetery is found in an orthodox church the users of these spaces for recreational activities are not only from the stated religion.

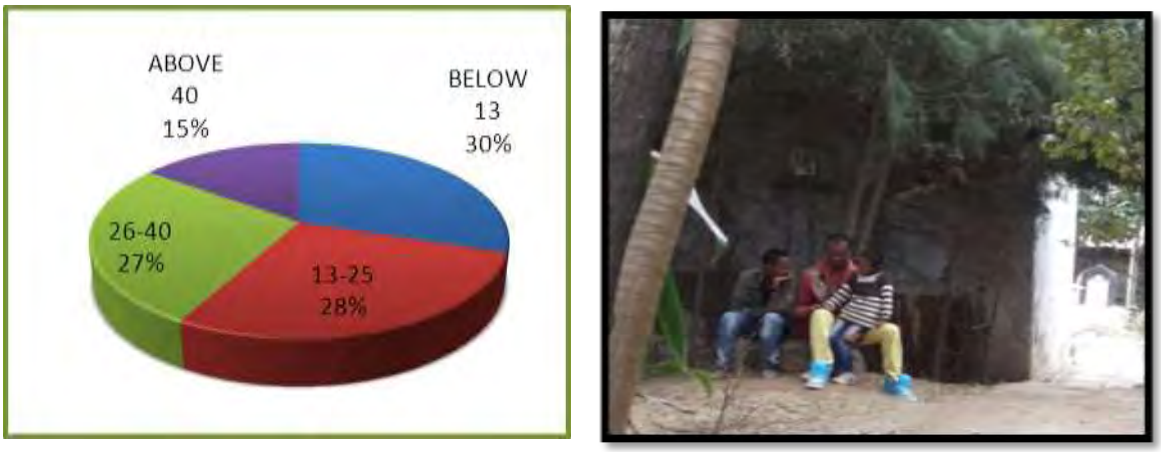

Figure 24. Indication of Age Group

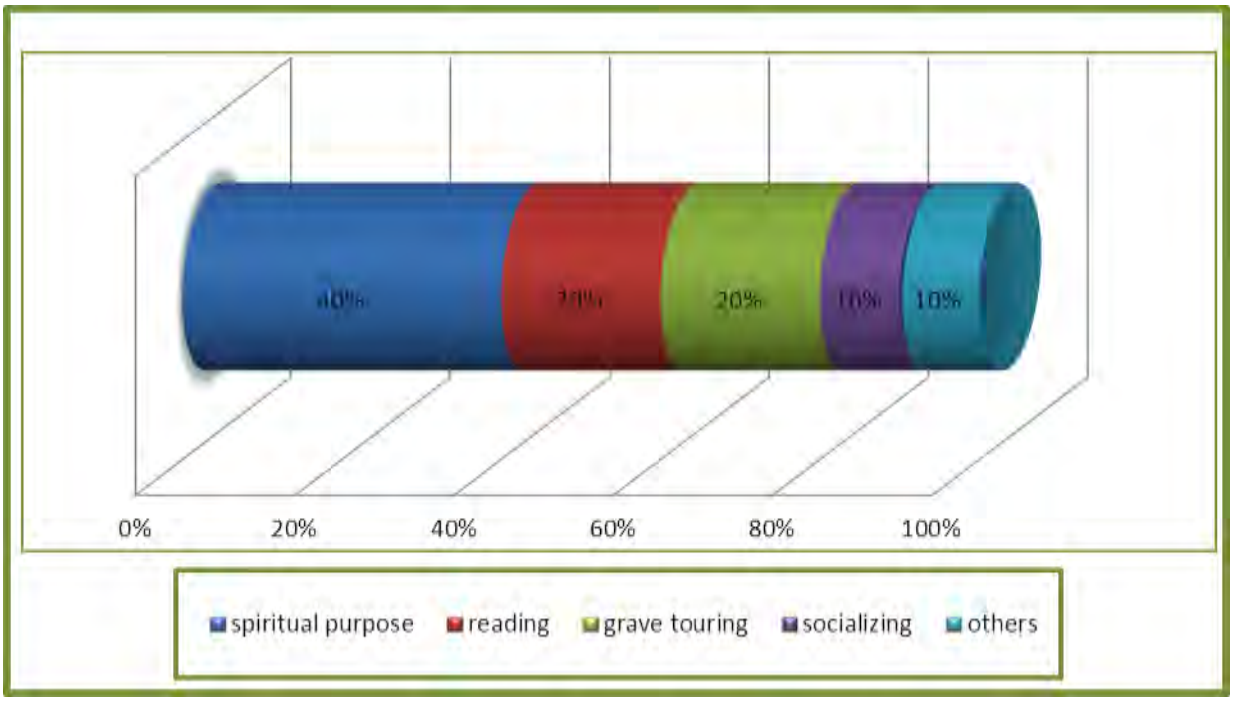

Figure 25. Activities Around the Holy Trinity Cemetery By Users

There is sitting furniture in the cemetery area where people sit and participate in different kinds of recreational activities. The serene environment of the Cathedral makes a good place for people to sit and meditate around graveyards. Figure 26. People Engaged in Different

Recreational Activities

The plots which consists graves of famous, prominent people and moments serves as a captivating place to walk through the cemetery. Hence the cemetery has a good potential to create activities like the one that has been going on in the United States Virginia‘s Arlington National cemetery which has application guide that directs users on a walking tour throughout the cemetery on a historical journey (Worpole, 2003). There is also Hollywood Forever Cemetery in Los Angeles which is the final resting place of celebrities and notable public figures, and it has long served as a tourist attraction and a site of public memory. In this cemetery tourists are encouraged to use the cemetery as social space, transforming relationships to the site (Levitt, 2012). There is good micro climate condition in the trinity cemetery area which compliments recreation activities.

Figure 27. Cemetery‘s Strong Attraction For Users

There is much tree diversity seen in the cemetery plots which are very old which have great crowns that gives shade covering large area.

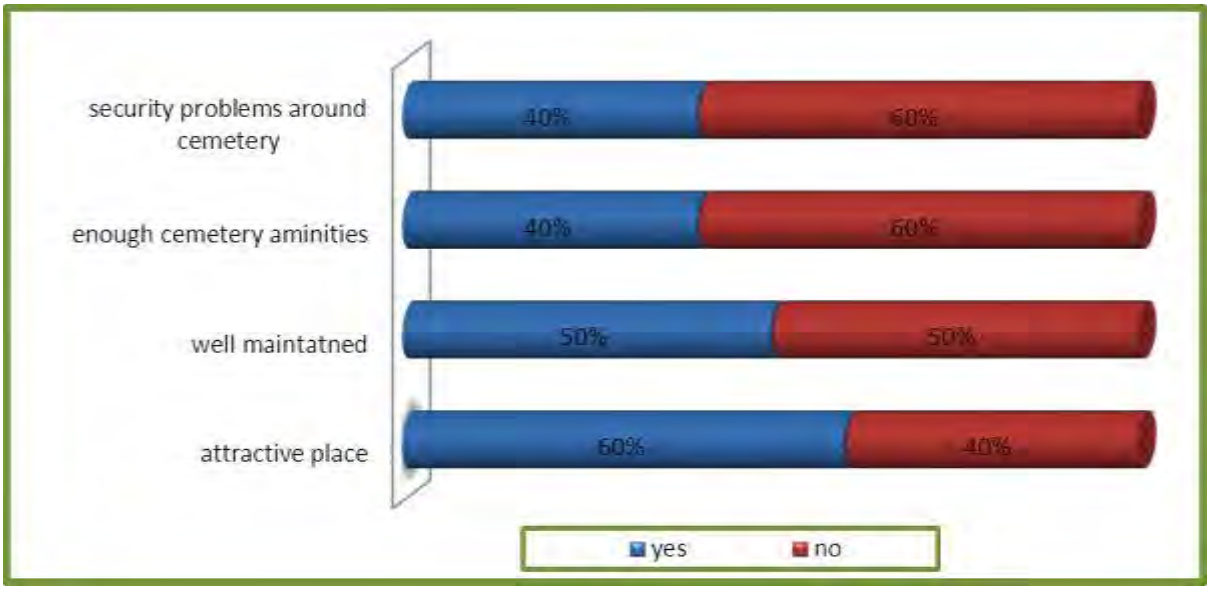

Figure 28. Summarized Answers By Users In The Holy Trinity Cemetery

Security The users of recreational ecosystem service answers are a great indication for the planning of future recreational development.

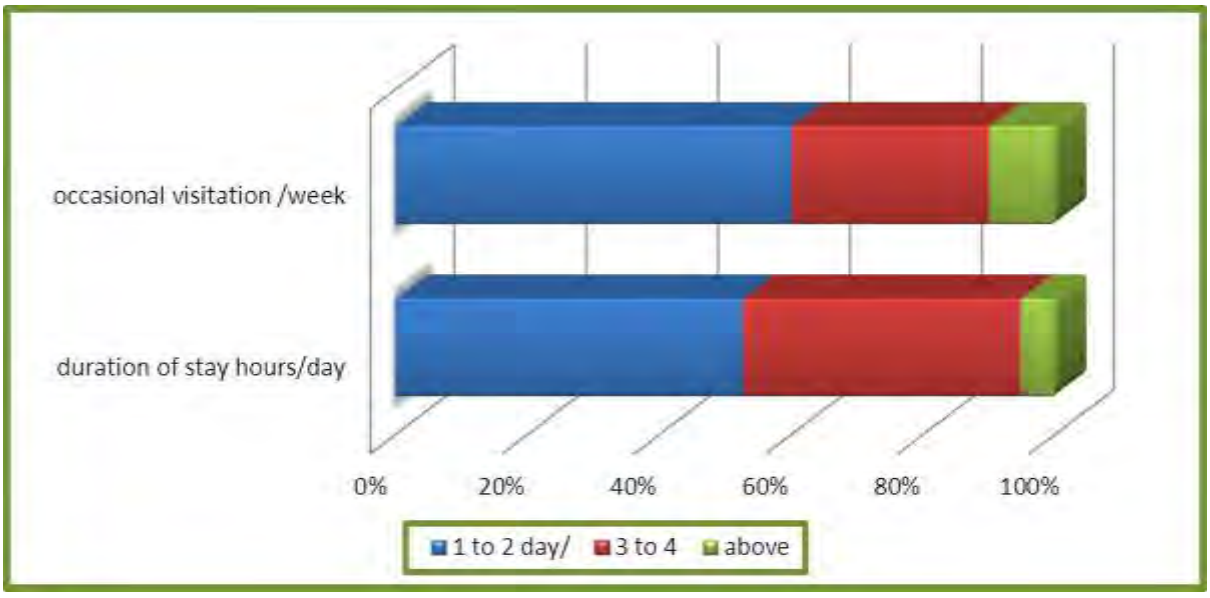

Figure 29. Period And Hours of Visitation By Users of The Holy Trinity Cemetery

The data collection indicates that people spend more time around graveyards and this place can be a place that people can truly enjoy and do different recreational activities.

4.1.9. Kolfe Muslim Cemetery

The Kolfe Muslim cemetery though once described as a place that resembles a park (Ayalew, 2000). But currently that is not how it stands though it still has its strong points for recreational activities usage. The burial standard of the Muslim helps remove a sense of deathscape to some extent and partially gives it to the living. Also the burial standard discourages vandalism since there is nothing to steal which creates a sense of security. The Muslim societies strong sense perspective of not dumping rubbish or abusing cemeteries gives the place neatness. The cemetery being the place where respected elders and religious heads of Muslim people are buried can serve as a magnet for people who want to come in for recreation. According to the cemetery management there are different animals that reside in it. Namely hyena, fox, civet cat, rats and different birds such as owl, doves etc.

It has a fair landscape design at the right side of the cemetery entrance which currently serves as a recreational space. Such as gathering and reading place for men, the topographic nature of the cemetery is a great resource in creating the wanted recreation space. Due to the dense population of trees there is good microclimate condition due to the abundance of trees. In addition to its pervious area which was 16,000 m^2 it has increased its area to 80,400 m^2. So if used properly it could be plus point for the recreation activities. If recreation is officially allowed in the future there is parking space for recreational ecosystem service users. The problem the cemetery is facing is it is not being seen for what it really is which a cemetery is but it is rather seen as a worshiping place.

Hence even though the workers in both managements have interest in using the space for recreational purposes there was disagreement from the Muslim management. The other problem is not ever body can go and walk around the cemetery specially the female gender. Especially since women are not allowed to participate in the funeral and stay behind waiting around the gate there is lack of sitting furniture for waiting for the funeral to end and this amenity is also lacking for recreational users.

4.2. Tree Inventory

4.2.1. Tree Species

A total of 756 trees were recorded in 18 plots among the eight cemeteries understudy. For Kechene Medhanealem 126 stems, Millennium 127 stems, Italian 61, Foreigner Catholic 77 stems, Ethiopian Catholic 131 stems , Evangelical 21 stems, Baha'i 65 stems and Holy Trinity 148 stems were recorded. In terms of abundance as shown in table 8 there are 23 tree species that belong to 17 families and 21 genus scattered among the eight cemeteries. And it is also noted that the dominate species are *Cupressus lusitanica* which is 18.3% followed by *Acacia melanoxylon* 13.7 % and *Eucalyptus globulus* 13.6 % among the cemeteries. On the contrary the least dominant species are *Podocarpus falcatus* 0.1 % followed by *Hyphaene thebaica* 0.3 % and *Ficus sur* which amounts to 0.4 %. Among this the family *Mimosaceae* and *Cupressaceae* being 16.7 % and *Euphorbiaceae* 11.1% and from the genus the most dominant being Acacia 13 % followed by *Cupressus* 8.7 %. So it can be a good indication that in cemeteries the species richness is very poor. It is said to plant no more than 10% of any species, no more than 20 % of any genus, and no more than 30 % of any family (Santamour, 2002). So from the above output the two species abundance is far greater than estimated but the genus and the family ratio is compliant with the estimation.

Table 8. Tree Species found in all the cemetery

No.	Species	Total number of trees	Portion of Trees
1	*Acacia abyssinica*	18	2.38%
2	*Acacia decurrens*	46	6.08 %
3	*Acacia melanoxylon*	104	13.7 %
4	*Callistemon citrinus*	8	1.1 %
5	*Casuarina cunninghamian*	23	3.0 %
6	*Cordia african*	11	1.5 %
7	*Cupressus lusitanica*	138	18.3 %
8	*Cupressus superviranes*	37	4.9%
9	*Dracaena steudneri*	21	2.8 %
10	*Dovyalis abyssinica*	8	1.1 %
11	*Eucalyptus globulus*	103	13.6 %
12	*Ficus sur*	3	0.4 %

13	*Grevillea robusta*	68	8.9 %
14	*Hagenia abyssinica*	4	0.6 %
15	*Hyphaene thebaica*	2	0.3 %
16	*Jacaranda mimosifolia*	25	3.3 %
17	*Juniperus procera*	38	5.01 %
18	*Millettia ferruginea*	20	2.7 %
19	*Phoenix reclinata*	47	6.2 %
20	*Podocarpus falcatus*	1	0.1 %
21	*Olea europaea*	19	2.5 %
22	*Schinus molle*	3	0.4 %
23	*Vernonia amygdalina*	9	1.2 %
	Total	756	100 %

4.2.2. Tree condition

Leaf area is a critical factor in determining many environmental benefits of trees. Typically the more healthy functional leaf surface area on a tree, the greater the environmental benefits. Assuming a tree has ample soil moisture and all other factors are equal, trees with a greater leaf surface area will typically transpire more water, thereby leading to greater evaporative cooling (Simpson, 1998). As indicated in figure 30 the Kechene cemetery the tree condition are 50 % good , 40 % fair ,10 % poor and 0 % dead/dying. In millennium cemetery the tree condition are 40 % good , 25% fair ,30 % poor and 5 % dead/dying. There is problem of small yellowing of leaf on two *Callistemon citrinus* (Bottle Brush), one *Acacia melanoxylon* (Omedla) and Medium drying of leaf on *Phoenix reclinata* (Zembaba) which could have been brought about by shortage of water or nutrition in the sampled plot area. Italian cemetery trees species condition is 70 % good , 20% fair ,10 % poor and 0 % dead/dying and considering this cemetery has 55.7 % of post trees and the condition of trees that are good is 70 % perhaps it is an implication of how well the management handles those trees in the plot. In the foreigner Catholic cemetery the tree conditions are mostly composed of 40 % good , 40% fair ,10 % poor and 10 % dead/dying.

The Ethiopian catholic cemetery trees are made upon 30 % good, 30% fair ,20 % poor and 20 % dead/dying. Though in the evangelical cemetery even though 100 % of the trees are post it is remarkable that the condition of trees are composed of 70 % good , 25 % fair ,5 % poor and 0 % dead/dying but still it‘s better to have seedlings that could take over these post trees.

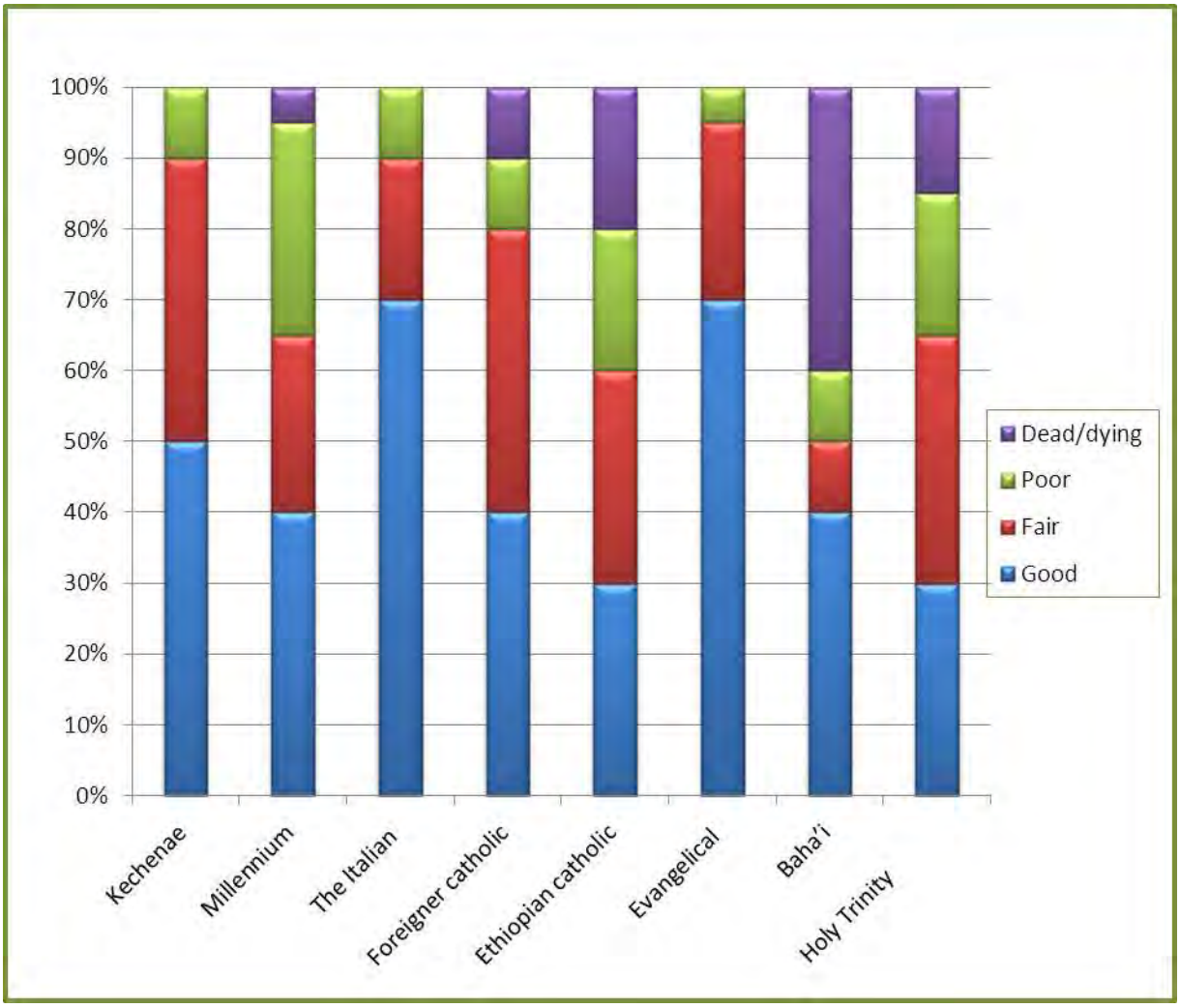

Figure 30. Comparison of tree conditions between cemeteries

The Baha'i trees condition is 40 % good , 10 % fair ,10 % poor and 40 % dead/dying there is a disease *of Cupressus lusitanica* (Yeferenj tid) which causes death to the trees trough time and the white snail resembling insect which is seasonal also attacking the *Jacaranda mimosifolia* (Yet' emenja zaf) has not been sought any. The holy trinity cemetery's the condition of trees are made of 30 % good , 35 % fair , 20 % poor and 15 % dead/dying some trees are observed to lack of leaves on the upper branches of trees which can be an indication that the limbs have died, and may be a sign of poor tree health. This is mostly due to the fact the trees composition are of 34 % post. Dead limbs have the potential to fall and cause damage cemetery visitors and recreational users.

4.2.3. Tree diversity

According to the result found by the Shannon diversity index in table 9 it is clear that Millennium cemetery has the highest tree diversity followed by the Holy trinity, Kechene medehaneyalem and Foreigner catholic. The Italian cemetery no wonder has low diversity since 62.3 % species is *Cupressus superviranes* which can be attacked borers and the cypress aphid can be whipped out living the cemetery in distress. And the evangelical cemetery all trees being *Acacia melanoxylon* tells its own story of very low diversity.

Table 9. Shannon diversity index among cemeteries

Cemetery Name		**Diversity**
Kechene Medhanialem		H = 1.66
Millennium		H = 3.56
Petroes we Paulos	Italian	H= 0.73
	Ethiopian Catholic	H=1.47
	Foreigner Catholic	H= 1.5
	Evangelical	H=0
Baha'i cemetery		H=1.65
Holy Trinity cemetery		H = 2.38

From the total of 756 stems that were recorded in 18 plots according to table 9 in terms of abundance, 44 % of the trees belonged to exotic species, while only 56% of the trees belong to indigenous species. The distribution is largely dominated by a few commonly encountered species. And it can be established that indigenous tree species are rather outnumbered in cemetery Kechene Medhanialem, Millennium Park, Italian, Evangelical and Baha'i. And in the other cemetery Foreigner Catholic, Ethiopian Catholic and Holy Trinity the indigenous are going hand in hand with the exotic tree species.

Table 10. Tree Species diversity among cemeteries

Cemetery name	Indigenous	Exotic
Kechene Medhanialem	33 %	67%
Millennium	30 %	70 %
Italian	33 %	67 %
Foreigner Catholic	57%	43%
Ethiopian Catholic	50%	50%
Evangelical Cemetery	0%	100 %
Baha'i cemetery	47 %	53 %
Holy Trinity cemetery	50 %	50%

Terrestrial invasive plants may also form dense stands crowding out native species, and impacting recreation and tourism by making natural areas less accessible and by potentially reducing wildlife and rare-plant viewing (Charles and Dukes, 2007). In another study it was reported that density of exotic tree species Yeka, Sheger and Beherstige park was (74.7%), (66.7%) and (72.1%) respectively. This indicates that the density of exotic tree species is higher than the indigenous tree species in these parks (Eyob, 2011). Here also, though it seems the indigenous have the upper hand the richness is dominated by exotic trees. But on the other hand Several invasive have provided positive recreation and tourism opportunities, especially in the area of fishing. Overall, we conclude that all cultural services are altered by invasive species, with some positive effects, but predominantly negative effects. Despite the challenge in placing monetary values on these services, it is critical to recognize their widespread influence (Charles and Dukes,2007). So weighing the pros and cons of these indigenous and exotic species cautiously is important.

When we come to the Kolfe muslim cemetery that was generally assessed there are different type of trees and shrubs in the cemetery that are both exotic and indigenous. These trees are believed to be planted during the era of the emperor or the Durge regime. Trees that are planted are currently brought from the seedling station on the criteria that it is indigenous and are watered twice a week. But most of the trees are neglected and are not well managed. In addition, the Cupressus lusitanica (Yeferenj tid) is mostly affected by aphid which the sub city has problem in handling it. There is water shortage which weakens the trees especially during the summer season.

Table 11. Tree age classification by percentage

Cemetery	Seedling	Sapling	Pole	Post
Kechene Medhanialem	14.3 %	12.7 %	18.3 %	54.7 %
Millennium	0.8 %	10.2%	23 %	66 %
Italian	4.9 %	32.8%	6.6 %	55.7 %
Foreigner catholic	9.0 %	20.4 %	20.4 %	50.2 %
Ethiopian catholic	16.8 %	27.5 %	19.8 %	35.9 %
Evangelical	0 %	0 %	0 %	100%
Baha'i	12.3 %	10.8 %	26.2 %	50.7 %
Holy trinity	10.8%	25.6 %	27.6 %	36 %

Good age diversity is essential for future population stability. Most importantly, species that have been proven to be adapted should be stabilized through ensuring the population of that species has a good age range. Replacing older tree is more important than encouraging species diversity (Aspect Studios and Tree Logic, 2011). Large trees constitute a better habitat for other urban species such as woodland birds, sequester greater amounts of carbon, contain more above ground biomass and provide more effective removal of air particulate pollutants, greater shade and more effective cooling (McPherson and Rowntree, 1989). According to this study the cemeteries above except Ethiopian catholic and Holy trinity have post trees above 50 % which imply better recreational ecosystem provision. Eventhough they have their advantages trees must be planted in a way that cover the green space all year round.

4.3. Cemetery Management

4.3.1. Kechene Medhanialem

This cemetery is under the management of the municipality for the Christian community. The Cemetery gives burial service to the nearby sub cities. There are two types of burial service given by the cemetery for the christen community namely Formal and informal. The formal type are for people whose religion are only orthodox and the latter one are for people that are not claimed by anyone typical example are people who have deceased from general and psychiatry hospitals. But specifically the Gulelee sub city is a major user of the cemetery burial service since there is a shortage of space for stranger cemetery in the sub city.

A) Employees of the cemetery

The cemetery has two ambulance, four body collectors, six funeral service holders, one case manager, ten guards, and eleven gardeners. The workers hired there are classified into two parts. These are the permanents and contracted ones. Under the contracted ones three committee are found. Namely, Nesante, Heberet and Agar in each committee 16 up to 20 workers work under them. The salary of the workers is according to the government scale. But the starting salary is 690 birr.

B) Yearly budget

The budget for managing the cemetery is 120,000 birr beginning from the year 2008. But this money seems insufficient for managing the cemetery or improving it. The cemetery only recently constructed case manager office, staffs changing room and guard house.

C) Funeral expense

The plot of land that is 2m length, 60 cm wide and 2.80 meter deep is provided by the government free of charge there are only payment for special services. The expense needed for a single funeral vary according to the materials used. If the burial involves cement 880 birr including the cross that is put up as a marker on the grave and burial without a casket is 275 birr. This money that is earned from this is collected by the funeral handler committees that are described above and the cemetery doesn‘t profit anything. In addition the cemetery gives the service of relocating skeleton and for this service the cemetery charges 20 birr and payment is made to the sub city.

When we come to tree management the trees in the cemetery are managed by the gardeners. All the gardeners have no education regarding plants or environment but they are experienced. Some of them have been working there 20-25 years. The trees are watered once a day and during shortage of water a truck that is the property of Gulelee sub city otherwise that waters the

street plants comes twice a week to water the trees and plants that requires it. The trees have a yearly check up by the experts of Ethiopian Electric Corporation so that they won‘t damage any electric lines. The trimmed trees will be distributing to the workers equally or auctioned off to the highest bidder. The other bushes and unwanted plants are controlled by burning. There is enough manpower for handling the cemetery trees and plants since there are permanent and contracted workers. For watering plants there are water pipes distributed throughout the plot which tries to ensures trees and plants get sufficient water when needed. But that doesn‘t seem sufficient because during the summer season the place looks a bit dry. This must be from the fact that there is no ground water or water storage tanker in place.

In addition there are abandoned spaces in the cemetery which have been previous graves which is currently taken up by shrubs and bushes. There are *Vernonia amygdalina* (Grawa) on some of the stranger (Baytewar) plots which suggests it is unkempt place though the cemetery doesn‘t lack manpower. In the cemetery plot there is a problem of electric wire passing through 23 *Acacia melanoxylon* (Omedla) trees which can create light or fire problem around the area in addition it demotes the aesthetics of the place that should be seen by the management.

The disease caused by aphid attacked the *Cupressus lusitanica* (Yeferenj tid) had not been found solution by the cemetery management. But it is a speculation from the cemetery management side but there was an attempt to solve the problem by asking the sub city to send them a specialist in handling the disease but there seem to be no solution was forwarded. The cemetery management hence tries to save the tree by trimming it or cutting it completely.
Some of the retaining walls of the plots are collapsing which creates landslide in the cemetery this is other problem that the management over looked. There are existing toilets which currently are dysfunctional but even if they were functional it is no doubt that they are inaccessible and in addition they are far into the cemetery. There are no trash canes, signs and sitting furniture in the cemetery. In addition one of the problem of the cemetery is that not being accessible to anyone who wants to enter the cemetery for recreational activity. It can be said it is guarded by the management over enthusiastically.

There is a great problem which really is a concern at times there is a putrid smell that comes from the outside which is due to the liquid waste disposed by the municipality near the cemetery. This smell is said to compromise the health of the workers in the cemetery. So the management of the cemetery needs to come up with a solution by working with the authorities.

4.3.2. The Millennium Cemetery Management

The cemetery is under the municipality for unidentified people. The cemetery management as a whole has an office, resting room for workers and one guard house and there is a construction plan for a hall. The cemetery currently has twenty four employees. From these four guards, twelve Gardner, two grave diggers, one cashier and one case manager. The Cemetery also has its own ambulance to bring in corpse from places.

For the management of the cemetery the budget needed is 3.7 million birr annually. But the cemetery is under budgeted and receives less than 100,000 or equivalent to it annually. For watering the plants in the cemetery the cost during the winter season is up to 1000 birr and 500 birr during the summer season. The cemetery salary that the employees earn differs according to their work station that is assistant of the ambulance makes 734 birr, gardener 694, cashier 957 birr, case manager 1,499 birr, grave digger and 734 birr , 694 birr , 734 birr and 817 birr for guards. Since 1995 Ethiopian calendar there have been no raise in Salary. The low salaries paid by the management have created a great dissatisfaction among the employees.

The Management team has received lots of encouraging certificate from different government organs for having the spirit for changing the cemetery and making the place recreationally functional. But since then the profit generated has been over taken by the sub city which created loss of sense of belongingness among the cemetery employees. But due to the parks achievement in making the cemetery into a recreational ecosystem service provider it is going to be official acknowledge by the municipality as a memorial park. Though the park has been closed for two years now due the management problem of acquiring the simple task of printing thickets for entrance. Since the cemetery management has already been successful in establishing the Park and once it is open again there is no doubt it will assume its recreational ecosystem service provision.

On the other hand there is management of trees and during Water shortage the management has two type of mechanism of handling the problem one is watering the plants by using a truck that can hold up to 14,000 liter of water and the other is storing water by 6 tankers. But it seems it is not enough because the place looks dry during the summer season. Along the pedestrian paths there should be a tree plantation every 5 meters (Getu *et al*., 2011). There are new plots being used for burial and new plots are being done with the standard of cemetery tree planting and the cemetery has 2 m width after every plot for Pedestrian walk way. The selected plants are not thought of but are rather planted randomly. There is no regard for wild life that are

harboring in the cemetery. In the sampled plot during to the pruning process four *Acacia decurrens* have been damaged on the trunk area which can make the trees vulnerable to disease or cause death. The litter burning site is killing four different tree species such as *Acacia melanoxylon* (Omedla) and *Eucalyptus globulus* (Nech‘ Bahr Zaf). The earlier burial ground still standing is shabby and totally populated by *Eucalyptus globulus* (Nech‘ Bahr Zaf) trees which have litter all over the cemetery and look like a forest.

4.3.3. Italian Cemetery

The cemetery is managed by the Italian embassy. And the management changes every four years. The cemetery has sufficient budget from the embassy annually. The employees in the cemetery get well paid up to 6,000 birr monthly which ensures high performance and long position occupation. The trees are watered once a day through water pipes that are buried in under the ground. The cemetery has a ground water tank which can store up to 5000L used during shortage of water. And to overcome water shortage there is underground water that is used by pumping and every three days the plants will be watered. But clearly the plants need more watering during the summer season. The trees are trimmed according to the need and the litter are given for free or used as fertilizers and every three years the soil will be changed. The grass is mowed with grass cutter which will have a smooth out put then the grass is taken by people who have cattle. But the grass type in this cemetery has the tendency to damage the water drainage system The cemetery has night time light which can increase the safety of the cemetery. It has clean public toilet which can be used by visitors. Trash cans are there in the cemetery. The management should provide sitting furniture.

4.3.4. Foreigner Catholic Cemetery

This cemetery is under the management of the Italian Catholic church. The cemetery is supported by the Foundation of Foreign Catholic people. The cemetery has three gardeners and two guards and they are paid up to five thousand monthly that ensure their best effort to maintain the cemetery. But the cemetery employees seem to lack a great deal of understanding the usefulness of trees or greenery. In the cemetery the gardeners trimmed and handle the trees as seen appropriate. Some trees such as *Acacia abyssinica* that are found could be dangerous for mourners and grave visitors that are still at seedling level. The cemetery is not accessible to people with disabilities. The cemetery does not have an alternative supply of water should there be water shortage. The cemetery management has put trashcans in appropriate intervals but no sitting furniture also in addition has limited parking space.

4.3.5. Ethiopian Catholic Cemetery

The cemetery is under the management of Catholic Church. The cemetery Management doesn‘t restrict anyone who wants to come and take a look in the cemetery. The burial ground looks an abandoned place which is running itself. The four sides of a grave‘s must be covered by grass (Getu, 2011). Here the paths are not defined and the burial ground is covered with red ash. No plots or design for the burial area and there is more hard escape than there is a soft escape. There are no gardeners allocated for the management of trees and plants in the cemetery. There are some problems on the *Cupressus lusitanica* such as Yellowing of leave and *Grevillea robusta* being dead. There are so many bushes and shrubs that can be dangerous to mourners and grave visitors due to the negligence of the management. The grave stones and statues which represent an era which tells their own story are not well managed by the management and are found in worst condition. Due to the low security it can be a target for vandalisms. In the greenery found in the cemetery there should be benches placed at selected locations that are made of wood or stone (Getu, 2011). The cemetery has not complied with this.

Figure 31. View of the Ethiopian Catholic cemetery

4.3.6. Evangelical Cemetery

The cemetery is under the management of British Embassy. There are two gardeners and are well paid which is 5000 birr monthly hence works to their full potential. The management has made the cemetery inaccessible to anyone who wants to enter it. The plants are well maintained and are trimmed every 3 or 4 month. The trees are examined by expert every couple of years. Soils for the trees are changed every two or three years which helps the tree to maintain their

growth process. There is no water shortage due to the fact that the cemetery has a ground water which helps to make the watering days constant and support other ecosystem services. All the post trees are *Acacia melanoxylon* (omedela) hence, if a disease attacks the trees all will be affected since there is no diversity. The management made no provision for sitting furniture.

4.3.7. Baha'i Cemetery

The Baha'i cemetery is under the management of the national spiritual assembly of the Baha'is of Ethiopia. The cemetery has one gardener and one guard with payment 1000 and 1300 birr per month. The burial ground is being taken by the St. Yosef cemetery which the management must handle. And the fence in one side has been torn down which makes it easier for cattle to come and graze in the cemetery. In addition it doesn't have guards at night which makes it easy for vandalism. The trees are well managed and are watered by hoes and there are no unkempt plants in the cemetery. The litter in the cemeteries are taken and turned to compost which later is mixed with the red soil that is put around the plants.

4.3.8. The Holy Trinity Cemetery

This cemetery is managed by the Holy trinity church. The plots in the cemetery are not aligned but rather disordered and overcrowded with grave and tomb stones. The path ways which are crocked as it is are taken up by shrubs and bushes. This issue should be addressed by the management of the cemetery. The cemetery has two gardeners and there was a training given to the lead gardener about trees and plants which helps in managing them better. The manpower for handling the trees and plants in the cemetery by this two gardeners is impossible considering the large plot area of the cemetery. The trees and plants get watered every three days and the soil of the trees gets change once a year. Since there is no burning site anymore the litter from the cemetery is used as compost for trees which is a good thing concerning the environment pollution issue. There is the damage done to the *Cupressus lusitanica* (Yeferenj tid) tree by the aphids which still don't have solution since the management isn't looking into the problem. The cemetery used to have a design but it has not been followed for a long time. There is no sitting furniture in many of the cemetery plot. Since the location is very convenient and most students and passersby would benefit from it if sitting furniture are made available by the management.

4.3.9. Kolfe Muslim Cemetery

The Muslim cemetery is managed by the Municipality & the Muslim administration. The burials are handled by the Muslim management since it is different than the standard used by the

municipality. Under the Muslim management there are twenty employees and under the sub city only six people from which two work as guards, one as a case manager and the rest three as guarders these employees are all male but these employees number fluctuate due to salary reasons. Their education varies from non to higher education level. The salary for guard and gardener is 694 birr. But having two different administrations is a great disadvantage for both the Muslim and the Kolfe Keranio sub city which creates a lot of managing conflicts.

From the July 2011 up to August 2012 there has been 1132 death were recorded and people who took death certificate were 47 in number and from these 940 birr were collected which is an indication of low income for management of the cemetery. The effort of the management team in changing a portion of the land that was previously abused and putrid smelling space to a place that people can come and read, sleep, and gather to some extent is commendable. The cemetery plots design has been consumed by the shrubs, bushes and seedlings that seem to be growing everywhere which creates a sense of unkempt and abandoned air. This is due to the lack of manpower and the cemetery management has it cleared up once a year paying a tremendous amount of money. Even though the cemetery management tries to plant indigenous trees the once that are brought in by the sub city are exotic trees which clearly implies a gap in human resource. The low wage paid to hire hands to take care of the cemetery keeps driving workers away and from the sub city side hence resulting in short hands for handling the cemetery. The belief of the Muslim management serves as a factor for not enabling caretakers to penetrate the inside of the cemetery land for proper cleaning and clearing. Due to this factor there is difficulty in walking through the cemetery during funeral hours for the mourners. There is also shortage of water and lack of watering trucks.

The faith followers or the Muslim management don‘t allow the recycling or disposition of skeletons so the cemetery plots could not be properly managed or reorganized according to the need. The large plot of land in the cemetery if were managed well it can be used for the proper utilization of cemetery and recreational space. The cemetery being surrounded by residential and nearby commercial activities can give recreational services that want to come and enjoy if more recreational space can be provided. Since the ground of the cemetery is not well kept it can serve as a hide out for thieves during night time. The disagreement of the two managements can create a huge conflict with the outside Muslim community and the government.

Table 12. Management problem of cemeteries

Name of Cemetery	Under budgeted	Management conflict	Shortage of manpower	Lack of human resource on trees	low income generation	Lack of cemetery plot map
Kechenae Medehanalem	✓			✓	✓	✓
Millennium	✓			✓	✓	✓
Evangelical						
Foreigner catholic						
Ethiopian catholic			✓	✓		✓
The Italian						
The Holy Trinity Cathedral	✓		✓			✓
Baha'i cemetery					✓	
Kolefe Muslim		✓	✓	✓	✓	✓

Chapter Five : Conclusion and Recommendation

5.1. Conclusion

Generally in the city of Addis Ababa cemeteries are only considered for the usage of a single purpose of dealing with death. And the suggestion of these spaces for recreational ecosystem service has been and is in some cases a subject that raises a brow. But more than ever the city needs the recreational ecosystems provision to the maximum, specially being a city that consumes its green spaces for construction purposes. Most of the city‘s neighborhoods don‘t have places were recreational activities are held on regular bases. One of the best ecosystem providers to the city being cemeteries whether it is provision, regulatory, cultural, or recreational provision have not been recognized fully. Even though cemeteries have the potential to become an excellent recreational ecosystem provider the cemeteries in Addis Ababa are underappreciated and their full potential unrealized by the cemetery managements.

As seen the nine cemeteries under study even though they are under different management they have to some extents similarities when it comes to recreational activities. Eventhough most of the cemeteries under the study have some recreational activities going on without the management‘s initiation the question remains could that be acknowledge officially and supported by the management. But there are hopes of ray that this possibility could be entertained in the long run. And since most of the cemeteries management employees are entertaining the idea consequently it could happen sooner than later. The case of millennium park cemetery is a major example of how a recreation and burial activity can go hand in hand and hence the other managements are hoped to come to that conclusion. People coming and enjoying themselves unintentionally or intentionally around cemeteries in the case of the Holy Trinity and Kolfe Muslim cemetery are signs that can also be taken as clear indictors that people whether users or employees are ready to engage in the idea of recreation in cemeteries .So it‘s about time the managements opens the door widely for the users who want to come and transform the dead spaces to a live one.

5.2. Recommendations

5.2.1. Recommendation for recreational Ecosystem Service

5.2.1.1. Kechene Medhanialm Cemetery

- Before establishing the recreational space in the cemetery a user survey must be undertaken.
- Other entry gate should be located at the northern wing of the cemetery by the baytewar burial ground.
- Additional structures need to be built with light materials for recreation service provision.
- Creation of security, visibility, signs, defined path ways, cycling trails and seating furniture.
- Standardized head stone as put in the regulations must be put.
- The existing toilets should be well maintained, functional, and accessible.

5.2.1.2. Millennium Cemetery

- To revive the recreational capacity the sub city should form a temporary management to
  - Handle the printing of the park entry thickets
  - Legalize the cemetery as a memorial park cemetery
  - Draft rules & regulation for governing this particular cemetery
- If needed higher part time expert to guide the team how to go about it.
- From the *Eucalyptus globulus* site that is going to be cleared and the fund gained can be used for recreational service commencement**.**

5.2.1.3. Italian Cemetery

- Promoting the cemetery by inviting the Italian community & other to learn war history by giving tours.
- Hold workshop on care of the cemetery landscape & this event promote it to the young generation.

5.2.1.4. Foreigner Catholic Cemetery

- Invite the catholic community, schools such as Nativity, Nazareth, St.Joseph & hold a memorial service for Sinore Bastian Neno who designed the burial plot and other known people.
- Ramp should be incorporated for accessibility to people with disabilities
- The good site sighing spots should be provided with sitting furniture and shades.

5.2.1.5. Ethiopian Catholic Cemetery

- Get in touch with universities of art and architecture to come on an educational tour.
- Contacting beauty contestant association & take the contestants to visit the first winner of the beauty pageant grave.
- Prohibiting signs should be put up to prohibit from writing & injuring any headstone & monuments.

5.2.1.6. Evangelical Cemetery

- To let the burial ground to be accessible to anyone who wants to enter it for a recreation;
- Provide sitting furniture & shades to encourage users.
- Hosting memorial service for fallen England & Ethiopian martyrs during World War II.

❖ Best result in recreational ecosystem could be achieved if the four cemetery managements could work together while hosting events so that the cemetery could attract lots of recreational users.

5.2.1.7. Baha'i Cemetery

- Since the compound walls are high the front walls should be lowered so that recreational users could be attracted to seat and also give an astatically view to pedestrian passers.
- The previous dead trees that have been cut could be used as a sitting furniture in the cemetery.

5.2.1.8. Holy Trinity Cemetery

- Holding memorial day and celebrating the achievements for famous buried people.
- Since the cemetery is located in a spiritual place it can attract Veterans to come and use the space for recreational purposes if there furniture provided for sitting.
- The cemetery management could organize historical tour for Selasi students or others.
- The management can also contact universities to come and take botanical class.

5.2.1.9. Muslim Cemetery

- Once the cemetery is open to recreational users regulatory signs should be put up to indicate hours of operation and rules that prohibit walking through the grave plots and other certain recreational activities so that there won t be any conflict.

- Sitting furniture should be provided in the front area as well as at the edge of the grave plots for the coming mourners while waiting for the funeral to start and for recreational users.
- Better security and visibility and the development of safe walking encourage recreational use.
  - General recommendation for all cemeteries is drafting specific regulations recreational usage is needed
  - Creating awareness among the society about recreation in cemeteries

5.2.2. Recommendation for Tree Inventory

5.2.2.1. Kechene Medhanialm

- Trees are 33% indigenous so it is recommended to plant more indigenous trees.
- Post trees occupy 54.7% of the age population so seedlings need to be planted & the dominated by Acacia melanoxylon other species seedlings need to be planted.
- Tree condition is generally good but 10 % the falls in the category of poor due to the disease caused by aphid on Cupressus lusitanica which should be treated.
- The electric wires passing through the Acacia melanoxylon (Omedla) should be managed.
- Herbs that are both annual and perennial should be planted.

5.2.2.2. Millennium Cemetery

- Though it has 70 % indigenous trees the dominant tree Eucalyptus globulus must not be planted & on the newly cleared area at least 40% indigenous species should be planted.
- Tree diversity is good compared with other cemetery result and should be maintained.
- 66 % trees are post & 0.8 % is seedling so it is best if seedlings are planted.
- 30 % trees are in poor condition & 5% of trees are dead/dying due to yellowing & drying of leaves on Callistemon citrinius, Acacia melanoxylon and Phoenix reclinata, the damage on the Acacia decurrens trees should be handled by a certified Arborist.
- Additional herbs that are both annual and perennial should be planted to increase the diversity.

5.2.2.3. Italian Cemetery

- 98 % are exotic trees which *Cupressus superviranes* is favored so additional indigenous trees should be planted.

- The cemetery tree diversity is very low which is expected and is recommended to diversify.
- Seedlings need to be planted since it is 4.9 % & post trees are 55.7 % .& since the post trees are susceptible to heart rot fungus which can create damage as it falls to the cemetery head stones and users.
- The tree condition being 70 % good, 20% fair & 10 % poor it is recommended that trimming & light pruning should be made for the fair & the poor.

5.2.2.4. Foreigner Catholic Cemetery

- 57 % are indigenous trees so they need to monitor as not to be outnumbered by exotic ones.
- Since the post trees are 49 % which is good, it is recommended that the seedlings are well taken care off
- The diversity of the cemetery is good which is recommended to maintain its status.
- 40 % good, 40% fair &10 % poor thus pruning the trees in fair & good condition would enhance their condition & prolong their life span also trimming the poor conditioned trees is needed.

5.2.2.5. Evangelical Cemetery

- 100 % exotic trees are on the site & the *Acacia melanoxylon* trees are the only dominated tree species so it is recommended to introducing new tree species.
- 70 % of trees are in good condition but for the 25 % fair & 5 % poor there should be mulching and pruning.
- 100 % are post trees which can be wiped out by disease so other seedling species need to be integrated.
- The diversity of trees needs to be incorporated.

5.2.2.6. Ethiopian Catholic Cemetery

- 50 % is exotic trees hence it is recommended more indigenous species are planted.
- It has good tree diversity and is recommended to maintain it or increase this diversity.
- The trees are 30 % good & fair & 20 % dead/dying so the first trees needs trimming & mulching & the trees in the stage of dying / dead are recommended for removal.
- 16.8 % are seedling so it is mandatory that installation of irrigation such as sprinkler, bucket & hose

- Inspections should be made twice a year on hazardous trees & should be pruned or removed by arborists.
- All trees in the cemetery should receive an annual application of fertilizer to sustain health.

5.2.2.7. Baha'i cemetery

- Indigenous trees are 47 % but it is dominated by *Cupressus lusitanica* which is continuously attacked by a cancerous disease so it well be good to increase the indigenous number of trees.
- 50.8 % of the trees are post & 12.3 % seedling but since most of the post trees are in poor or dying condition it is recommended to increase the seedling plantings, mulching & soil testing is appropriate.
- Diversity of trees in the cemetery is low & it is recommended that additional species are to be planted.
- Surplus herbs that are both annual and perennial could be planted to increase the diversity.

5.2.2.8. Holy Trinity cemetery

- Indigenous trees are 50% but *Phoenix reclinata* is the hence surplus indigenous trees should be planted.
- Condition of trees are made of 30 % good , 35 % fair , 20 % poor and 15 % dead/dying . So pruning is recommended for the good, fair and poor conditioned but removal is recommended for the dead.
- Tree diversity must be improved.
    - General recommendation for all cemeteries is an education about tree diversification and management for all the cemetery employees.

5.2.3. Recommnedation for Mangment

5.2.3.1. Kechene Medhanialm

- Awareness creation must be done among the society.
- Ground water or water storage tanker must be incorporated
- Increase the expense for burial services and share some percent from the burial service .
- Private or nonprofit partner to provide funding, programming, volunteers and publicity.

5.2.3.2. Millennium Cemetery

- Planting or burial plan proper layout map should be produced for guidance.
- Future profit from the recreation income must be shared with founder s association that should be formed. In addition the employee s salary should be increased.
- Hall for weddings, meetings & theatrical performance should be built to increase income.

5.2.3.3. Italian Cemetery

- The grass that is damaging water drainage system & grave stones on the site should be removed.

5.2.3.4. Foreigner Catholic Cemetery

- Education is needed for the employee on the basic understanding of the usefulness of trees.
- The cemetery must have an alternative supply of water that could enhance the cemetery s aesthetics.

5.2.3.5. Ethiopian Catholic Cemetery

- The management needs to hire gardeners.
- Planting or burial plan map must be drafted.
- Different artistic statues on the tombs on the west side of the cemetery must be conserved.
- The management could also print calendars of these statues and raise money.
- Using these statues the management of the cemetery could generate income by hosting an art exhibition

5.2.3.6. Holy Trinity Cathedral

- For the cemeteries plant planting or burial plan proper plot layout map must be drafted.
- The path ways which are crocked are further taken up by shrubs these paths should be cleared.
- The management should first organize the work force and hire help and increase their wedge.
- Organize the students of the Selasi Cathedral School or any volunteers to celebrate clean your plot day.

5.2.3.7. Muslim Cemetery

- Both the Muslim & the Kolfe Keranio sub city management must have a united responsibility.
- The administration should increase the salary of the employees so that it doesn t lack manpower.
- Contacting the Muslim school nearby & have the boys clear the plots under supervision
- For proper implementation of plantings and burial in the cemetery proper layout map must be drafted.
- The preservation and maintenance of pathways and road to maintain the historic design.
- The two managements must create a plan to instruct the community on what is acceptable on regards to maintain the cemetery cleaning.

Reference

Aspect Studios and Tree Logic (2011). Urban Forest Diversity Guidelines, Tree Species Selection Strategy for the City of Melbourne.

Ayalew Abay, Fisseha Wegayehu, Tsegaye Girmay and Zeleke Zewdie (2000). A primary study on Cemeteries and Worship places in Addis Ababa, Office for the Revision of Addis Ababa Master Plan.

Azene Bekele-Tesemma, Birnie, A and Tengnas, B. (1993). Useful Trees and Shrubs for Ethiopia Identification, Propagation and Management for Agricultural and Pastoral Communities, regional soil conservation unit (rscu) swedish international development authority.

Bachant-Bell D. (2004). The Rose Hill Cemetery, Historic Tour Guide No. 12, City of Bloomington, Indiana.

Bolund, P. and Hunhammar, S.(1999). Ecosystem services in urban areas. *Journal of Ecological Economics 29: 293–301.*

Bonner, A. (2010). How trees enhance the value and character of township cemeteries Urban Forester, ODNR division of Forestry.

Bureau of natural resource, (1999). Sustainable plant list Third Edition · Wildlife life division Rhode island.

Chaparro L. and Terradas J. (2009). Ecological Services of Urban Forest in Barcelona CREAF(Centre de Recerca Ecològica).

Charles H and Dukes S.J. (2007). Impacts of Invasive Species on Ecosystem Services, Ecological Studies, Vol. 193 W.Nentwig (Ed.) Biological Invasions, Springer-Verlag Berlin Heidelberg.

Clarke, K.R. and Warwick, R.M. (2001). Changes in marine communities: an approach to statistical analysis and interpretation, 2nd edition, PRIMER-E: Plymouth.

David Gray and D. Pelegrin (1973). Reflections on the Park and Recreation Movement. Dubuque, Iowa, William C. Brown.

Davis, L. (2011). Resurrecting a landscape Creative interpretive programming in cemeteries.

DeGroot, J. (1998). Cemetery plantings.http://www. DeGroot's Nurseries- Garden Clippings /.

Endlicher, W., Müller, M. & Gabriel, K. (2007). Climate Change and the Function of Urban Green for Human Health. A paper presented at a workshop on –Ecosystem services of natural and Semi- natural ecosystem International Academy for Nature Conservation, Vilm, Germany.

Eyob Tenkir (2011). Trees, people and the built environment, Addis Ababa Environmental Protection Authority, Addis Ababa, Ethiopia.

Faloon, S. (2011). http://www. Flowers to Plant at the Cemetery / ehow.com /.

George Torkildsen, (1986). Leisure and Recreation Management. 2nd edn, London, E. & F. N. Spon .

Getu W/ Semayate, Selemon Gezaw, Alemshet kebede, Mesefin Tefera and Twedroes Begashaw, (2011). Cemetery development and administration procedural Manual ,Municipality of Addis Ababa, Amharic version.

Glaves, P., Egan, D., Harrison, K. and Robinson, R., (2009). Valuing Ecosystem Services in the East of England, East of England Environment Forum, East of England Regional Assembly and Government Office East England.

Grahn, P. and Stigsdotter, U. A., (2003). Landscape planning and stress. Urban Forestry and Urban Greening.

Haines-Young, R.H. and Potschin, M.P., (2010). Proposal for a Common International Classification of Ecosystem Goods and Services CICES for Integrated Environmental and Economic Accounting (V1). Paper prepared by Centre for Environmental Management, University of Nottingham, United Kingdom.

Harnik P., (2010). Urban Green ,Innovative Parks for Resurgent Cities, island press.

Harnik P. and Merolli A., (2010). Cemeteries Alive ,Graveyards are resurging as green spaces for the public, The Trust for Public Land.

Huang LSC, (2007). Intentions for the recreational public landscaped cemeteries in Taiwan.Landscape Research, Routledge, Taylor and Francis Group.

Icon Group Ltd., (2002). The 2000-2005 World Outlook for Amusement and Recreation Services.

John, P., (1983). Outdoor Recreation and Resource Management. London, Croom Helm.

Joel, Gazis-Sax., (2007). Living Things: Cemetery Plants, City of the Silent, http://www.alsirat.com/symbols/plants/.

Kebede Tadese, (2012). Trees of Ethiopia (a Photographic Guide and Description). Washera Publishers Addis Ababa, Ethiopia.

Korpela, K. M., Hartig, T., Kaiser, F. and Fuhrer, U., (2001). Restorative experience and self-regulation in favorite places. Environment and Behavior.

Levitt L., (2012). Solemnity and Celebration: Dark Tourism Experiences at Hollywood Forever Cemetery.

Loudon, J. C ., (1843). On the Laying Out, Planting and Management of Cemeteries. Ivelet Books Ltd, 1984.

Maco E. scott, (2009.) A practical approach to assessing structure, function, and value of street tree populations in small communities

McPherson EG, Rowntree RA, (1989). Using structural measures to compare twenty-two U.S. street tree populations.

Miller, R.W. (1997). Urban Forestry: Planning and Managing Urban Greenspaces. 2nd.ed. Englewood Cliffs, New Jersey: Prentice Hall.

Millennium Ecosystem Assessment, (2005). Ecosystems and Human Well-being: Synthesis, Washington, DC.: Island Press.

Neufert, E., and P., (2000). Architects‘ Data, third Edition, Blackwell Science.

Nowak, D. J. and Crane, D. E. , (2002). Carbon storage and sequestration by urban trees in the USA. Environmental Pollution.

Nowak, D. J., (2002). The effects of urban trees on air quality, USDA Forest Service, Syracuse, NY.

Paracchinia, M.L., Zuliana G., Maesa J., Alessandra La Nottea Leena Kopperoinenb, Furmanb E., Perez-Sobac M., Goossenc M., (2011). Mapping recreation as an example of cultural ecosystem service, ALTER-Net LTSER workshop, Helsinki.

Patrick Omeja, Joseph Obua, and A. B. Cunningham (2004). *Regeneration, density and size class distribution of tree species used for drum making in central Uganda, African Journal of Ecology, Afr. J. Ecol., 42, 129–136*

Price, R., (2007). Introductory guide to valuing ecosystem services, Department for Environment, Food and Rural Affairs, United Kingdom, Crown.

Richardson, R. (1989). Why was death so big in Victorian England? In R. Holbrooke (ed.), death, ritual and bereavement, London: Routledge.

Rugg, J. (2000). Defining the place of burial: what makes a cemetery a cemetery? Mortality.

Santamour, Jr. F. S. (2002). Trees For Urban Planting: Diversity Uniformity, And Common Sense,U.S. National Arboretum Agricultural Research Service U.S. Department of Agriculture Washington, D.C.

Smiley, E. T. 1989. Computer Software for Urban Forest Management: A Buyers Guide. In G. Moll, and S. Ebenreck, eds., *Shading Our Cities.* Washington , DC: Island Press

Simpson, J.R. (1998). Urban forest impacts on regional cooling and heating energy use: Sacramento County case study. J. Arboric..

Shashua-Bar, L., O. Potchter, A. Bitan, D. Boltansky and Y. Yaakov. (2010). *Microclimate modelling of street tree species effects within the varied urban morphology in the Mediterranean city of Tel Aviv, Israel. International Journal of Climatology 30(1): 44-57.*

Swint, L. (2010). The Catholic church and green burial, Conrad Pickel Studio.

Tate, R. L. (1985). Uses of street inventory *data.* J. Arboric.

Tyrvainen, L., Silvennoinen, H. and Kolehmainen, O. (2003). Ecological and aesthetic values in urban forest management. Urban Forestry and Urban Greening.

Ulrich, R. (1984). View through a window may influence recovery from surgery.

Ulrich, R.S., Simons, R.F., Losito, B.D., Fiorito, E., Miles, M.A., Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. J. Environ.

UN Habitat (2007). Situation analysis of informal settlement in Addis Ababa United Nations Human Settlements Program.

Uslu A. (2010). An ecological approach for the evaluation of an abandoned cemetery as a green area: The case of Ankara /Karakusunlar cemetery.

Wood P. James (1999). Tree Inventories and GIS in Urban Forestry

Woolley, H. (2003). Urban open spaces, Spon Press.

Worpole k. (2003). Last Landscapes, The Architecture of the Cemetery in the West, Reaktion Books.

Yetnayet Ayalneh (2012). Evaluating transport network structure: case study in Addis Ababa, Ethiopia

Appendix I

Kechene Medhanialem Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5- 9.9 cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia melanoxylon	9	2	6	43	60
Callistemon citrinus		3			3
Casuarina cunninghamiana			6		6
Dovyalis abyssinica			8		8
Eucalyptus globulus				26	26
Grevillea robusta		7			7
Jacaranda mimosifolia		4	3		7
Phoenix reclinata	8				8
Vernonia amygdalina	1				1
					126

Millennium Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia abyssinica		1			1
Acacia decurrens				4	4
Acacia melanoxylon		3	5	3	11
Callistemon citrinus			4		4
Casuarina cunninghamiana		1			1
Eucalyptus globulus			1	76	77
Grevillea robusta		7	18		25
Jacaranda mimosifolia				1	1
Millettia ferruginea	1				1
Vernonia amygdalina		1	1		2
					127

Italian Cemetery Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5- 9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Cupressus lusitanica	3	20			23
Cupressus superviranes			3	34	37
Olea europaea			1		1
					61

Foreigner Catholic Cemetery Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia abyssinica		3	2	5	10
Acacia decurrens	7	10	5	15	37
Acacia melanoxylon			4	3	7
Cupressus lusitanica			3	8	11
Juniperus procera			1	7	8
Olea europaea		2			2
Vernonia amygdalina		1	1		2
					77

Ethiopian Catholic Cemetery Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia decurrens			1	3	4
Cordia africana	4		7		11
Cupressus lusitanica	4	1	15	38	58
Grevillea robusta	10	20			30
Juniperus procera			3	6	9
Millettia ferruginea	4	15			19
					131

Evangelical Cemetery Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia melanoxylon				21	21

Baha'i Cemetery Tree Size Classification

Scientific name	Dia.<5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia abyssinica				4	4
Casuarina cunninghamian			4	9	13
Cupressus lusitanica				20	20
Dracaena steudneri	7	4			11
Hyphaene thebaica		2			2
Jacaranda mimosifolia	1	1	12		14
Schinus molle			1		1
					65

Holy Trinity cemetery tree size classification

Scientific name	Dia.< 5 cm	Dia. 5-9.9cm	DBH 10-19.9cm	DBH > 20 cm	Total
Acacia abyssinica		1		2	3
Acacia decurrens			1		1
Acacia melanoxylon		1	4		5
Callistemon citrinus		1			1
Casuarina cunninghamian				3	3
Cupressus lusitanica		2	24		26
Dracaena steudneri	1	3	1	6	10

Ficus sur				3	3
Grevillea robusta				6	6
Hagenia abyssinica			4		4
Jacaranda mimosifolia		1	2		3
Juniperus procera			1	20	21
Olea europaea			2	14	16
Phoenix reclinata	11	27	1		39
Podocarpus falcatus			1		1
Schinus molle		2			2
Vernonia amygdalina	4				4
					148

Kolfe Muslim Cemetery General Tree Species

Scientific name	Common name
Acacia abyssinica	Flat Thorned Top (Bzera Grar)
Acacia melanoxylon	Australian Black wood (Omedla)-
Casuarina cunninghamian	Australian beefwood (sheweshewae)
Croton macrostachyus	Fever – Berry (Besana)
Cupressus lusitanica	Mexican Cypress (Yeferenj tid)
Eucalyptus globulus	Blue Gum (Nech‘ Bahr Zaf)
Ficus sur	Broom Cluster Fig (Shola)
Jacaranda mimosifolia	Jacaranda (Yet‘ emenja zaf)
Juniperus procera	African Pencil Cedar (T‘d)
Grevillea robusta	Silver Oak
Olea europaea	African wild Olive (Wera)

Appendix II

Shannon Diversity Index

Kechene Medhanialm

No.	Species	No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	*Acacia melanoxylon*	60	0.512821	-0.66783	-0.34248
2	*Callistemon citrinus*	3	0.025641	-3.66356	-0.09394
3	*Casuarina cunninghamiana*	6	0.051282	-2.97041	-0.15233
4	*Dovyalis abyssinica*	8	0.068376	-2.68273	-0.18343
5	*Eucalyptus globulus*	26	0.222222	-1.50408	-0.33424
6	*Grevillea robusta*	7	0.059829	-2.81626	-0.16849
7	*Jacaranda mimosifolia*	7	0.059829	-2.81626	-0.16849
8	*Phoenix reclinata*	8	0.068376	-2.68273	-0.18343
9	*Vernonia amygdalina*	1	0.008547	-4.76217	-0.0407
TOTAL		126			-1.66754
H= ΣPi*ln(Pi)*-1					1.667543

Millennium Cemetery

No.		No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia abyssinica	1	0.007874	-4.84419	-0.03814
2	Acacia decurrens	4	0.031496	-3.45789	-0.10891
3	Acacia melanoxylon	11	0.086614	-2.44629	-0.21188
4	Callistemon citrinus	4	0.031496	-3.45789	-0.10891
5	Casuarina cunninghamiana	1	0.007874	-4.84419	-0.03814
6	Eucalyptus globulus	77	0.606299	-0.50038	-0.30338
7	Grevillea robusta	25	0.19685	-1.62531	-0.31994
8	Jacaranda mimosifolia	1	0.007874	-4.84419	-0.03814
9	Millettia ferruginea	1	0.007874	-4.84419	-0.03814
10	Vernonia amygdalina	2	0.015748	-4.15104	-0.06537
TOTAL		127		ΣPi*ln(Pi)	-1.27097
H= ΣPi*ln(Pi)*-1					1.270971

Italian Cemetery

No.		No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Cupressus sumper	37	0.606557	-0.49996	-0.30325
2	Cupressus lusitanica	23	0.377049	-0.97538	-0.36777
3	Olea Europaea	1	0.016393	-4.11087	-0.06739
TOTAL		61		ΣPi*ln(Pi)	-0.73841
H= ΣPi*ln(Pi)*-1					0.738409

Foreigner Cemetery

No.	Species	No .of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia decurrens	37	0.480519	-0.73289	-0.35217
2	Acacia abissinica	10	0.12987	-2.04122	-0.26509
3	Acacia melanoxylon	7	0.090909	-2.3979	-0.21799
4	Cupressus lusitanica	11	0.142857	-1.94591	-0.27799
5	Juniperus procera	8	0.103896	-2.26436	-0.23526
6	Olea europaea	2	0.025974	-3.65066	-0.09482
7	Vernonia amygdalina	2	0.025974	-3.65066	-0.09482
TOTAL		77		ΣPi*ln(Pi)	-1.53814
H= ΣPi*ln(Pi)*-1					1.538141

Ethiopian Catholic

No.	Species	No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia decurrens	4	0.030534	-3.4889	-0.10653
2	Cordia africana	11	0.083969	-2.4773	-0.20802
3	Cupressus lusitanica	58	0.442748	-0.81475	-0.36073
4	Grevillea robusta	30	0.229008	-1.474	-0.33756
5	Juniperus procera	9	0.068702	-2.67797	-0.18398
6	Millettia ferruginea	19	0.145038	-1.93076	-0.28003
TOTAL		131		ΣPi*ln(Pi)	-1.47685
H= ΣPi*ln(Pi)*-1					1.476854

Evangelical Cemetery

No.	Species	No. of stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia melanoxylon	21	1	0	0
TOTAL		21		ΣPi*ln(Pi)	0
H= ΣPi*ln(Pi)*-1					0

Baha'i Cemetery

No.	Species	No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia abyssinica	4	0.061538	-2.78809	-0.17157
2	Casuarina cunninghamian	13	0.2	-1.60944	-0.32189
3	Cupressus lusitanica	20	0.307692	-1.17865	-0.36266
4	Dracaena steudneri	11	0.169231	-1.77649	-0.30064
5	Hyphaene thebaica	2	0.030769	-3.48124	-0.10712
6	Jacaranda mimosifolia	14	0.215385	-1.53533	-0.33069
7	Schinus molle	1	0.015385	-4.17439	-0.06422
TOTAL		65		ΣPi*ln(Pi)	-1.65879
H= ΣPi*ln(Pi)*-1					1.658786

Holy Trinity cemetery

No.	Species	No. of Stems	Pi	ln(Pi)	Pi*ln(Pi)
1	Acacia abyssinica	3	0.022222	-3.80666	-0.08459
2	Acacia decurrens	1	0.007407	-4.90527	-0.03634
3	Acacia melanoxylon	5	0.037037	-3.29584	-0.12207
4	Callistemon citrinus	1	0.007407	-4.90527	-0.03634
5	Casuarina cunninghamian	3	0.022222	-3.80666	-0.08459
6	Cupressus lusitanica	26	0.192593	-1.64718	-0.31723
7	Dracaena steudneri	10	0.074074	-2.60269	-0.19279
8	Ficus sur	3	0.022222	-3.80666	-0.08459
9	Grevillea robusta	6	0.044444	-3.11352	-0.13838
10	Hagenia abyssinica	4	0.02963	-3.51898	-0.10427
11	Jacaranda mimosifolia	3	0.022222	-3.80666	-0.08459
12	Juniperus procera	21	0.155556	-1.86075	-0.28945
13	Olea europaea	16	0.118519	-2.13269	-0.25276
14	Phoenix reclinata	39	0.288889	-1.24171	-0.35872
15	Podocarpus falcatus	1	0.007407	-4.90527	-0.03634
16	Schinus molle	2	0.014815	-4.21213	-0.0624
17	Vernonia amygdalina	4	0.02963	-3.51898	-0.10427
TOTAL		148		ΣPi*ln(Pi)	-2.38971
H= ΣPi*ln(Pi)*-1					2.389713

Appendix III

Questions for Administration of cemeterys under different management

1) When was the cemetery established and by whom?
2) What is the plot area of the cemetery?
3) Under whose management is the cemetery?
4) What type of burial standard does the cemetery management follow?
5) What type of service does the cemetery give and to whom?
6) How many workers do the cemetery has?
7) Do the gardeners have any type of education regarding plants or environment?
8) What is the amount of Salary do the workers have?
9) What type of economic benefits does the cemetery provide? And who benefits from its existence?
10) What type of plants and trees does the cemetery management favors? Why not diversify?
11) Where do you obtain seedlings to plant in the cemetery?
12) Have the plants been attacked by diseases? If yes, what type of diseases? When? What measures did you take to treat the disease?
13) What type of technique does the cemetery use to trim and manage the plants?
14) How many times do the plants get watered per day or week?
15) How does the cemetery management handle water shortage and what type of effect does the shortage create on the plants?
16) Is there any type of change exhibited throughout the history of the cemetery example land use change?
17) Is there any future plan for making the cemetery in to a recreational space?
18) In the opinion of the management can the cemetery be used for recreational purposes?
19) Are there any problems for the management while maintaining or using the cemetery as a recreational space?
20) What types of wild life are there in cemetery?
21) What plan or aspiration does future hold for this particular cemetery?

This questioner is done for the Millennium Park Cemetery which is one of the case study area of this Recreational ecosystem service paper

1. What is your sex?

   ☐ Male ☐ Female

2. What is your age group?

   A) Below 12 B) 13 – 25 C) 26 – 40 D) above

3. Do you know that the park also serves as a cemetery?

   ☐ Yes ☐ No

4. Will you continue to use it after this knowledge?

   ☐ Yes ☐ No ☐ I don‘t know

5. Is the location of the cemetery park convenient for transportation and other re☐s?

   Yes ☐No ☐ Neutral

6. Do you consider the entrance fee affordable?

   ☐ Yes ☐ No ☐ Neutral

7. In your opinion do you think the place attractive aesthetically?

   ☐ Yes ☐ No

8. Do you think it is well maintained?

   ☐ Yes ☐ No ☐ neutral

9. What type of recreational activities do you participate in the park cemetery?
10. How many hours do you spend there?

    A) 1-2 Hours B) 3-4 Hours C) 5-6 hours D) More than that

11. How occasionally do you come here?

    A) 1-2 times a week B) 3-4 times a week C) above that

12. How much money do you usually spend in the park cemetery?

    A) Less than 5 birr B) 5-15 birr C)16- 25 D) 25^{+}

13. What type of sex group do you observe dominantly coming to the park cemetery?

    A) Male B) Female C) Both

14. What type of age group do you see go to the park cemetery?

    A) Below 13 B) from 13- 23 C) from 24 -35 D) above this

15. Are you satisfied with the services provided in the park?

    A) Satisfied B) dissatisfied C) Neutral

16. In your opinion what type of services do you think should be upgraded?

17. Do you consider the park cemetery a safe place for users?

    Yes ☐ No ☐

18. Do you think the shades and sitting furniture provided in the park Cemetery are enough?

    Yes ☐ No ☐

19. Are you satisfied with park cemetery design for disabled, elderly, and pregnant women?

    A) Satisfied B) Dissatisfied C) neutral

20. Are you satisfied with the working hour of the park?

    B) Satisfied B) Dissatisfied C) neutral

21. Where do you spend your time after the park cemetery is closed?

This questioner is done for the Holy Trinity Cathedral Recreational ecosystem service users

1) What is your sex group?

   ☐ Male ☐ Female

2) What is your age group?

   A) Below 13 B) 13 – 25 C) 26 – 40 D) above

3) What type of religion do you follow?

   A) Orthodox Christian B) Muslim C) Protestants D) Others

4) When you come to the Cathedral is this where you usually sit around?

   ☐ Yes ☐ No

5) For What purpose do you come around to the Cathedral cemetery area?

   A) For spiritual B) For reading C) for grave touring D) for Socializing E) others

6) How occasionally do you come to cemetery area for recreational activity?

   A) 1-2 times a week B) 3-4 times a week C) more than that

7) How many hours do you spend there?

   B) 1-2 Hours B) 3-4 Hours C) More than that

8) Do you see many people coming here for recreational activities around the cemetery?

   ☐ Yes ☐ No

9) What kind of recreational activities around the cemetery do you see them participating in?

   A) Reading B) Chatting C) Having group meetings D) touring E) Others

10) In what age group do you think the people who come for recreational activities?

A) Below 13 B) from 13- 25 C) from 26 -40 D) above this

11) Do you have problems while sitting or moving around the cemetery? If yes please Specify_____

12) What type of religion do you think they follow?

A) Orthodox Christian B) Muslim C) Protestants D) Others

13) Is the place attractive aesthetically?

☐ Yes ☐ No

14) Do you think it is well maintained?

☐ Yes ☐ No

15) Do you think the shades and sitting furniture provided around the Cemetery are enough?

☐ Yes ☐ No