A FINAL REPORT ON THREAT REDUCTION ASSESSMENT

BY

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All views and opinion expressed therein remain the sole responsibility of the consultant and do not necessarily represent those of USAID/PACT and NWC.

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1.0 INTRODUCTION

Recent decades have seen a serious biodiversity decline due to habitat loss and alteration especially of tropical forests leading to a profound species-extinction crisis (Heywood, 1995; Pimm *et al.*, 1995; Whitmore, 1997). Thus, much of tropical biodiversity is unlikely to survive without effective protection (Pimm *et al.*, 1995; Myers *et al.*, 2000). To counteract the anthropogenic impact and conserve biodiversity and ecosystem processes parks and protected areas and more recently community/private sanctuaries have been established worldwide. When establishing these sanctuaries, the communities and conservation practitioners are ultimately interested in protecting or restoring biodiversity, hence much of the day to-day work of conservation involves designing and implementing strategies to protect species, landscapes, and ecosystems largely in response to threats to biodiversity. It involves taking action to counter threats – the human activities that negatively impact biodiversity. Understanding threats is a critical step in many stages of the conservation process such as choosing where to work, developing strategies to address these problems and coming up with measures to determine whether a given project or program is achieving its desired results. Hence, threat assessment involving the identification, evaluation, and ranking of threats to specific conservation targets (biodiversity) is an integral part of conservation planning and management. Given the urgency for conservation action within the context of limited financial resources and a growing recognition of the deepening biodiversity crisis, the emphasis on systematic conservation planning and evaluation of management effectiveness has greatly increased in recent years. Government and non-government conservation organizations are under increasing pressure to pay more attention to three broad questions: i) What targets should be conserved?, ii) How should conservation strategies be designed? and, iii) Are conservation strategies effective in achieving conservation goals? Threat assessment is critical to addressing all three questions. Threat assessment is also a significant component of conservation priority setting processes for species and ecosystems (Groves *et al.*, 2002; IUCN, 2002). For example, regional conservation planning may identify several hundred potential conservation areas within a planning region on the basis of ecological criteria alone such as diversity, *endemism*, uniqueness, or the value of ecological services. Some areas, however, are in more urgent need of action than other areas. Therefore, a further step in the conservation planning process prior to implementation is to set priorities for action within the planning region. Threat assessment is an important criterion used to set such priorities. Once sites have been selected, threat assessment can help design strategies to conserve biodiversity targets (Margoluis and Salafsky, 1998). There is a growing trend among conservation practitioners to design conservation projects by identifying threats to conservation targets (such as species and ecosystems) at a site and then developing interventions or strategies that explicitly address these threats (Bryant *et al.*, 1997; Salafsky and Margoluis, 1999; TNC, 2005).

Conservation practitioners are also increasingly being asked to measure the effectiveness of their efforts to conserve biodiversity in ways that are scientifically sound, practical, and comparable across sites. Threat reduction assessment (TRA) described by Salafsky and Margoluis (1999) is one approach that has been used in monitoring protocols to measure the effectiveness of management action (Hockings *et al.*, 2000; Margoluis and Salafsky, 2001) and finally to measure conservation success. This approach monitors threats to conservation targets rather than directly monitoring the conservation targets; e.g. through this approach one would monitor harvest rates for hardwoods rather than the size and status of hardwood populations. Assessment of the progress in reducing threats provides a framework for measuring conservation success. A threat reduction index is used to implement the TRA approach and is designed to identify threats, rank them according to their relative importance, and assess progress in reducing each of them. Threats are ranked on the basis of three criteria: area, intensity, and urgency. Area refers to the percentage of the habitat(s) in the site that the threat will affect: will it affect all of the habitat(s) at the site or just a small part? Intensity refers to the impact of the threat on a smaller scale: within the overall area, will the threat completely destroy the habitat(s) or will it cause only minor changes? Urgency refers to the immediacy of the threat: will the threat occur tomorrow or in 25 years? This approach of directly identifying threats is sensitive to changes over short time periods and throughout a site, comparisons among projects and sites are possible, data can be collected through simple techniques and the method is practical and cost-effective. Furthermore, the results can be readily interpreted by conservation staff and can provide detailed, adaptive management guidance to program managers.

2.0 TERMS OF REFERENCE

2.1 PURPOSE AND RATIONALE OF THE STUDY

The goal of Naivasha Community Ecotourism Development Program is to conserve biodiversity at each of the five sites (Lake Elementaita/Gilgil, Ututu Conservancy/Kikopey, Kedong ranch/Hells Gate National Park, Mt. Longonot and Eburru forest) while supporting sustainable development and economic growth of the local communities. The purpose of this study is to provide a clear picture of the conservation status of the biodiversity in Naivasha ecosystem by carrying out a Threat Reduction Assessment. The biodiversity in Naivasha Basin facing increasing levels of environmental degradation. Consequently, the improvement of management strategies of the biodiversity is a top priority for NCEDP. To improve and optimize management strategies, threat reduction assessment is essential since it will enable NCEDP and the community to identify management strengths and weaknesses, reveal severity and distribution of levels of human impact, respond to pervasive management problems, refine their conservation strategies and reallocate budget expenditures. The success of the various program activities will require that challenges that are affecting biodiversity at the sites are addressed. Through TRA approach, factors threatening biodiversity will be identified, origin traced and mitigation measures developed. Then the progress in achieving conservation can be assessed by monitoring the degree to which these threats are reduced. As the Naivasha Community Ecotourism Development Program has proposed several project activities at each site, the TRA study will provide baseline information upon which to monitor and evaluate whether the current activities are addressing the priority threats or there is a need to change their focus. The TRA information will also be useful in designing new projects so that their activities are geared towards reducing identified threats. Overall, the study will provide a framework to monitor and measure the effectiveness of the program in achieving biodiversity conservation by benchmarking the success to the area, intensity, urgency of each threat, and the degree to which the threats have been addressed by project activities.

2.2 LOCATION AND SCOPE

The study will be carried out in the areas around Lake Elementaita/Gilgil, Ututu Conservancy/Kikopey, Kedong ranch/Hells Gate National Park, Mt. Longonot and Eburru forest hills. It is expected that the study will as far as possible bring a comprehensive understanding of the Naivasha ecosystem by providing: -

a) Background information on the climatic, physical and biological conditions of the Naivasha ecosystem e.g. indigenous, exotic as well as invasive vegetation species, geology, topography, precipitation, etc
b) An updated list of birdlife both migratory and resident, wild animals; common, as well as rare and endangered species. This should include a write up on the conservation status of the key species occurring around Naivasha

c) The current conservation status of all flora and fauna in the Naivasha ecosystem and their relation to Multilateral Environmental Agreements (MEAs) such as CITES, CMS, RAMSAR and CBD

d) The various anthropogenic activities around Naivasha that have a potential negative impact on the natural environment

e) An updated analysis of the household incomes data for the area and the implication on natural resources extraction/utilization in coming years

f) A resource map for the Naivasha area and its environs with particular focus on the project sites

g) The land use patterns as well as the land tenure system and its implication on the conservation of natural resources particularly wildlife

h) The documentation of the various biophysical and other indicators that could be used to monitor and evaluate the NCEDP program impacts such as land hectareages etc and their methodology

i) An evaluation of the current measures and practices being undertaken to conserve natural resources and an assessment of their efficacy

j) The projected impacts of the various threats facing biodiversity in Naivasha and a proposal on interventions required to stem the negative trend

Further, the study will as much as is feasible provide adequate quantitative and qualitative information while maintaining focus on the real essence behind USAID, KCSSP and the NWCs involvement with the project sites, which is attaining sustainable NRM.

2.3 OBJECTIVES OF THE STUDY

2.3.1 OVERALL OBJECTIVE

The main objective of the study is to determine the current status of biodiversity, threats and mitigation measures in the Naivasha ecosystem by quantifying and qualifying specific and identified threats to the existence of natural flora and fauna and propose key simple and practical interventions for reducing the identified threats and interventions focusing on reducing such threats while addressing household poverty. A Threat Reduction Assessment will be the main focus for this study.

2.3.2 SPECIFIC OBJECTIVES

a) To identify the current threats facing biodiversity in the Naivasha ecosystem particularly around the five project sites.

b) Establish the magnitude/extent of the identified threats.

c) Establish the poverty-environmental linkages in the Naivasha area and its environs.

d) Evaluate the temporal changes in wildlife habitats over the last 20 to 50 years using satellite imagery.

e) Determine whether the current conservation practices/efforts are adequate to achieve the goal of sustainable NRM.

f) Estimate the impact of the current land tenure system/land use pattern on biodiversity in the Naivasha area particularly at the five project sites.

g) Document the current flora and fauna of the study area and establish if some species have disappeared in the recent past.

h) Evaluate if the current trend in global warming and climatic change poses a significant threat to biodiversity around Naivasha

i) Determine the potential role of various stakeholders. E.g. private sector, government, local institutions, NGOs/CBOs etc. in the reduction of threats to biodiversity.

j) Identify key measurable indicators of biodiversity losses or gains that could be used to measure impact of proposed interventions for sustainable NRM

2.4 COMPONENTS OF STUDY DESIGN

In order to achieve the objectives of the study, 4 main tasks were performed namely the i) desk study, ii) field study, iii) data treatment and reporting, and, iv) data synthesis and reporting. The activities carried out in each of the 4 tasks are as summarised below:

2.4.1 TASK I: A COMPREHENSIVE DESK STUDY OF THE SECONDARY INFORMATION

The first step involved compilation and assessment of available relevant existing data and information. This part of the assessment was to establish what data and information exists, and whether it is accessible. A detailed desk study of these published and 'grey' literature relating to Naivasha ecosystem will thereafter undertaken to distil, procure and document baseline information including climatic and geographical distribution data on as many biotic and environmental parameters as possible at every level of organization; conservation status for biotic entities, livelihoods and their linkages to environmental resources, local perceptions of the success of the project and peoples' knowledge (including scientists, stakeholders, and local and indigenous communities).

Data sources included geographic information systems (GIS) and remote sensing information sources, published and unpublished data, and traditional knowledge and information accessed through the contribution, as appropriate, of local and indigenous people. The sources were but not limited to:

- Nakuru District Development Plan (2002-2008)
- Central Bureau of Statistics 1999 population census data and 2005 Naivasha constituency Household Poverty Index data
- Project documents
- Various reports from past research
- Past and current Satellite images, aerial photographs and maps of the area
- Management Plan for Lake Naivasha

- Maps
- All other relevant documents

For in-depth understanding and due to the extent and diversity/uniqueness of activities in Naivasha Basin, the desk study was been categorized into review of literature of areas surrounding i) Lake Naivasha, ii) Lake Elmenteita and, iii) Eburru Forest Hills.

A full list of references is provided.

All data/information was analyzed, synthesized and then summarized into a report under relevant headings/themes/topics to address the objectives. After review, a "gap analysis" was performed to identify information gaps to enable the collection of such data during the field study.

2.4.2 TASK II: FIELD STUDY

Two methods was used to collect field data on biodiversity status, threats to biodiversity, conservation status of biotic entities (for instance, their rarity, endemism, and endangerment), water quality, ecosystem integrity and a socio-economic profile of the community at each of the site. Braun-Blanquet approach to vegetation description and classification (Mueller-Dombois and Ellenberg, 1974; Westhoff and van der Maarel, 1978) was used for vegetation survey while Participatory Rapid Appraisal (PRA) tools and techniques were used for participatory threat reduction assessment and to gather information on socioeconomic and livelihood activities.

2.4.3 TASK III: DATA TREATMENT AND REPORTING

In order to achieve the study objectives, a Threat Reduction Assessment methodology was used to calculate Threat Reduction Assessment Index (TRA Index) according to Salafsky and Margoluis (1999). TRA Index was assessed retrospectively by "re-creating" baseline data on feasible parameters like changes in land use changes, forest area, population etc. Threats were identified, ranked according to specific criteria, and an assessment of progress in reducing each of them was done.

2.4.4 TASK IV: DATA SYNTHESIS AND REPORTING

Overall, this study process led to production of a Final Report containing findings and recommendations with attempts to clearly identify and scope the priority environmental concerns including emergent threats to sustainable resource management and sustainable livelihood activities in the Naivasha ecosystem.

3.0 BACKGROUND STUDY AREA INFORMATION

3.1 THE LAKE NAIVASHA AND ITS ENVIRONS (KEDONG RANCH/HELLS GATE NATIONAL PARK AND MT. LONGONOT)

3.1.1 INTRODUCTION

Lake Naivasha which is approximately 150 km^2 in total area (Harper *et al.,* 1990) was declared Kenya's second Ramsar Site in 1995. It is a unique freshwater lake in the Rift Valley Province of Kenya, 100 km Northwest of Nairobi (Harper *et al.,* 1990). It lies on the floor of the Eastern Rift Valley at a mean altitude of 1890 m a. s. l, Latitude $0^0$45' to 0^0 56' South and Longitude $36^0$22' to 36^0 54' East (LNRA, 1999) (Fig. 1). The lake has 3 distinct components: the main lake which is about 1,500 hectares; Cresent Island Bay, which forms the deepest part of the lake, presently 15 m deep and Crater lake. Cresent Island Bay is almost a separate lake and is chemically distinct from the main lake. Lake Sonach; a small crater lake, 3km from the main lake is also part of the Lake Naivasha system (Sikes, 1989). Currently Lake Naivasha has an average depth of 4.6 m. Total water volume is estimated at 680 x 106 m^3, but varies with water levels (Sikes, 1989).

The lake and its environs fall under Ecoclimatic Zone IV which is described as environmentally fragile and prone to land degradation. The area supports a wide variety of wild animals ranging from small to large herbivores, birds, reptiles and amphibians. The variety, number and distribution of these animals are related to the nature, variety and diversity of plant species within the area that offer different habitats. The most dominant herbivores include buffaloes, hippopotamus, giraffe, waterbuck, impala and zebra. A number of bird species are associated with Lake Naivasha. It offers good feeding and breeding sites for birds such as flamingoes and Great White pelicans. The lake is therefore an important tourist attraction centre. Before 1925 the small-toothed carp *(Aplocheilichthys antinorii)* and *Barbus amphigramma* were the only fish species in the Lake Naivasha (paucity probably due to historical episodes of the lake drying out). By 1962, probably as a direct result of the introduction of the largemouth bass, the *A. antinorii* has disappeared. The present fish population is made up of introductions by man. These species are the large-mouth bass (*Micropterus salmoides)*, introduced from the USA in 1927, 1951 and 1956, *Tilapia zillii* ((1956 from Lake Victoria - the introduction contained *Oreochromis leucostictus*, which is now the most numerous), and other tilapiine species which are not encountered today. Three cyprinodonts, *Gambusia, Poecilia* and *Lebistes*, were introduced to control mosquitoes. The exotic rainbow trout (*Onchorhynchus mykiss*) occasionally strays into the lake from the River Malewa, while *Barbus amphigramma* migrates between the lake and the river. The Louisiana red swamp crayfish (*Procambarus clarkii*) was introduced in 1970 as a food source for the bass.

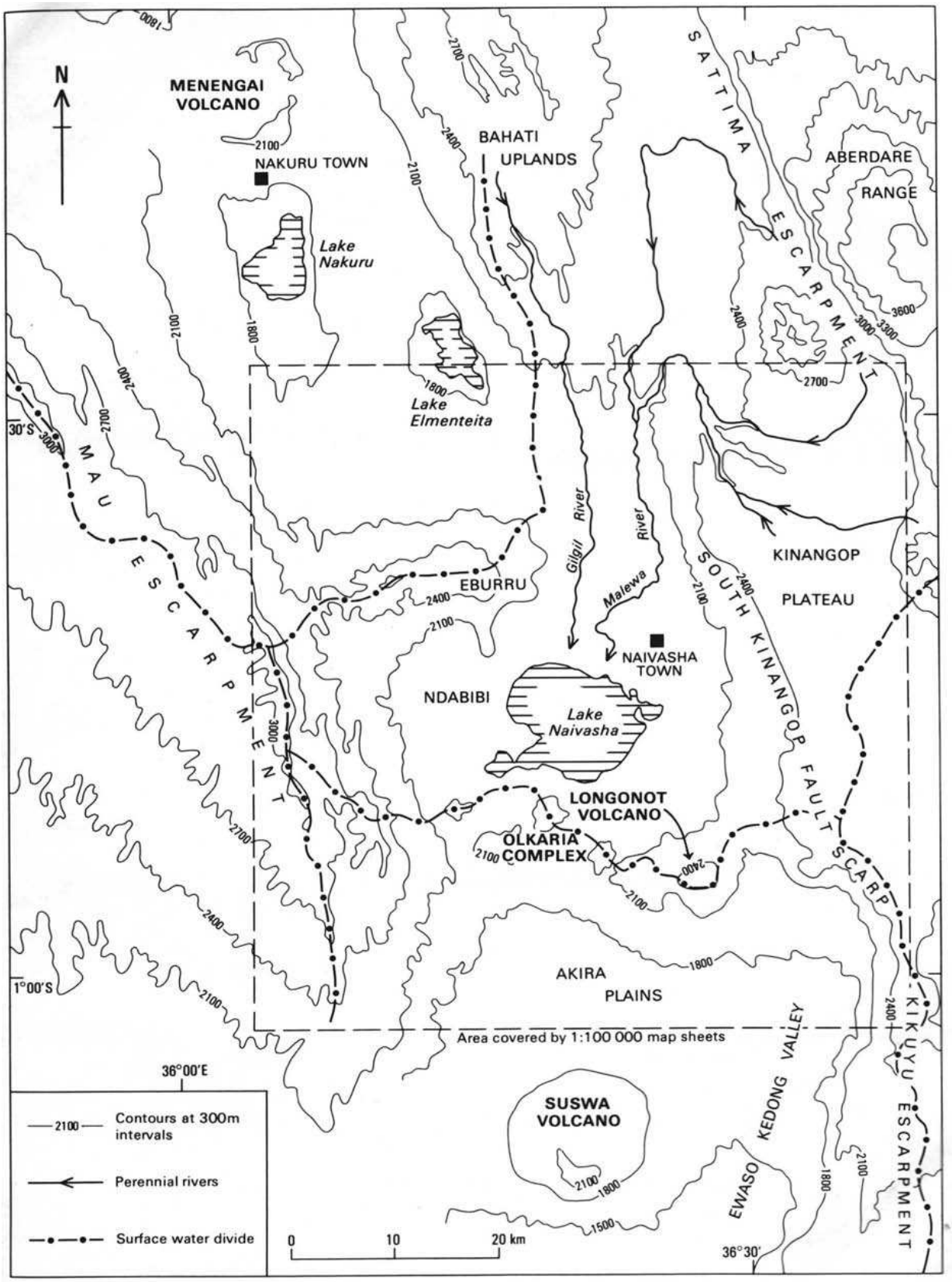

Figure 1. The location of the study area and its catchment. Modified from Clarke *et al*., 1990.

3.1.2 SOCIOECONOMIC PROFILE

According to the 1999 Population and Housing Census report, the population for the Naivasha division was 112,058, with population growth at 3.5 %. According to 2005 Household poverty survey, Naivasha division had 39,692 individuals (39%) living below the poverty line (Table 1). The locations with the highest number of individuals living below the poverty line include Moindabi (45%), Longonot (43%) and Ndabibi (42%) with populations of 2,249 out of 4,974, 8,596 out of 19,955 and 1,467 out of 3,534 respectively (Table 1). People are involved in smallscale mixed farming. Maize and beans are the main crops grown but for subsistence only as crop failure is very high due to low and erratic rainfall. Some households keep a few livestock (sheep, goats and cattle) that are occasionally liquidated to buy food and as a result they have accumulated very little assets. Majority of these farmers live below the poverty line are trapped in the vicious cycle of poverty and environmental degradation. To make up for crops losses, the people are involved in commercial production of charcoal. Those living close to Lake Naivasha are involved in fishing for both subsistence and commercial purposes. However, due to unsustainable fishing methods and over fishing, the lake is usually closed to fishing for six months (June to November) every year since 2005 and only about 42 boats are then licensed to fish.

The most significant activity but for large scale farmers, however, is the intensive irrigated greenhouse floriculture and horticulture - Kenya is currently the leading exporter of cut flowers and Naivasha supplies about 75% of these. Although the sector employs thousands of Kenyans and significantly contributes to the GDP, it also poses a threat to the lake's integrity due to pesticide and fertilizer use, removal of fringing swamps, and over-abstraction of water. Livestock ranching and private game sanctuaries and conservation areas exist in the division.

3.1.3 CLIMATE

The area is warm and semi-arid; receiving an average rainfall of 620 mm annually while annual evaporation is approximately 1735 mm (Litterrick *et al.*, 1979). The area experiences a double rainshadow effect from the flanking escarpment to the east and west. As a result the basin receives less rainfall than the surrounding highlands. The rainfall has muted bimodal distribution with a major peak in April – May and a minor one in October – November. The higher rainfall in the elevated regions of the catchments (i.e. Aberdare Ranges and Kinangop Plateau) partly offsets the annual deficit through the Malewa River discharge (LNRA, 1993). The mean monthly temperature is almost uniform ranging from 18^0 – 30^0C, and the mean annual temperature is around 26^0C. The coldest months are April and July with temperature ranging between 16^0 –17^0C, while the hottest

TABLE 1. SOCIOECONOMIC PROFILE OF THE NAIVASHA ECOREGION

Division/Location	Headcount Index: Percent of Individuals below Poverty Line (std. error)	Poverty Gap as Percent of Poverty Line (std. error)	Number of Individuals from 1999 census*	Estimated Number of Poor Individuals (std. error)**
GILGIL DIVISION	**40 (8.70)**	**13 (3.87)**	**69,633**	**27,751 (6,058)**
Karunga	36 (16.89)	12 (7.28)	16,336	5,891 (2,759)
Miti Mingi	39 (16.64)	12 (7.31)	12,940	4,983 (2,152)
Gilgil	39 (11.86)	13 (5.34)	18,645	7,308 (2,211)
Kiambogo	40 (12.20)	13 (5.11)	21,712	8,659 (2,648)
NAIVASHA DIVISION	**35 (6.55)**	**12 (2.80)**	**112,058**	**39,692 (7339)**
Hell's Gate	29 (8.98)	10 (3.80)	34,432	10,097 (3,091)
Maiella	29 (10.05)	9 (3.84)	11,016	3,238 (1,107)
Naivasha East	37 (12.96)	12 (5.75)	20,997	7,788 (2,721)
Naivasha Town	38 (17.31)	13 (8.65)	4,735	1,795 (819)
Malewa	39 (10.06)	14 (4.99)	12,415	4,890 (1,248)
Ndabibi	42 (17.89)	14 (7.86)	3,534	1,467 (632)
Longonot	43 (11.40)	15 (5.22)	19,955	8,596 (2,274)
Moindabi	45 (14.55)	16 (7.31)	4,974	2,249 (723)

Source: CBS, (2007). Kenya Poverty Atlas Volume 2. (c). Central Bureau of Statistics, Ministry of Planning and National Development, Government Press, Nairobi.

months are January to March with temperatures ranging between 28^0 – 30 ^{0}C. There is quite a big diurnal variation and a definite cold season as a result of cold air coming down from the Nyandarua Ranges. The coldest temperature provides a well-marked cold season and makes it possible to grow grapes and deciduous fruits around the lake

3.1.4 GEOLOGY AND TOPOGRAPHY

Naivasha basin is situated in the Gregory Rift Valley part of Great Rift Valley, which stretches from Jordan in the Middle East to Mozambique, SE Africa. The Rift Valley was formed through many episodes of faulting and volcanism many years ago (LNRA, 1993). Therefore, the geology of the area is mainly of lacustrine or volcanic origin (Thompson and Dodson, 1973). The older deposit varies in composition but largely comprises of fine white ash with intercalation of puaceous gravels deposited in lacustrine valleys.

The geography of the area is dominated by the faults that formed the Rift Valley. The deepest region of the lake is Cresent Island basin, which is 11m deep, and is the remains of an old volcanic crater rim. The lake is surrounded by a number of features. To the northwest is the Eburru Volcanic Mountain, which reaches a height of 2800 m a.s.l, to the east, lays Nyandarua Ranges and to the south is Mt. Longonot 2776 m a. s. l with almost circular crater. To the southwest is the Mau Ranges that form part of the western wall of the Rift Valley.

3.1.5 HYDROLOGY

Lake Naivasha is a unique ecosystem in that it is the only fresh water lake in Kenya's Rift Valley floor, all others being salty (Gaudet, 1979). The lake has no surface outlet. It receives 90% of its inflow from the perennial Malewa and Gilgil rivers, which originate from Nyandarua ranges. Malewa River has drainage area of 1730 km^2 and that of Gilgil is 429 km^2 (Sikes, 1989). The remaining input comes from seasonal streams, direct precipitation and ground seepage (LNRA, 1993). The catchment is dominated by igneous rocks and a number of pyrodastic formations including basalts, pumice and tuffs as a result of volcanic activity.

3.1.6 SOILS

Soils in the catchment area are generally developed from volcanic activity, and are of moderate to low fertility, deep clayish loam, greyish, brown to black in colour, often with drainage problems. The soils often degenerate into black cotton soils with impeded drainage in low-lying areas (Harper, 1990). The area in the lower portion of Malewa River has imperfectly drained silty, clay and sandy soils. The Eastern and Northern portion of the lakeshore has a combination of silty loam, sandy loam or clay loam that has developed in lacustrine deposits. The principles controlling

the depth of the soil in the area are influenced by the complex relationship between the parent materials, climate, topography, vegetative cover, time and weathering process (Terborgh, 1974).

The general conditions of the lakeshore soil series are predominantly alkaline, sodic and lacking organic matter. The high ration of sandy soil and high rate of land degradation through human interferences makes the soil susceptible to surface erosion by water and wind. Slopes around the mountains and major escarpments are generally steep and pose a serious erosion hazard.

3.1.7 BIODIVERSITY STATUS, THREATS AND CONSERVATION PRACTICES

3.1.7.1 FLORA

The vegetation is heterogeneous from aquatic plants such as papyrus around the lake margins, submerged macrophytes to terrestrial vegetation comprising of grasslands, bushlands, woodlands and forests. Generally, savannah vegetation is predominant (Harper, 1990). The vegetation types and distribution patterns are strongly associated to soil type that in turn is associated to topography (Watson & Parker, 1970; Harper, 1990). Other factors that influence the vegetation types include the level of water table, herbivory or selective feeding, trampling and human disturbances such as logging and farming (LNRA, 1993). The natural vegetation of the basin mainly consists of low *Acacia* shrub grassland with *Acacia drepanolobium* ("Whistling Thorn") as main the woody species and *Themeda triandra* as the dominant grass. Since the 1980s, however, most of the natural vegetation has been cleared or degraded into grassland or converted to cropland due to population increase especially due to migration into the area.

Woodland surrounding the lake is dominated by *Acacia xanthophloea*, grasslands by P*ennisetum clandstenum*, *Digitaria abyssnica, Cynodon dactylon, Themeda triandra* and herb, *Indigofera brevicalyx* while shrubland is dominated mainly by *Tarchonanthus comphoratus and Achyranthes aspera.* In rocky areas, *Euphorbia candelabrum* and *Euphorbia buseii* are dominant and the habitat is also suitable for succulents. *Themeda triandra, Eragrostis superba, Hyparrhenia hirta, Setaria pumila and Cynodon pleotostachy* are the common grasses and are all associated with *Tarchonanthus camphorates* shrubland. At the head of the River Malewa is a sub-montane tropical evergreen forest dominated by P*odocarpus falcatus.* Slopes above the lake are typically dominated by *Setaria sp. (S. pumila, S. sphacerata, S. verticillata)* grasses, although these areas are now drastically overgrazed and the wooded grasslands have been degraded down into bushland of *Tarchonanthus camphoratus* typically common in the Rift valley floor.

3.1.7.2 FAUNA

3.1.7.2.1 AVIFAUNA

Lake Naivasha regularly supports more than 20,000 water bird congregations, with a mean of 22,000 (1991-1997). In total, there are more than 350 bird species, including many waterfowl species like grebes, pelicans, cormorants, herons, storks, ibises, African darters, spoonbills, flamingos, 22 species of ducks and geese, waders, gulls and terns. The woodland provides habitat for the globally threatened Grey-crested Helmet-shrike *Prionops poliolophus* (Red List: NT). Another globally threatened bird found in the Naivasha woodlands is the Basra Reed Warbler *Acrocephalus griseldis* (Red List: EN), a winter visitor and passage migrant whose exact status is unknown. There are regionally threatened species both as regular visitors and residents e.g. Great Crested Grebe *Podiceps cristatus* (critical), Maccoa Duck *Oxyura maccoa* (endangered), African Darter *Anhinga rufa*, Great Egret *Casmerodius albus* (CITES Appendix III), Saddle-billed Stork *Ephippiorhynchus senegalensis (*CITES Appendix III), White-backed Duck *Thalassornis leuconotus*, Baillon's Crake *Porzana pusilla obscura* and African Skimmer *Rynchops flavirostris* (all vulnerable). The riparian/papyrus habitat supports certain endemic species such as Papyrus Gonolek and White-winged Swamp-Warbler.

3.1.7.2.2 MAMMALS

The riparian, papyrus and littoral macrophyte zones provide safe haven, foraging and breeding ground for many resident and migrant bird species, as well as other wildlife such as the Hippo, Waterbuck, Buffalo, Giraffe, Eland, Zebra, Thomson's and Grant's gazelles, bushbuck, duikers, mongooses, otters, various snakes and rodents as well as the occasional leopard which are found on the shores of the lake, in the acacia woodland and the neighbouring national parks and sanctuaries. There are several hundreds of hippos *Hippopotamus amphibious* (CITES App. II) at Lake Naivasha. Other species of mammals, mainly living in the riparian lands, are buffalo *Syncerus caffer*, monkeys Colobus sp., Impala and waterbuck *Kobus ellipsiprymnus*. Hell's Gate National Park, which has an access corridor to the lake, hosts many other species of game. The lakeside is also important for raptors, like the eagle *Haliaeetus vocifer*, harriers *Circus ranivorus* and *C. aeruginosus*, and osprey *Pandion haliaetus* (Database, 1995).

Kigio Wildlife Conservancy is a noteworthy 3,500-acre conservancy between Nakuru and Naivasha in Kenya. The Conservancy holds approximately 3,500 heads of wildlife (including the endangered Rothschild Giraffe, a 200 strong herd of Buffalo, Impala, Grant's and Thomson's gazelle, Eland, Hyena, Leopard, Hippo and over 250 bird species) which are protected by an electric fence on three sides and the Malewa River on one. The Conservancy is at the forefront of eco-tourism in the Rift Valley lakes area.

Hell's Gate National Park covers an area of 68.25 square km and is located south of Lake Naivasha, approximately 90 km from Nairobi. It has diverse topography and geological formations. It has historically been an important home for the rare lammergeyer Olkaria and Holley's extinct volcanoes can be seen as well as obsidian forms from the cool molten lava. The park is home to such animals as the buffalo, Maasai giraffe, eland, Coke's hartebeest, lion, leopard, and cheetah. There are over 103 species of birds in the park, including vultures, Verreaux's Eagles, augur buzzard and swifts. At the park also is a Maasai Cultural Center providing education about the Maasai tribe's culture and traditions. The park is popular due to its close proximity to Nairobi and lowered park fees compared to other National Parks. One is encouraged to hike and cycle in the park. This is a rarity in Kenyan National Parks, and is only made possible due to the lack of dangerous animals such as lions and elephants, though there is a small number of cheetahs and African Buffalo. It is also known for its scenery which includes the Fischer's Tower and Central Tower columns and Hell's Gate Gorge. The national park is also home to three geothermal power stations at Olkaria.

Mt. Longonot National Park is located southeast of Lake Naivasha in the Great Rift Valley of Kenyan and covers 52 km^2 most of it being occupied by Mt. Longonot, a young volcano rising to 2,776 meters above sea level. Mount Longonot is a dormant stratovolcano which is thought to have last erupted in the 1860s. The sides of the mountain have beautiful V-shaped valleys and ridges. The stony soils have little vegetation but the crater has a forest of small trees covering the crater floor. Small steam vents are found spaced around the walls of the crater. The park has limited range of mammals, including buffalo baboons and monkeys in the crater. The mountain is also home to various species of wildlife, notably zebra and giraffe.

Between these two National parks lies the 80,000 acres Kendong Ranch straddling the slopes of Longonot and bordering Hell's Gate National Park to the west. It acts a dispersal area for wildlife and amongst the many species of game, which roam freely over the open plains are eland, giraffe, zebra, impala, gazelle, Coke's Hartebeest, hyena and bat-eared fox. There are several nocturnal species such as the African springhare, white tailed mongoose, and the aardvark.

3.1.7.3 THREATS TO BIODIVERSITY

Over the past two decades the semi-arid rangeland zone around Lake Naivasha in the central Rift Valley of Kenya has come under severe human pressure. Main causes are the steady encroachment into the area by smallholder farmers coming from higher parts of the Rift Valley, and the

subsequent reduction of grazing land left for the Maasai pastoralists (Ataya, 2000). These developments have lead to overgrazing followed by severe water/wind erosion, which has now become a major threat to the livelihood of many inhabitants of the rangeland zone. The area is also being denuded of trees for firewood and charcoal burning for commercial purpose. There is a major issue of bush meat and human/wildlife conflict and wildlife is being snared on a large scale for meat and skins.

In Lake Naivasha, the primary invasive weeds are water fern (*Salvinia molesta*), water hyacinth (*Eichhornia crassipes*), and water lettuce (*Pistia stratiotes*). *S. molesta* and *E. crassipes* continue to be very prevalent in the lake. A number of animals (primarily fish, invertebrates and rodents) have been introduced into Lake Naivasha in various ways. Some of these too appear to be invasive. At least two, the Louisiana red swamp crayfish (*Procambarus clarkii*) and a large water rodent, the Coypus (*Myocastor coypus*) are anecdotally blamed for the loss of the indigenous water lilies, formerly important as a food species for many of the waterbirds using the lake, now replaced in that role to some extent by invasive weeds. Poor fishing methods have damaged and thus reduced the extent of littoral macrophytes and hence the population of diving birds such as the African Darter.

3.1.8 LAND USE

Current land use is mainly nomadic pastoralism with some marginal arable farming on small isolated farms, remnants of the smallholder settlement schemes that were abandoned in the early 1990s. The indigenous people of the areas surrounding Lake Naivasha are the Maasai who originally were pastoralists. At present due to intermarriages with other communities, coupled with human settlements in these areas, they have also started practicing agriculture, which has become a major threat to natural vegetation. However most of the areas in the basin are suitable only for grazing, unless irrigation is practiced. The land around the lake is being used for horticultural industry but under irrigation but these area has been steadily been expanding into the neighbouring ranges as seen from satellite images taken over the years. Farms range in size from those owned by large companies for flower farming to small farms. Lucerne farms that are also well established mainly support dairy industry. Other socio-economic activities around the lake include geothermal power generation, commercial fishing, domestic water supply, tourism and recreation services. The lake's resources are therefore very attractive and support a wide array of economic activities (LNRA, 1993). As a result, irrigation schemes, fertile soils and water accessibility have attracted many investors to this region.

Little natural vegetation is left in the catchment. The headwaters of the Malewa, the main water source for the lake, are situated in the Aberdare National Park and the adjoining gazetted forest. The vegetation consists of humid Afro-mountain forest and bamboo. Fog is very frequent and may play a role in the water balance. The Kinangop and Bolosat Plateau were large grassland plains in the past. An estimated 30% is now covered with maize or vegetables and many fast growing tree species. The upland areas are largely covered by tree-savannah landscape and dry land forest. Remnants of this forest can still be seen on the escarpment. The bottom of the rift valley is an open savannah landscape in the past.

3.2 THE LAKE ELEMENTAITA AND ITS ENVIRONS (LAKE ELEMENTAITA/GILGIL, UTUTU CONSERVANCY/KIKOPEY)

3.2.1 INTRODUCTION

Lake Elmenteita is a unique shallow alkaline lake lying on the floor of Kenya's southern Rift Valley. It was declared Kenya`s fifth Ramsar Site in 2005. It is located about 130 km north of the capital city Nairobi and stretches over $0^0$38' to $0^0$54' S and 36^0 29' to 36^0 16'E (Fig. 1). The surface elevation is 1,670 m a.s.l. The surrounding landscape is characterized by dramatic rocky faults, volcanic outcrops and cones. The catchment of the lake are found on Eburru mountain range, Bahati, Mau and Aberdare forest which form a very important water catchment area for the lake groundwater flows.

Elmenteita is one of the major flamingo Lakes in Kenya. The lake itself fluctuates between 19 and 22 km^2 with a depth of about 2 m and has a terrestrial buffer zone of 108.8 km^2. It is located in a closed basin whose water budget is maintained by recharge from hot springs located on the southern lakeshore, two inflowing rivers, surface runoff, direct rainfall and evapo-transpiration. High rate of evapo-transpiration leaves behind white pellets of soda ash (sodium bicarbonate), which is mined by the local community as livestock mineral supplement. The Lake is a part of a wider catchment basin where human population has been increasing rapidly in recent years.

The high alkalinity, conductivity and other physical-chemical parameters limit its capacity to host many aquatic species. But the few aquatic species that have adapted to the lake's limnological conditions show high productivity. The blue green algae *Spirulina plantensis* and benthic algae are the main primary producers that support the lakes' food chain. Over the years, a fish species, *Oreochromis alcalicus grahami* has been introduced to the lake from Lake Nakuru, about 23 km to the west. This to a great extent has enhanced the population of piscivorous birds that also feed upon

the flamingo eggs and chicks. As a result, over a million birds that formerly bred at Elmenteita are now said to have sought refuge at Lake Natron in Tanzania.

3.2.2 SOCIO-ECONOMIC PROFILE

Based on 1999 population census, Gilgil division had a population of 69,633 of which in 2005, 27,751 individuals (40% of the population) was living below the poverty line (Table 1). In the program's area of interest, Kiambogo and Gilgil locations had the highest percentage of individuals living below the poverty line at 40 and 39% respectively (Table 1). Like Naivasha division, the division is a marginal area with people engaged in small scale mixed subsistence farming with farm size ranging from 2 to 5 acres. In general, these divisions have the highest proportion of people living below the poverty line in the formerly Nakuru district and now Naivasha district. Main crops grown include maize and beans with irrigation being used to grow vegetables for both subsistence and commercial purposes. Livestock production is prominent especially around Kikopey and Elmenteita. Commercial charcoal production is also prominent. The people around Lake Elmenteita are invoved in harvesting sand and salt from the lake which they sell along the Nairobi-Nakuru highway. At Elmenteita, land owners are involved in some sort of ecotourism activities whose impact as a source of income is very minimal. The land owners of Kikopey Ranch have set aside land for the establishment of Ututu Conservancy. In addition, ballast rocks are mined for ballast crushing.

3.2.3 CLIMATE

There is considerable variation in climate within the Lake Elmenteita catchment basin depending on altitude and topography. The climate ranges from cold, hot and humid to arid and semi-arid climatic conditions characteristic of areas within the Rift Valley. Maximum and minimum recorded temperatures are 33^0C and 12^0C respectively. The area falls under agro-climatic zone V and is much drier than Naivasha. Records in the area indicate a mean annual precipitation of between 600 to 700mm. Rainfall is bimodal with the long-rains in April to June and the short rains between October to November. The short rains are less pronounced and the area is reported to be under the influence of the Congo monsoons from the south which cause some light rains during the months of June and July (Ojany and Ogendo, 1973).

3.2.4 GEOLOGY

Lake Elmenteita is situated in a high altitude depression of the Eastern portion of the Great Rift Valley in Kenya. The upper Pleistocene Gamblian sediments of the Elmenteita area are indicative of a larger lake and a wet episode in the history of the region when Lakes Nakuru, Elmenteita and Naivasha were one lake. The shallow closed basin is dominated by Tertiary and Quaternary pyroclastic and lacustrine deposits. The geology of the area consists of young volcanic and

sedimentary rocks. To the south lies the "badlands", an area of young volcanic rocks including cones and flows of Holocene age. To the North are a number of slightly older volcanic rocks predominantly basalt lava. On the eastern side of the lake are a number fault scarps. There is also an extensive faulted area further east forming the edge of the Rift valley. The lake lies between two areas of diatomite, Kariandusi to the east and Kockum to the west. This gives evidence of the area having been a much bigger lake in the past. Saline flats covered with trona surround the modern lake. In most parts the existence of the Gilgil trachyte is evident. These are particularly widespread along the Gilgil escarpment, Soysambu estate and some parts of Mbaruk. The trachyte might also overly the Mbaruk basalt at several places. Much of the southern and western sides of the lake is covered by what McCall terms "Elmenteita badlands" which form into basalt-cinder cones at various places the most distinguishable being the cone at the southern shores of the lake. Some very recent tuff cones can also be identified south of the Lake. Around Kariandusi area, diatomite forms layers separating the Gilgil trachyte to form the Kariandusi lacustrine sediments formed during lower or middle Pleistocene. This deposition is believed to have occurred within a larger basin of the joint ancient Nakuru-Elmenteita Lake.

3.2.5 HYDROLOGY

Lake Elmenteita has no surface outlet or underground seepage for releasing its water to other aquifers. The lake water levels are maintained through ground recharge by hot springs found in the southern part of the lake and seepage to its south-east, Meroronyi, Mbaruk and Kariandusi river flows, direct rainfall and evapo-transpiration. The drainage basin, which has a dendrite pattern, can be divided into four minor watersheds namely: Mbaruk, Chamuka, Kariandusi and Mbaruk-Chamuka. Mbaruk watershed is the largest and wettest while Kariandusi is the driest. Both Chamuka and Kariandusi manifest geothermal activities. The major tributaries of Mbaruk watershed include Bonde, Rutara, Gichure, Ndunduri and Weruini. Tributaries for Chamuka watershed include Ndiri-ini, Nyaituga, Kanjiuri and Kiringa. The Mbaruk-Chamuka watershed represents the main flow into the lake through both Mbaruk and Chamuka which converge about 1.5 km from the lakeshore. The Kariandusi watershed extends from the upper areas of Gitare and Northern Gilgil, into the mid lowland and lowland zones of Kariandusi and Elmenteita. Major tributaries include Kabugi, Gitare, Kekopey and Mai-Mahiu. These are relatively small streams, which are ephemeral in nature.

3.2.6 SOILS

Primarily the soils are of volcanic origin and tend to be friable, well drained and in some instances shallow. Those on the central plains are mainly derived from lacustrine deposits and volcanic ashes. Having developed on sediments, the soils are grey, deep, poorly drained and slightly

calcareous to saline in nature. On the more open grassland plains are soils derived from pumice beds and ashes from recent volcanoes and appear to be well drained friable loams to sandy clay loam that support the bulk of grazing land around the lake. Rocks that compose the cliffs and rock outcrops are of basaltic formation. Stream basal materials in the area indicate higher proportions of fine sediments and silt except around Mbaruk railway station where clay is abundant. The middle watershed areas are relatively rocky, particularly across Kasambara and Kiringa where the proportion of sand and gravel in stream basal material is much higher. Upper catchment areas are relatively non-rocky and unlike the rest of the basin are characterized by more detritus silts with small quantities of clay. The Mbaruk-Chamuka watershed soils have sand, silt and gravel constituting the dominant stream basal materials. Stream basal material of the Kariandusi consists of sand, gravel and diatomaceous earth. The lake bottom is filled with weathered material from the catchment area. The soil type is mainly sandy alluvial, of volcanic origin as evident by soda ash and fine sandy/loam soils on the lake bottom and its immediate surrounding areas. The soil in most areas is highly permeable and very little surface runoff is noticeable after rains; soils vary considerably within the basin from light grey dusty soils (Andosols) on the flat plains around lake Elmenteita, which have developed on the diatomaceous silts of this part to gravel at deposition sites. High rate of evapo-transpiration leaves behind white pellets of soda ash (sodium bicarbonate), which is mined by the local community as livestock mineral supplement.

3.2.7 BIODIVERSITY STATUS, THREATS AND CONSERVATION PRACTICES

3.2.7.1 FLORA

Vegetation in the Elmenteita drainage basin consists of upland forest, woodland, bush land and grassland, however in the recent years, much of the natural forest and woodlands has either been removed or modified into shrubs and bush land through cultivation, grazing and fires. The natural vegetation is mainly *Acacia* and *Tarconanthus camphoratus* bushland interspersed with *Themeda triandra* grassland. Patches of *Acacia xanthophloea* woodland occur near the shore, and formerly covered a large area south of the lake. Vegetation around the lake is sparse and can be categorized into five major vegetation zones as follows: (i) The woodlands are concentrated around the mouth of rivers with *Acacia xanthophloea*, as the dominant tree species rising up to 25 meters high with clear vertical stratification. Below the upper canopy are various climbers including *Senecio petitianus*, *Commicarpus pedunculosus* and *Ipomea cairica*. The herbaceous layer is dominated by *Acyranthus aspera*, *Hypoestes verticillaris*, *Conyza foribunda*, *Solanum incanum*, *Urtrica maasaica, Gutenbergia cordifolia*. Grasses of the ground layer include *Cynodon dactylon*, *Pennisetum clandestinum* and *Panicum* spp. among others. (ii) Dry bush land covering parts of the eastern, southern and western of the lake where dominant tree species include *Acacia xanthophloea* and *Eurphobia candelabrum*. Bush species include *Rhus natalensis*,

Sesbania sesban, *Lantana trifolia* and *Vernonia* spp. The grasses include *Cynodon dactylon*, *Chloris gayana* and *Panicum* spp. (iii) The grasslands can be categorized into two groups: (a) Lakeside grasslands dominated by *Sporobolus* spicatus and *Chloris gayana*; (b) Other grasslands, dominated by *Themeda triandra*, *Sporobolus fibriatus*, *Eragrostis* spp., *Punnisetum catabasis* and *Cynodon dactylon*. (iv) The Marshes located in the southern part of the lake, dominated by *Cyperus laevigatus* and *Typha* spp. Otutu scrubland is located south of the lake is dominated by *Olea* sp. and *Tarchonanthus camphronatus*. (v) *Cyperus* dominates the plant-water ecotone, especially around areas of seepage and maintains the ecological character of the lake, through provision of non-saline water that is important for bird soda bathing. *Acacia xanthophloea*, the yellow-barked tree is the most characteristic feature of areas of high water table. It also forms an important habitat for the African fish eagle, the grey-crested helmet-shrike and other birds.

3.2.7.2 FAUNA

3.2.7.2.1 AVIFAUNA

Over 450 species of birds have been identified of which 80 are waterfowl (KWS, 2005) and biannual bird count records show that Lake Elmenteita regularly supports thousands water birds with over 610.000 number of birds present at the site over the past five year of counts (2000-2004) (KWS, 2005). Elmenteita attracts visiting flamingoes, both the Greater and Lesser varieties, which feed on the lake's crustacean and insect larvae and on its suspended blue-green algae, respectively. The Lake regularly hosts over 20,000 Lesser and Greater Flamingos at any given time of the year. In addition, the Lake is a major breeding site for two species of Pelicans (Great White and Pink-backed). The populations of Pelicans have over the recent years increased at the sites. The lake is the only breeding site for the great white pelican *(Pelecanus onocrotalus)* in East Africa and is a critical source of food (benthic diatoms) for the lesser flamingo, particularly when food at Lake Nakuru (spirulina) is not available (KWS, 2005).

The western part of the lake is dominated by numerous islands of black lava, mostly bare but occasionally invaded by the grasses *Sporobolus spicatus* and *Chloris gayana*. In dry years, these islands are connected to the shore by stretches of mud flats and have been found to provide the only suitable nesting and breeding grounds for Great White Pelicans (*Pelecanus onocrotalus*) in the Rift Valley region. The lake is also home to several other bird species notably mars storks (*Leptoptilos crumeniferus*). The grasslands especially those found in the western shores of the lake are breeding site for Blacksmith plover (*Vanellus armatus*), and the Lake acts as an important dispersal area for Lesser Flamingo (*Phoenicopterus minor*) when environmental conditions especially food resource base is limiting in other saline lakes like Nakuru and Bogoria. African fish eagle (*Haliaeetus vocifer*) is a

characteristic species of Lake Elmenteita, but its population is low. Pied kingfisher (*Ceryle rudis*), the only species of Kingfisher that feeds by fishing from the hover rather than always from a perch is found in the lake. The lake regularly supports migrant waders such as Pied avocet (*Recurvirostra avosetta*) and Little stint (*Calidris alba*) and other migratory birds such as the Eurasian Marsh Harrier etc. on their stopover during migration. The Lake is a major staging site for Palaearctic migrants and over the years, significant populations of different migrant species including other major waterbird species in Kenya have been recorded at the site.

Lake Elmenteita supports several species falling into different conservation categories as threatened, vulnerable and endangered at local, national, regional and international levels. These include, Lesser Flamingo (*Phoenicopterus minor)* and Greater Flamingo (*Phoenicopterus ruber roseus)* are both regionally and globally threatened mainly due to their habitat specificity. Given the anthropogenic impacts around the Lake, there is need for serious conservation efforts and listing the Lake as a Ramsar site would attract the much needed attention as the lake is a major refuge for flamingos in Kenya's southern Rift Valley. Other threatened species found in the Lake are: (i) Great Crested Grebe (*Podiceps cristatus*): critically threatened in the eastern Africa region; (ii) Great White Pelican *Pelecanus onocrotalus*: global restricted range and on the CMS Appendix I.; (iii) Great Egret (*Casmerodius albus*): (CITES APP. III); iv) Maccoa Duck (*Oxyura maccoa*): Proposed for CMS Appendix I listing and v). Grey-crested helmet shrike (*Prionops poliolophus*), globally threatened whose habitat is almost exclusively the acacia woodland.

3.2.7.2.2 MAMMALS

The lake ecosystem has small populations of migratory Zebras *Equus burchelli,* Buffaloes *Syncerus caffer*, *Thomson's* Gazelles *Gazella thomsoni* and Giraffes *Giraffa camelopardalis*. Other animals common around the lake include hyenas and Dik dik *Rhynochotrogus kirkii,* hyenas, eland and families of warthog. Most of these animals are concentrated around the northern woodlands where human influence is minimal. The sanctuary surrounding the lake supports the endangered Rothschild giraffe *(Giraffa camelopardalis rothschildi)* and black and white colobus monkey *(Colobus guereza).*

3.2.7.3 THREATS TO BIODIVERSITY

In recent years, much of the natural forest and woodlands has either been removed or modified into shrubs and bushland by cultivation, grazing and fires. However, there are remnant patches of forests at Otutu, Kariandusi hot springs and the Acacia stand at the southern end of the lake. However, the remaining vegetation is now severely depleted due to continued harvesting of vegetation for fire wood and charcoal burning. In fact the situation is grave especially in Ututu/Kikopey where due to scarcity of wood, people are now not only harvesting the aerial parts

but are also uprooting stumps making natural regeneration near impossible if not impossible. Use of non fuel species like the thorny *Vernonia* sp. is now widespread, an indication that wood is scarce. Small game is threatened by poaching. There has been substantial destruction of the *Acacia xanthophloea* woodland on the south-eastern shores. There is also competition for resources between the wildlife and livestock for forage leading to overgrazing. There is also widespread wildlife habitat destruction especially due cutting of trees for fire wood and charcoal burning. As a result of these unsustainable natural resources use, much of the rangeland is in poor condition which forces the wildlife into the nearby Soysambu Ranch which well protected and there is sufficient forage. Large herds of Maasai livestock and increased human settlements due to land subdivision not only displace wildlife but also scare them away. Incompatible land use, cultivation and wildlife conservation leads to increased conflicts resulting in killing of wildlife to protect wildlife. However, the underlying cause of unsustainable natural resources is deeply rooted in poverty which in 2005 was estimated at 7,308 ± 2,211 individuals out of a population of 18, 645 in 1999 census. Actually in Gilgil location of Gilgil Division, 39 ± 11.86% of the population was found to be below poverty line in 2005 (Table 1). This means that for conservation to succeed, alternative livelihoods that alleviate poverty must be introduced as an incentive for biodiversity conservation.

3.2.8 LAND USE

The catchment is under various land use practices which include mining, agriculture, ranching, forestry conservation, urbanization, transportation and settlement among others. Part of the lake's environs is protected and part is a private wildlife sanctuary. Private ranches, including the Soysambu Wildlife Sanctuary, cover about 75% of the shoreline. This portion is generally well protected. Overgrazing on the rangeland during periods of drought, particularly in the south-eastern sector accelerates erosion after heavy rains.

Local inhabitants depend on the hot springs around Chamka for domestic freshwater supply, subsistence irrigation and water for livestock. Subsistence farming on the eastern side is leading to increased siltation of the lake from soil erosion, while increased offtake from the Meroronyi stream and destruction of vegetation in the catchment are reducing water inflows. Farm forestry is practiced in the smallscale farms. The nomadic Maasai also use the area as a grazing and salt-licking site for their livestock. Salt, sand and diatomite mined from the site at both small and large-scale on the eastern shores may be a serious problem in future

3.3 EBURRU FOREST

3.3.1 INTRODUCTION

Eburru Forest is located Latitude 0.65°to 0°39'0" South and Longitude 36.22° to 36°13'0" East and lies between Nakuru and Naivasha Districts at the border of Narok and Naivasha District. It rises from about 2400 to 2800 m above sea level. The forest covers an area of 8760 hectares. Located to the north west of Lake Naivasha, it forms the drainage divide between the lake and the Laikipia-Elementaita basin. The complex extends over an area of about 8,715 hectares and comprises three topographic entities: Western Eburru, Eastern Eburru and Waterloo Ridge. It is part of the Mau Forest Complex and it was gazetted under legal notice No 44 of 1932. The forest has several craters; underground springs and is still volcanically active with many steam jets in the forest and in areas surrounding it. The Maasai refer to Eburru Forest as Ol-donyo Opuro '*hill of steam'* owing to the steam jets that are a common sight in the area.

Eburru Forest is significant in several ways. It forms an important catchment for lakes Nakuru, Naivasha and Elementaita, which are recognized internationally as Ramsar sites i.e. wetlands of international importance. Along with several ground springs, it is the source of Ndabibi River.

3.3.2 SOCIO-ECONOMIC PROFILE

Eburru scheme and Kiambogo settlement scheme are located in Kiambogo location of Gilgil division which according to 1999 population census had a population of 69,633 of which in 2005, 27,751 individuals (40% of the population) was living below the poverty line (Table 1). Unlike other locations in the division, the location has middle to high potential with people engaged in smallscale mixed subsistence farming. The farm size ranges from 5 acres in Kiambogo to 18+ acres in Eburru. Main crops grown include maize, potatoes and beans for subsistence and pyrethrum and wheat for commercial. At least each family is involved in some form of livestock production but on a small scale. Commercial charcoal production is a major enterprise in both schemes.

3.3.3 CLIMATE

The upper part of the location which is surrounds the forest receives sufficient rainfall to support rainfed agriculture but productivity is greatly hampered by the rocky nature of the soil especially in Eburru. The area is also cold typical of high mountains which makes crops to take a long time to mature. The upper part of the forest receives about 1270 mm of rainfall per year while the lower parts which include the Kiambogo scheme receive just about 760mm of rainfall yearly.

3.3.4 GEOLOGY AND TOPOGRAPHY

Eburru volcano is elongated perpendicular to the Gregory Rift NW of Lake Naivasha. The 2856-m-high, E-W-trending main edifice is eroded, but young partly vegetated rhyolitic domes occur on

the east flank and are probably of Holocene age (Thompson and Dodson, 1963). Pleistocene phonolitic and trachytic lava flows are overlain by rhyolitic obsidian lava flows forming much of the northern and NE slopes of the main massif. A prominent late-Pleistocene rhyolitic lava flow from SE-flank vents extends almost to Lake Naivasha. Extensive fumarolic activity occurs at cinder cones and craters constructed along dominantly N-S-trending faults cutting the massif.

3.3.5 HYDROLOGY

Ebuuru forest is the source of Ndabibi River which flows towards Lake Naivaisha. River Nderit which is now seasonal originates from Mau passes through the Kiambogo area. The area has numerous underground springs and steam jets and the people especially in Eburru and lower part of Kiambogo rely on cooled steam jet for their water needs.

3.3.6 SOILS

The soils are loam forest soil with kaolin which a light coloured kaolimite rock calyed material. It is a product of geothermal activity and weathering. In its natural state, it is used in the manufacture of porcelain, wall tiles, paper and ceramics. Obsidian rocks also occur.

3.3.7 BIODIVERSITY STATUS, THREATS AND CONSERVATION PRACTICES

3.3.7.1 FLORA

The vegetation of the area is typical of that of closed canopy forest although selective harvesting has reduced the upper canopy. Major tree species include *Dombeya kirkii*, *Olea* sp., *Verbena* sp., *Rhus natalensis, Grewia similis*, *Podocarpus* sp. The grass cover is dominated by *Pennisetum clandestinum and Cyperus rotundus.* The herbaceous layer is composed of *Solanecio* sp, *Hypoestes forskahlii, Urtica massaica and Clutia abyssinica.*

3.3.7.2 FAUNA

3.3.7.2.1 AVIFAUNA

Though inhabited by birds, there is little information available on the species as well as abundance and this requires some documentation. However it is part of the Mau forest complex which contains a rich bird fauna and has been accorded Important Birds Area (IBA) status. Forty-nine of Kenya's 67 Afrotropical Highland bird species are known to occur in the Mau Forest Complex. Among them are the grey throated barbet *Gymnobucco bonapartei,* Luhders bush shrike *Laniarius leuhderi,* equatorial akalat *Sheppardia aequatorialis,* the red chested owlet *Glaucidium tephronotum,* banded prinia *Prinia bairdii* and black faced rufous warbler *Bathmocercus cerviniventris* are notable. Of these, 11 are in the globally threatened (CITES I&II) category and include the Verreaux Eagle *Aquila verreauxii*, Amani Sunbird *Anthreptes pallidigaster* and Taita Thrush *Turdus helleri.* Others include regional endemics such as Hartlaub's Turacco *Turaco hartlaubi*, the restricted range Hunter's Cisticola *Cisticola hunteri* and Jackson's Francolin *Francolinus jacksoni.*

3.3.7.2.2 MAMMALS

The forest harbors diverse wildlife species that include columbus monkey, buffalo, giant forest hog, the endangered bongo, buffalo and bushbuck.

3.3.7.3 THREATS TO BIODIVERSITY

Eburru forest is threatened with charcoal burning, forest fires, poaching of cedar posts, forest encroachment through illegal grazing and unplanned cultivation and settlements within and around the forest. The deforestation in the Eburu is a major concern as most of the valuable hardwood trees have been illegally logged. The largest portions of the remaining forests are largely composed of secondary growth as illegal logging for timber and charcoal burning has devastated large swathes of the forest. There has also been no policy to guide the establishment of farming systems around this forest, including the famous *shamba* system that has caused havoc to the forest. As a result, 90% of the forest has been cultivated or encroached and water sources have dried up. In addition, the clearing of the forest has driven the wildlife down the hills to the neighbouring Lake Naivasha riparian land where they have been associated with overgrazing especially the buffaloes.

3.3.8 LAND USE AND VEGETATION/HABITAT COVER

Eburru forest was ranked by the Kenya Indigenous Forest Conservation Program (KIFCON) as having high values in fuel wood, charcoal and with medium value in commercial timber. The forest has massive potential of ecotourism owing to its vast attractions that range from steam jets, rare animal species and scenic valleys and hilly terrain, hence the need to protect it. The livelihoods of the forest adjacent communities mainly Kikuyu, Maasai and Dorobos are highly dependent on the forest. Local uses of the forest include firewood collection, source of pole wood, charcoal, grazing, thatching materials and source of medicine.

4.0 FIELDWORK METHODOLOGY

4.1 VEGETATION SURVEY OF NAIVASHA ECOSYSTEM

Using a satellite image, the different vegetation types in Naivasha/Elmenteita Basin were identified and confirmed through ground `truthing'. To assess species cover and abundance in each of the vegetation type, 3 belt transects (Lake Naivasha-Lake Elmenteita, Lake Naivasha-Eburru forest and Lake Naivasha-Mt. Longonot) representing all the vegetation types in Naivasha ecosystem were pre-selected. Sampling was be done in each of the vegetation type occurring within the belt transect. An attempt was made to sample at least three relevés within each of the vegetation type along the belt transect. Sample plots were marked with stakes, and the relevés were located in homogeneous areas of vegetation using the centralized replicate method of the Braun-Blanquet approach to vegetation description and classification (Mueller-Dombois and Ellenberg, 1974; Westhoff and van der Maarel, 1978). Within each survey plot, all vascular plant species were recorded and assigned a cover abundance score using a modified seven point Braun-Blanquet scale (r = rare, + = common but less than 1%, 1 = 1-5%, 2 = 6-25%, 3 = 25-50%, 4 = 51-75%, 5 = 76-100%). Relevés varied in size depending on the type of plant communities (grass, herb, shrub, woodland and forest). Species that cannot be identified in the field will be tagged for later identification at the East African Herbarium. Notes were also made on geology, soil type and soil depth. The percentage of rock out-cropping, surface rock, litter and bare soil were estimated. Evidence of recent fire, erosion, clearing, grazing, weed invasion or soil disturbance was also recorded for assessment of range condition and trend. Each belt transect and relevé was georeferenced (for future use in monitoring) using a global positioning system (GPS). Digital photographs were also taken at each site. In addition, water samples were collected from the two lakes, rivers and other water bodies for standard analysis.

4.2 SOCIOCONOMIC SURVEY

A Participatory Rapid Appraisal (PRA) was carried out at each of the 5 (Ututu Conservancy/kikopey, Kiambogo, Eburru, Mt Longonot and Elmenteita) sites focusing on key conservation target condition and socioeconomic status of the community. The purpose was to gather information to enable biodiversity Threat Reduction Assessment as well as community livelihood activities and their linkages to site biodiversity.

4.2.1 PREPARATIONS

Prior to conducting the PRA, secondary sources including books, journal articles and unpublished documents on Naivasha ecosystem were reviewed. While informative, this review revealed a notable lack of detailed and reliable data on Biodiversity value and its status and no Threat Reduction Assessment has been carried out. Semi-structured interviews with key informants in the

study sites was carried out during the reconnaissance survey and the information was used to guide PRA preparation, selection of the tools and to frame questions to obtain information specifically on:

- Land tenure system, land size
- Livelihood activities and their interaction with natural systems and different, livelihood circumstances
- Knowledge on conservation
- Natural resources and their utilization
- the current conservation status of biodiversity
- major direct and indirect causes of degradation of natural resources, threats to the existence of natural flora and fauna
- interventions required for reducing the identified threats
- Nature Based Enterprises as alternative livelihood

4.2.2 RESPONDENTS

PRAs was carried out in Ututu Conservancy/Kikopey, Kiambogo, Eburru, Mt Longonot and Elmenteita sites with key informants who included representatives of groups engaged in ecotourism projects, project staff, wardens in neighbouring National Parks (Longonot and Hell's Gate), KWS staff at Naivasha office, NGOs and other experts where available.

4.2.3 PRA FIELDWORK

A multi disciplinary team, which included community members, consultant team and project staff, was formed prior to exercise. The PRA committee was selected by community members and consisted of an equal representation of men, women and youth. The PRA tools used were the following:

- secondary data review;
- informal and semi-structured interviews;
- direct observation;
- diagram of village institutions and groups;
- historical profile of the community, time line, trend line;
- village map;
- transect of the village;
- seasonal calendar of selected aspects

To ensure that information is valid and reliable, PRA teams followed the rule of thumb that at least three sources (triangulation) at each site were used to investigate the same topic. Hence, information collected

from one source was validated or rejected by checking with data from at least two other sources or methods of collection.

Information gathered by PRAs was used in conjunction with field vegetation surveys and analysis of land use maps and aerial photographs to evaluate recent changes in vegetation cover and abundance of key species. Identified threats were analyzed using pair-wise ranking and action plans developed by the PRA team. From the data thus collected, an information "pyramid" was assembled describing the biodiversity threats, causes, mitigation measures and conservation priorities. Further, this information was used for participatory Threat Reduction Assessment as follows:

4.3 THREAT REDUCTION ASSESSMENT

Measurements of TRA and Calculation of TRA Index was done using Threat Reduction Assessment (TRA) Biodiversity Support Network methodology developed by Margolis and Salafsky (2001). This approach selects a key conservation target condition and then identifies and traces the factors threatening the target. Overall, the technique examines the ability of the project to achieve biodiversity conservation by evaluating the area, intensity, urgency of each threat, and the degree to which the threats have been addressed by project activities.

4.3.1 DATA TREATMENT AND REPORTING

Using the data provided in the background information and field study for each site, a graphic conceptual model for identifying the conservation target, indirect and direct threats, and objectives and activities to reduce each threat was developed for each site.

4.4.2 DATA SYNTHESIS AND REPORTING

Data generated from the above activities was consolidated and synthesized into a final report. In addition, some practical and cost effective interventions for reducing the identified threats, and specifically interventions focusing on reducing such threats while addressing household poverty have been proposed. Needs and niches for economic incentives which community requires for natural resource conservation were identified. Opportunities for alternative sources of sustainable livelihoods as well as measures to strengthen the efficiency of natural resource utilization for some of the existing income sources as a direct incentive measures for conservation were also identified. Finally, supportive measures for practicability of the identified livelihoods and economic instruments for the conservation of natural resources were formulated.

5.0 RESULTS

5.1 VEGETATION SURVEY

The draft Landcover/ landuse map has 14 different zones with 8 community types (Table 2). In addition, 226 plant species were identified in the basin (Appendix III). Previous work classified the whole of Lake Naivasha region as having being one vegetation zone (Acacia shrubland). The new zones are:

1. Natural forest, 2. Swamp vegetation, 3. Open grassland, 4. Woodland, 5. Bushed grassland, 6. Wooded grassland, 7. Bushland, 8. Shrubland, 9. Scrubland, 10. Aquatic vegetation, 11. Riverine woodland, 12. Agricultural land, 13. Settlement, 14. Water.

5.1.1 COMMUNITY TYPES

Nine major community types were identified and designated as I, II, III, IV, VI, VII, VIII and IX. Plant communities have been named by use of the dominant plant species within each group. One or more plant species with the highest mean cover- abundance value have been used in naming the plant communities (Whittaker, 1975). To get the mean cover abundance value, the average of cover/ abundance scale of each species in every community where they occur is calculated. According to White (1983), more than one plant species normally dominate a particular plant community. The nine community types are :

I. Community type I- *Acacia xanthophloea – Pennisetum clandistenum* community

Acacia xanthophloea dominated this community type. This community occured mainly as *Acacia* woodland near the lake. *Acacia xanthophloea* was the dominant tree layer, while *Pennisetum clandistenum* constituted the ground cover**.** Another plant species that was closely associated with this community type was *Pennisetum squamulatum*. The presence of grasses as dominant species in the lower canopy outcompeted the growth of herbs and shrubs that were found to be very rare.

II. Community type II - *Tarchonanthus camphoratus- Solanum incanum* community

This community type is characterised by *Tarchonanthus camphoratus* as the dominant shrub. *Solanum incanum* was the common herb in this community. Grasses such as *Digitaria milanjiana, Chloris gayana and Conyza newii* were also present. Other species associated with this plant community are *Justicia lorata, J. flava, Ocimum suave, Prunus africana* and *Polygala sphenoptera.*

III. Community type III – *Digitaria abyssnica-Eragrostis superba- Sida cuneifolia* community.

This community is mainly dominated by *Digitaria abyssnica, Eragrostis superba* and *Sida cuneifolia* in the field layer. Other plant species that had less abundant field layer composition included *Hyparrhenia hirta, Sesbania sesban, Setaria pumilis, Sida acuta, S. massaica,* and *Solanum nigrum.*

Table 2. Characteristics of the various vegetation zones/sites

Location name	UTM reading	Community type	Vegetation Type	Disturbance	Range condition	Range trend
Loldia farm	9920332	VII	Aquatic-papyrus/water hyacinth	Overgrazed & trampling	Poor	Downward
	9920346	I	Wooded Grassland (*Acacia xanthphloea-Pennisetum*)	Overgrazed by wildlife	Fair	Maintained
	9920384	I	Mixed woodland	None	Good	Maintained
	9923738	II	Shrubland	Overgrazed by wildlife/livestock	Fair	Downward
	9923740	II	Grassland/scrubland	Overgrazed by wildlife	Fair	Downward
	9929232	II	Shrubland	burning	Good	Maintained
Kedong/KWS lakeside	9914888	I	Grassland	Grazing, clearing	Fair	Maintained
	9905198	V	Bushland (*Acacia drepanolobium*) -dwarfed	Overgrazing by wildlife and livestock	Poor, soil exposed	Downward
	9905174	II	Shrubland (*Tarconanthus*)	Overgrazing and trampling by wildlife and livestock	Poor, soil exposed	Downward
	9907782	IV	Wooded grassland (*Euphorbia candelabrum*)	None	Excellent	Maintained
	9907422	IV	Wooded grassland (*Euphorbia buseii*)	Selective harvesting	Good	Downward
	9908348	III	Grassland	Overgrazing, gullies, cattle tracks	Poor	Downward/deteriorating
Otutu/Kikopey-Lake Elmenteita	9947362	VII	Aquatic (*Cyperus laevigatus*)	Overgrazing and trampling by wildlife and livestock, salt/sand excavation	Fair	Maintained but could deteriorate
	9947224	IV	Grassland (*Cynodon*)	Overgrazing and trampling by wildlife and livestock	Fair	Maintained but could deteriorate
	9947228	I	Woodland (*Acacia Xanthophloea*)	Moderate grazing	Excellent	Maintained and improving
	9945756	II	Shrubland	Moderate grazing	Good	Maintained
	9945896	III	Grassland	Overgrazing by wildlife and livestock, cattle and vehicle tracts	Poor	Downward/deteriorating
	9947224	II	Shrubland	Overgrazed by wildlife and livestock	Good	Maintained but could deteriorated with increasing grazing pressure
Eburru Forest	9928400	IX	Closed Forest	Selective harvesting, edges disturbed, grazing	Fair	Upward/Improving due to regeneration

IV. Community type IV - *Euphorbia candelabrum- Euphorbia buseii* community

Both *Euphorbia candelabrum* and *Euphorbia buseii* constituted the dominant tree layer. Other important but less abundant associated field layer species were *Euphorbia tirucalii, Ipomea cairica, Euclea divinorum* and *Maytenus senegalensis.* This plant community occured in rocky habitats with high sand content in the soil.

V. Community type V - *Acacia brevispica-Acacia drepanolobium* community

This plant community is mainly dominated by *Acacia brevispica* and *Acacia drepanolobium* in the tree layer. *Acacia gerrardii, Acacia seyal and Tarchonanthus camphoratus* occured as shrubs. This plant community is highly influenced by altitude. It was found to dominate in areas of higher altitude far away from the lake.

Economic importance: Community I-V. Grazing areas for both cattle and wildlife especially gazelles and zebras. They are also source of fuelwood and building material for the local community.

VI. Community type VI- Papyrus community

This is predominantly a monoculture stand of *Cyperus papyrus*. This vegetation type is widely distributed along the Lake edge and cover between 30 and 50 km^2 and is conspicuously absent along the rocky shores at Hippo Point, Yatch Club and Crescent Island. It is also absent in Lake Sonachi (Crater Lake) and Oloidien (the small lake) due to their salinity.

VII. Community type VII- *Cyperus laevigatus* and *Typha spp community*

The marshes located in the southern part of the Lake Elmenteita are dominated by *Cyperus laevigatus*. The area of the lake receiving fresh water at the mouth of River Kariandusi is dominated by *Typha* sp.

Economic importance: Community VI & VII. It is a habitat and grazing ground for buffaloes and swamp antelopes. They are also a habitat and breeding ground for fisheries and an estimated 450 bird species.

VIII. Community type VIII- Floating vegetation

This is a monoculture of the notorious aquatic weed, *Eichhornia crassipes* (Mart.) Solms (Water hyacinth) with some remnants of *Salvinia molesta* (Kariba weed) *and Pisitia stratiotes* (Nile cabbage).

IX. Community type IX: Highland/mountain closed forest

A continuous stand of trees at least 10m tall with interlocking crowns/understorey.

Economic Importance

They are an important habitat for wildlife. The communities living near them frequently visit them for grazing livestock, charcoal burning (though illegal), firewood and honey collection. However,

some parts of the forests have been cleared to give way to cultivation. In addition they are catchment areas as the three rivers feeding Lake Naivasha originate from there.

The most dominant vegetation types in Naivasha Basin were identified as being Acacia *xanthophloea* woodland and *Tarchonanthus camphoratus* shrubland.

5.1.2 ECOLOGICAL ASSESSMENT

5.1.2.1 INDICATORS OF ECOLOGICAL TREND

Range Trend refers to changes in the rangeland vegetation and soils, or plant succession on rangelands. Vegetation succession is often a predictable process. The presence of desired plant species was used as an indicator of factors of ecological trend. The presence of young, medium sized and mature desired/palatable plant species was used as an indicator that either the species was regenerating or was maintaining itself. On the other hand low vigour as exhibited by dead centres in bunch grasses and absence of young grasses was used as indicators of grass dying and therefore indicating the trend is downward. In addition, the presence of plant residue or mulch on the soil was used to indicate non eroding soils and usually an improving range condition.

5.1.2.2 INDICATORS OF ECOLOGICAL CONDITION

Range Condition refers to a set of characteristics of the rangeland plant community relative to forage production, soil quality, topography and a specific plant species composition as related to some standard (Tueller, 1991; Naveh, 1977). It is how we wish the range to appear.

Range ecological condition of the study area was taken to be down from ideal if:

1. Desired species are replaced by unpalatable species.
2. Reduced plant cover and exposed bare soil surfaces due to overgrazing and erosion.
3. Signs of erosion or any combinations of the above.

The range conditions were classified as excellent, good, fair or poor.

5.1.2.3 ECOLOGICAL CONDITIONS AND TREND OF THE RANGE

Compared to 1995 assessment (Kariuki & Msafiri, 1996), many of the grasslands are now in poor condition and a few farmers have maintained them in excellent condition (Table 2). Rangelands in most areas are heavily degraded by overgrazing hence have exceeded their carrying capacity and are giving way to erosion. Desired grass species are replaced by annuals and thus a downward trend. In the western side of Lake Naivasha, this is attributed to an increase in wildlife migrating from Eburru forest as a result of habitat destruction. Another reason is that wildlife within these private ranches are more secure from poaching while increasing settlements are blocking their migration. Due to high population of buffaloes, the papyrus fringe has been completely destroyed. In Kikopey and Elmenteita, range condition is similarly poor and trend is downward due to over

grazing by livestock from both local residents and migrating pastoralists. Wildlife population low due to the presence of livestock and other human activities like tree cutting and charcoal burning that scare them away and confining them to the nearby Soysambu ranch.

5.1.2.4 LAND USE/LAND COVER CHANGES

From the study, it is evident that, there are a lot of land use changes within the Naivasha Basin s with corresponding land use activities in the area. The analysis of 1973 satellite image shows the land use in the study area is mostly rangeland for glivestock. The riparian reserve was extensive and area coverage by Lake Naivasha and the riparian very distinctive. Around the Lake Naivasha, the riparian reserve was still undisturbed.The field survey, satellite image and aerial photographs analysis and interpretation for 1986 show a gradual decrease in rangeland area while 2000 image shows intense land use activities within the basin. Most of the changes that have taken place were those of conversion of rangeland areas to cropland for floriculture.

NB:This section will be completed when all images are in.

5.2 THREAT REDUCTION ASSESSMENT

5.2.1 INTRODUCTION

Nakuru Wildlife Conservancy (NWC) is implementing a Community Ecotourism Development Program whose strategic goal is to increase the level of economic benefits that communities realize from natural resources while addressing the causes of natural resource/biodiversity degradation. NWC has commissioned this Threats Reduction Assessment (TRA) analysis to assess the biodiversity threats at the sites where it is implementing the ecotourism projects and evaluate the current activities, to see if they help address priority threats and determine if there is a need to change the goals, objectives, or activities in any of the sites. This will help the conservancy and the stakeholders understand the major direct and indirect threats to biodiversity as well as the context and root causes of the threats and therefore develop and implement projects that mitigate the identified threats. The assessment is also intended to provide baseline data for future monitoring and evaluation of project activities undertaken by the program. The assessment will also help prioritize and anticipate what threats might become more severe in the future. This information is critical in designing effective interventions, communicating the rationale behind the program design, and creating adaptive management systems.

5.2.2 DATA COLLECTION METHODS

Naivasha Basin is home to a number of important species of flora and fauna in the region. Several species of birds, mammals, and reptiles have been recorded and have been the basis for the conservation of its biodiversity. To protect the region from loss of biodiversity, Nakuru Wildlife Conservancy and other NGOs and the local communities have taken active role in the region's biodiversity conservation management.

The consultancy conducted on behalf of NWC a threat reduction assessment (TRA), an approach that offers a low-cost, practical alternative to more cost-and-time intensive approaches to measure the success of biodiversity conservation initiatives. The TRA is based on data collected through simple techniques, directly related to program interventions, and readily interpreted by project staff. The assessment was carried out in June 2008.

The Threats Reduction Assessment was based on a review of secondary data sources (see output 2) and primary data sources that included PRA, focus group discussions, key informant interviews, vegetation survey and direct observations. One PRA and a focus group discussion were held at each site to gather information on resources, biodiversity threats and conservation priorities. The TRA was based on three environmental variables, namely habitat integrity, quality and ecosystem

functioning. Participants were asked to consider these variables and to make an evaluation and value judgement. A key assumption in using TRA as an evaluation tool is that if threats to a site have been mitigated, then management activities will have succeeded. Conversely, if threats have not been mitigated, the site management approach has failed. It was therefore imperative that each site assessment group was able to identify threats to the site biodiversity and, with facilitation, estimate the degree to which these threats had been reduced as a measure of site's management success. A threat reduction index (TRA-Index) was then used to evaluate the effectiveness of a management approach. The process followed four steps.

Participants were led through a 'brainstorming' exercise during which they provided a narrative history of the area, its natural resources as well as threats to biodiversity and ways and means to reduce/eliminate them. Every threat that participants mentioned was written on a flip chart to help participants visualize and reflect on the identified issues. A threat was defined as any human related phenomenon that could be avoided, either by the community, KWS or other management agency, which would negatively affect the existence of the biodiversity (Salafsky & Margoluis, 1999). Participants considered threats to habitat integrity, quality and ecosystem functioning. Natural phenomena such as droughts were not considered threats. Participants ranked the threats according to their relative importance. This was achieved by considering the speed at which the threats could harm the site biodiversity, their intensity of destruction and the area they could affect. A ranking scale of 1 (minimum) to a maximum corresponding to the number of threats at that site was used throughout the exercise because it was easy to understand and acceptable to participants. A total sum score was computed after all the threats were scored. The group assessed the extent to which the site management activities had mitigated the various threats. Each participant was asked to award marks out of 100, based on their evaluation of the extent to which management efforts had mitigated the threats. Scores were assigned on a percentage basis; in which zero indicated a threat had not been addressed at all and 100% indicated management had fully mitigated a threat. The scores for each threat were discussed in turn to reach a consensus about a realistic score for the success of the management approach. After the scoring and ranking exercise, total ranking scores were multiplied by the percentage of the threat met to get a raw score for each threat. The threat reduction index was computed as (Salafsky & Margoluis 1999):

TRA index $= \Sigma$raw scores$/\Sigma$possible rankings $\times 100$.

This procedure was carried out for all five sites and threat indices were compared between sites with non-parametric statistics.

In the Elmenteita area, PRA and focus group discussions were held with members of the Lake Elementaita Conservation Group. In Otutu Conservancy/Kikopey Ranch, PRA and focus group discussions were held with the Ranch owners while in Kiambogo, Nature & People Network (NAPNET) members were involved. In Eburru and Longonot, the processes involved members of Eburru settlement scheme and Mt. Longonot Guides & Porters Club respectively. Key informant interviews were held with KWS staff from the Naivasha District Office, Mr. Ambose Nyaga of Nakuru Wildlife Conservancy and managers of farms around Lake Naivasha. An interview guide was designed and used in all the sites (Appendix I and II).

5.3 BACKGROUND INFORMATION FROM PRAS AND FOCUS GROUP DISCUSSIONS

5.3.1 GILGIL/LAKE ELEMENTAITA (LAKE ELEMENTAITA CONSERVATION GROUP)

5.3.1.1 HISTORICAL BACKGROUND

- First group settled in the area in 1982.
- At the time – area heavily forested all the way to the Kariandusi valley.
- Wildlife was abundant
- Lake level was also very high compared to today.
- Human population was low.

The conservation project began in 1997 due to the following reasons:

- As a way of starting to utilize the wildlife as a resource to reduce increasing human – wildlife conflict.
- KWS encouraged the setting up of the project in order to share the resource.
- Agricultural activities were diminishing as a result of low production of beans and maize due to high soil porosity and low rainfall (unreliable). Maize only attains fast growth for the first 3 months after planting then gets stunted or dries up.

5.3.1.2 NATURAL RESOURCES IN THE AREA

- ✓ Lake Elmenteita and its fauna (flamingoes and pelicans)
- ✓ Fresh water inflows from nearby Kariandusi river
- ✓ Wildlife (mainly gazelles)
- ✓ Grazing fields
- ✓ Salt and salt products
- ✓ Livestock

5.3.1.3 CURRENT STATUS (2008)

- ❖ High human population
- ❖ Land adjudicated into 2 acre plots and fenced
- ❖ Low wildlife population
- ❖ Decreased lake water levels
- ❖ Low flamingoes population; high pelican populations.
- ❖ Even when flamingoes migrate back to the lake, few return
- ❖ High mortality rates of pelicans.
- ❖ Cultivation up to the lake reserve

5.3.1.4 SOURCES OF LIVELIHOOD

Includes

- Sale of livestock (goats) – money used to buy seeds.

- Most families own at least a cow and a few goats but there are some people with none.
- Originally, the main source of income was from charcoal burning of indigenous trees such as *Tarchonanthus* but all were cut down when people settled.
- Farming (maize and bean)

5.3.1.5 DIRECT THREATS TO BIODIVERSITY

1. Tree cutting
2. Poaching
3. Mining of sand and salt
4. Pastoralists invasion
5. Over abstraction of water from River Kariandusi
6. Charcoal burning

5.3.1.6 INDIRECT THREATS TO BIODIVERSITY

1. Unemployment
2. Ignorance (lack of awareness)
3. Hunger and drought (low rainfall)
4. Diseases
5. Human population increase
6. Poverty

5.3.2 KIKOPEY/OTUTU CONSERVANCY

5.3.2.1 HISTORICAL BACKGROUND

The area was subdivided in 1973 but first people settled in 1977

Status at the time:

- Area heavily forested with leleshwa (*Tarchonanthus*)
- Lots of wildlife
- Piped water existing
- Rainfall was about 700 mm/year
- Lots of food and cash crops: Cotton, groundnuts, potatoes, bananas, cassava, sugar cane
- Maize (used to plant seed 511 and 512 which took 5 – 6 months to mature

5.3.2.2 NATURAL RESOURCES IN THE AREA

- Remnants of open canopy forests
- Wildlife
- Steam jets (Hot springs)
- Historic caves

- Craters
- Volcanic lava flows
- Northern side – lake Elementaita
- Over 450 spp of birds in Elementaita
- Pasture
- Diatomite
- Mineral sand/soil

5.3.2.3 CURRENT STATUS (2008)

- ✓ From 1984, drought started setting in
- ✓ Food production is low leading to food insecurity
- ✓ Forest has disappeared
- ✓ *Tarchonanthus* gone
- ✓ Very few wildlife (due to overgrazing)
- ✓ Soil erosion intense
- ✓ Charcoal burning prevalent
- ✓ Serious firewood problem
- ✓ Significant vegetation change with the red cedar (Mutarakwa) and *Olea capense* gone (now in nursery)
- ✓ The European settlers used to carry out ranching, new comers practice subsistence agriculture of maize and beans. Currently there is very low maize production if any
- ✓ Rainfall now less 300 mm per year and unpredictable
- ✓ Pastoralism has increased resulting in overgrazing and severe erosion
- ✓ Wind has increased due to disappearance of wind breaks, brings pests to the crops as a result aphids population has increased on beans and maize while cold weather and dust have increased also
- ✓ Dam water available but highly silted and disease infested

5.3.2.4 SOURCES OF LIVELIHOOD

- Subsistence farming – area semi-arid
- Livestock farming– cows, sheep, chicken, goats (10 to 20 on average) but some have none.

5.3.2.5 DIRECT THREATS TO BIODIVERSITY

1. Charcoal burning
2. Overgrazing

3. Poaching (subsistence)
4. River water abstraction
5. Tree cutting
6. Land clearing/conversion (Land conversion)
7. Fencing/blocking of wildlife dispersal and migration corridors

5.3.2.6 INDIRECT THREATS TO BIODIVERSITY

1. Unemployment
2. Low rainfall
3. Settlement/population increase
4. Climate change leading to frequent droughts and crop failure
5. Poverty
6. Lack of environmental conservation awareness
7. Lack of tree nurseries

5.3.3 KIAMBOGO/KAHUHO (NATURE & PEOPLE NETWORK)

5.3.3.1 HISTORICAL BACKGROUND

First people settled in the scheme in 1975

Situation then

- Forest and Wildlife abundant. Wildlife included a lot of buffalos and antelopes
- Nderit River was permanent.
- Farming was done in small scale
- Crops grown included maize, beans, carrots and pyrethrum
- Springs and boreholes were abundant
- Rainfall was abundant
- Wind was not strong as it is now
- In 1975 land acreage was an average of 2.5 acres. In 1978, acreage increased to 5 acres
- Livestock by then were cattle and pasture was plenty. Large percentage of the livestock was owned by the Government through the Agricultural Development Corporation (ADC) and only a small proportion by individuals

5.3.3.2 NATURAL RESOURCES IN THE AREA

- ✓ Natural forests
- ✓ Water from dams and rivers
- ✓ Wildlife
- ✓ Sand
- ✓ Quarry stones

- ✓ Land
- ✓ Livestock
- ✓ Pasture

5.3.3.3 CURRENT STATUS (2008)

- Much of the forest has been cleared or degraded
- River Nderit now seasonal
- Wind speed and intensity has increased greatly
- Forest conversion to agricultural land has increased
- Number of wildlife has decreased highly
- Livestock ownership by individuals has increased
- Pasture has greatly decreased
- Rainfall has decreased and has become unreliable
- Crop yield has decreased
- Population has increased greatly
- ADC farm is now divided to individuals
- Malaria and water borne diseases prevalent
- Climate has greatly changed with a rise in the average ambient temperature

5.3.3.4 SOURCES OF LIVELIHOOD

- Subsistence mixed farming (livestock, maize, vegetables, pyrethrum)

5.3.3.5 DIRECT THREATS TO BIODIVERSITY

1. Charcoal burning
2. Logging
3. Forest and grass fires
4. Poaching
5. Overgrazing
6. Forest conversion to cropland

5.3.3.6 INDIRECT THREATS TO BIODIVERSITY

1. Human population increase
2. Decreased rainfall

5.3.4 EBURRU SETTLEMENT SCHEME

5.3.4.1 HISTORICAL BACKGROUND

Between 1966 and 1968, the settlement was established, before then, it was occupied by white settlers

1979 – Subdivision of land into 16-18 acres parcels occurred and people starting to settle on their land in 1980

Situation then

- Eburru forest was large in size
- Human population was very low
- Farming activities then were minimal
- Firewood was plenty
- White settlers grew pyrethrum and did ranching
- Wildlife then was plenty particularly buffalos, antelopes and game birds

5.3.4.2 NATURAL RESOURCES IN THE AREA

- ✓ Wildlife
- ✓ Forest
- ✓ Hot springs (geysers)
- ✓ Minerals

5.3.4.3 CURRENT STATUS (2008)

- Forest cover reduced drastically
- Increased conversion of forest to farmland
- Increased human population and livestock
- Pasture reduced extensively and now not sufficient for the livestock
- Rainfall greatly reduced
- Harvest (20 bags of maize) when rain is reliable/sometimes less 20 bags when there is no enough rainfall.
- Area is becoming warmer and drier with less cold spells
- Wildlife numbers have reduced and it Is no longer easy to spot them
- Some valuable medicinal plant species are becoming rare or extinct due to land use changes and human pressure

5.3.4.4 SOURCES OF LIVELIHOOD

- Mixed farming (livestock, maize, beans, vegetables, pyrethrum)

5.3.4.5 DIRECT THREATS TO BIODIVERSITY

1. Habitat destruction
2. Forest fires
3. Tree cutting
4. Charcoal burning

5. Poaching
6. Land conversion to cropland
7. Overgrazing

5.3.4.6 INDIRECT THREATS TO BIODIVERSITY

1. Lack of environmental conservation awareness
2. Poor farming methods/practices
3. Overdependence on fuel wood

5.3.5 MOUNT LONGONOT (MT. LONGONOT GUIDES & PORTERS CLUB)

5.3.5.1 HISTORICAL BACKGROUND

The area was settled in 1969.

Situation then

- Forest (bushland)
- Acreage $5^1/_2$ acres per family
- No settlements
- Wildlife abundant
- Rainfall high – 2 seasons January and August
- Less wind
- No rivers reported
- No cultivation
- Low population density
- Mornings characterized by heavy dew

5.3.5.2 NATURAL RESOURCES IN THE AREA

- ✓ Wildlife
- ✓ Sand

5.3.5.3 CURRENT STATUS (2008-37 YEARS LATER)

- Forest gone
- Agricultural expansion (bushland converted to cultivated land)
- Very little rainfall
- Low farm production
- No dew
- Increased livestock (However now decreasing due to insecurity)
- Charcoal burning stopped due to low vegetation

5.3.5.4 SOURCES OF LIVELIHOOD

- Subsistence mixed farming (pyrethrum, wheat)

- Business – trading (small shops, grocery, clothes) and livestock
- Tour guide & porters
- Apiculture

5.3.5.5 DIRECT THREATS TO BIODIVERSITY

1. Land conversion (rangeland to cropland)
2. Poaching
3. Grass fires
4. Overstocking
5. Charcoal burning

5.3.5.6 INDIRECT THREATS TO BIODIVERSITY

1. Reduced rainfall
2. Diseases (foot and mouth disease)
3. Human population increase
4. Lack of environmental conservation awareness

6.4 TRA FINDINGS

6.4.1 PERCEIVED THREATS TO BIODIVERSITY

This section describes the current and upcoming threats to biodiversity as reported by the secondary (desk study) and primary (direct observation, the communities and key informants) data sources in Lake Elmenteita/Gilgil, Ututu Conservancy/Kikopey, Mt. Longonot, and Kiambogo and Eburru settlement schemes. In all the sites, biodiversity and other natural resources were reported to be threatened by a variety of human activities, management failures and natural factors.

The major threats to biodiversity identified by local communities in the Naivasha Ecoregion were in total, 8 indirect (Table3) and 9 direct threats in all the 5 sites (Table 4). A tenth direct threat which was mentioned by key informants and KWS staff but not by the communities (since it did not occur within any of the sites) was accidents along Nairobi – Nakuru highway (near Marula Farm, Gilgil toll station and Mai Mahiu) as wildlife cross the road from either side in search of water and forage. Nearly 100 accidents per every three months have been recorded in recent times. Also another direct threat that was observed in areas around Eburru and Kikopey is the slash-and-burn farming. Management failure in form of policing and regulating activities in the forest especially as it concerns Eburru forest was found to contribute directly to threats from illegal charcoal burning, logging and other activities that are averse to forest conservation including grazing in the forest. Fresh water biodiversity in Lake Naivasha is specifically threatened by over abstraction of water, reduced inflow, destruction of water catchment areas, riparian land reclamation, destruction of papyrus fringe, aquatic weeds, water pollution, overfishing and fish poaching. Some of fishing activities are carried out in the fish breeding areas in the swamps resulting in catching of juveniles which has had a negative impact on fish stock. As a result of reduced fish stock, fishing in the lake is usually closed between June and November each year to allow stock recovery and even when fishing is opened, only less than 50 boats are currently licensed to fish down from over 1000 boats before 2005. The closure and reduced number of licensed boats leaves local communities dependent on fish industry without livelihood. This is thought to make the individuals to seek alternative livelihood and hence engage in illegal activities (poaching, charcoal burning etc) that are a threat biodiversity. In total, there are 8 and 20 indirect and direct threats respectively operating in Naivasha Baisn as a whole, with 9 direct threats being specific to Lake Naivasha itself.

The most frequently reported direct threats to biodiversity were charcoal burning, poaching, overgrazing, logging/tree cutting, fire and land conversion for both subsistence and commercial

agriculture (Table 4). Other parameters that cause minor but direct threats to the biodiversity identified by single sites include mining, river water abstraction and habitat destruction (Table 4). Population increase, poverty, unemployment, diseases, lack of /or inadequate environmental conservation awareness education, unreliable rainfall and drought represents the indirect threats in Naivasha Basin. Generally, indirect threats are of low intensity but they act as triggers/drivers of direct threats. They also increase the magnitude and intensity of the direct threats. Population pressure, lack of environmental conservation awareness education and unreliable rainfall/drought were the greatest of the indirect threats. They were found to operate in 4 (80%) out of the 5 sites (Table 4). Among the threats perpetuated outside the sites, water catchement destruction and accidents involving wildlife were the largest in terms of impact. These threats are unmitigated and require immediate attention.

The threats differ in their magnitude and severity between the sites. No site is generally considered less threatened than the others even the National Parks. In fact these Protected Areas (PAs) experience similar threats and of the same magnitude as those of community areas especially in form of poaching, logging and overgrazing by livestock. In a study carried out in 2004, Hell's Gate National Park was found to be faced by threats in form of human encroachment; land-use changes; pollution, loss of wildlife corridor; and human-wildlife conflicts. Mt. Longonot National Park on the other hand was found to be faced with threats inform of loss of wildlife corridor and human-wildlife conflicts.

Table 3. Indirect Biodiversity threats per site identified in Naivasha Basin

	INDIRECT THREAT	Elmenteita	Otutu/Kikopey	Kiambogo	Eburru	Longonot	Total
1	Human population Increase	YES	YES	YES		YES	4
2	Poverty	YES	YES				2
3	Unemployment	YES	YES				2
4	Lack of environmental conservation awareness	YES	YES		YES	YES	4
5	Unreliable rainfall/Drought	YES	YES	YES		YES	4
6	Human and livestock diseases	YES				YES	2
7	Poor enforcement of PAs regulations			YES	YES		2

Table 4. Direct threats to Biodiversity per site identified in Naivasha Basin

	THREAT	Elmenteita	Otutu/Kikopey	Kiambogo	Eburru	Longonot	Total sites occurring
1	Tree cutting	YES	YES	YES	YES		4
2	Poaching	YES	YES	YES	YES	YES	5
3	Mining	YES					1
4	Overgrazing	YES	YES	YES	YES	YES	5
5	Charcoal burning	YES	YES	YES	YES	YES	5
6	River water abstraction	YES					1
7	Land conversion		YES	YES	YES	YES	4
8	Fires (Forest or grass)			YES	YES	YES	3
9	Habitat destruction				YES		1

6.4.2 GENERAL DIRECT THREATS

Some of the threats such as game poaching, logging, overgrazing and charcoal burning were widespread. The most common threats across all the sites were poaching of game, charcoal burning and overgrazing. Tree cutting/logging occurred in all the sites except Longonot where there were no suitable trees while land conversion was only not a threat in Elmenteita. This is probably because at Elmenteita, all the land has been subdivided into 2 acre plots and is already being used for agricultural purposes. Fire was particularly a threat in Kiambogo, Eburru and Longonot sites where it is used for slash and burn farming and sometimes it starts from charcoal burning activities. It spreads to large non targeted areas consuming large chunk of vegetation and displaces wildlife as it destroys its habitat. Water abstraction, riparian land reclamation, water pollution, reduced inflows, aquatic weeds, overfishing and fish poaching were documented as threats particular to Lake Naivasha. The data also show additional external threats such as highway accidents and water catchment destruction as site specific. Direct threats are caused by a variety of threat activities (Table 5). Most of the direct threats are a result of more than one threat activity that is perpetuated by a number of human activities.

Table 5. Summary of identified direct threats and their causes in community areas of Naivasha Basin

	Threat identified	Threat activities	Causes for identified threat
1	Tree cutting/logging	• Illegal extraction of medicinal plants, timber, firewood, wood carving, thatching and construction materials	• Increased human population and diminishing land and land based resources. • Poor rural populace that is dependent on natural resources for basic needs • Poor enforcement of regulations governing protected areas
2	Poaching/snaring	• Snaring of wildlife for meat • Killing/poisoning of wildlife (in retaliation)by local communities with bows and arrows, using spotlights, and other crude weapons • Displacement of wildlife through snaring and fencing • Blocking of wildlife routes to minimize wildlife-related damages	• Local community depressed livelihoods • Availability of illegal markets outlets for wildlife meat • Desire for alternative source of proteins (meat) by local communities • Crop raiding by herbivores • Livestock depredation by large carnivores • Human injury and death • Destruction to other property (e.g. water pipes and shelter). • Competition for resources with man and livestock (water and forage)
3	Mining	• Excavating lake shores • Extraction, prospecting of minerals and quarrying	• Diversification and expansion of revenue base for individuals
4	Overgrazing	• Illegal grazing of livestock in protected areas • Migration of pastoralists to new areas	• Increase and confinement of livestock in pastoral communities due to changes in land tenure • Lack of range management
5	Charcoal burning	• Illegal extraction of medicinal plants, timber, firewood, wood carving, thatching and construction materials	• A conservation model that excludes human settlement and use of most protected areas • Increased human population and diminishing land resources • Poor rural populace that is dependent on natural resources for basic needs • Diversification and expansion of revenue base for individuals • Commercial interests in the charcoal industry
6	River water abstraction	• Extraction and diversion of water resources by local communities for irrigation	• Unreliable rainfall/drought • Increased human population and diminishing land resources • Poor rural populace that is dependent on natural resources for basic needs
7	Land conversion	• Increasing human settlements and associated infrastructure • Expansion of agricultural activities in open wildlife rangelands where it is unsuitable • Increase in market, settlement centers and associated infrastructure in wildlife ranging areas	• Increased human population and diminishing land and land based resources • Incompatible land use changes with wildlife conservation • A desire for alternative or additional sources of income by local communities • A conservation model that excludes human settlement and use of

			most protected areas • Diversification and expansion of revenue base for local communities • Increased human population and associated food needs • Poor rural populace that is dependent on natural resources for basic needs
8	Fires	• Slash and burn farming • Charcoal burning	• Diversification and expansion of revenue base for individuals • Commercial interests in the charcoal industry
9	Habitat destruction	• Expansion of agricultural activities in open wildlife rangelands where it is unsuitable • Diminishing wildlife dispersal areas outside protected areas • Loss of migration routes to other nearby protected areas or part of their range • Degradation of wildlife dispersal areas	• Increased human population and diminishing land and land resources • Increase and confinement of livestock in pastoral communities due to changes in land tenure • Incompatible land use changes with wildlife conservation • A desire for alternative or additional sources of income

6.4.3 GENERAL INDIRECT THREATS

Poverty and unemployment were found to be the reasons why natural resources are overexploited and misused around Elmenteita/Gilgil and Kikopey/Otutu areas while population increase was a factor at all sites except Eburru (Table 3). This could be attributed to the fact that land in Eburru is still large (16 to 18 acres per family) and can still absorb the population pressure. In Elmenteita, Kikopey and Longonot sites, insecurity in form of cattle rustling was found to exist and was implicated for increasing poverty as it dispossess households of their livestock, a social capital that is usually comes handy especially in times of drought or illness when it is liquated to buy food, pay school levies and medical bills. It was unusual that neither poverty nor unemployment was identified as a threat to biodiversity in Mt. Longonot, and Kiambogo and Eburru settlement schemes. It is unusual because poverty and unemployment are generally believed to be the cause of unsustainable utilization of biodiversity. All the sites have been experiencing an increased demand for fire wood and charcoal, both nearby and from other towns. Both the high birthrate and level of migration to the areas and towns have caused this increased demand. The Elmenteita `nyama choma' ranch offers a ready market for charcoal while the Nairobi-Nakuru highway provides easy access to markets outside the region. Overall, however, lack of livelihood options was reported to increase pressure to the biodiversity.

6.4.2 ANTICIPATED THREATS TO BIODIVERSITY

In Elementeita, Kikopey and Kedong, immigration and settlement of both the pastoral and farming communities are considered to be the largest anticipated threat to biodiversity. The areas continue to receive new pastoralists who are displaced by expansion of agricultural activities from the neighbouring Narok North and South districts as well as new farmers. As more pastoralists arrive, livestock theft is likely to increase leading to poverty among the local communities who may in turn exert undue pressure on the scarce biological resources and additional conflicts over the use of resources are bound to increase. Already the local community has reported cases of increased livestock theft. The area under range in most ranches has been decreasing as some of it is being converted to cropland under irrigated horticultural farming. Since the ranches have large herds of both livestock and wildlife, it is expected that competition for forage will continue to further intensify. This is due to the fact that the range condition in most of the ranches is already in poor and the trend is downward due to overstocking and overgrazing. The range condition and trend assessments suggest that the ranches stocking rate (both livestock and wildlife) is way above their carrying capacity. This situation also increases the likelihood of human-wildlife-livestock conflicts over resources especially water and forage leading to further biodiversity degradation.

Increased demand and high price of charcoal and firewood will continue to create incentives for people to get involved in tree cutting. Poverty, lack of environmental conservation education and employment options and the increasing market demand for charcoal and fuelwood (due to increased price of kerosene, cooking gas and electricity) makes it less likely that those involved in the charcoal burning activities will abandon the trade unless very attractive option are availed to them. Another anticipated threat around Lake Naivasha is the expansion of area under irrigated horticulture/floriculture outside the traditional areas which also results in increased water abstraction.

6.4.3 CONSERVATION PRIORITIES

During the field interviews and focus group discussions, we asked the communities to prioritize the threats according to the area affected, severity, urgency and how probable it would be to address the threat successfully. The results are presented inform of TRA index below:

Table 6. Summary of threat reduction assessment indices for the various sites

	Elmenteita/Gilgil					Ututu/Kikopey					Kiambogo					Eburru					Longonot				
THREAT	AREA	INTENSITY	URGENCY	RANKING	% REDUCTION	AREA	INTENSITY	URGENCY	RANKING	%REDUCTION	AREA	INTENSITY	URGENCY	RANKING	% REDUCTION	AREA	INTENSITY	URGENCY	RANKING	% REDUCTION	AREA	INTENSITY	URGENCY	RANKING	% REDUCTION
Tree cutting	2	6	6	14	90	3	3	3	9	70	5	4	5	14	25	6	5	6	17	20					
Poaching	5	2	3	10	90	1	1	2	4	95	1	1	2	4	60	1	2	3	6	0	1	1	4	5	0
Overgrazing	4	3	2	9	10	4	4	4	12	30	3	3	3	9	65	2	1	1	4	30	4	4	2	10	0
Water abstraction	3	5	4	12	5																				
Mining	6	1	1	8	5																				
Land conversion						2	2	1	5	70	2	2	1	5	65	5	6	4	15	40	5	5	3	13	0
Fire											4	5	4	13	80	4	4	2	10	80	2	2	1	5	0
Charcoal burning	1	4	5	10	90	5	5	5	15	70	6	6	6	18	50	7	7	7	21	5	3	3	5	11	90
Habitat destruction																3	3	5	11	40					
TRA Index	52%					62%					55%					29%					22%				

Except Longonot, charcoal burning and tree cutting were ranked highest in the other four sites and were reported to be both the most prevalent requiring urgent mitigation measures (Table 6). These two threats were also the most intense because the practices exhaust the few remaining trees. Despite being widespread, poaching did not feature highly in terms of priority for immediate mitigation in any of the sites. This could be that the communities do not perceive any immediate direct benefits from wildlife conservation. Instead, the communities deplored the damage caused to their crops and property by wildlife. This feeling could actually be fuelling the anti wildlife sentiments that actually leads to poaching/killing of wildlife at some sites like Longonot, Kiambogo and Eburru. For the purpose of mitigation, it is important to differentiate between poaching which is carried out as a form of livelihood from the killing/poisoning of wildlife by crop or livestock farmers to protect their crops and livestock from depredation by wildlife. The later involves animals like baboons, monkeys, birds, some carnivals and some small mammals.

Three (60%) of the five sites had TRA indices above 50% (range: 52–62%), whereas the remaining two (40%) had TRA indices below 30% (range: 22–29%) (Table 6). Longonot had the lowest TRA index (22%) while Otutu/Kikopey had the highest (62%) (Table 6). Eburru was also found to have low TRA index of 29%, which means that the collective impacts of the threats have been ameliorated by a third only. The low index in Longonot appears to be due to the fact that the activities of the group are concentrated within the Mt. Longonot National Park where they derive their livelihood from tour guiding and offering transport to tourists. As they concentrate on this, there is very little effort directed towards biodiversity conservation in the surrounding area. In fact the group does not appear to connect the dependence of the park on the human activities taking place around it and as a result, with the exception of charcoal burning threat which had a reduction of 90%, all the other threats remain unmitigated recording no reduction (0%). Even the reduction in charcoal burning is attributed to lack of suitable trees. The closeness of the National Parks not only makes it easy for poachers to access wildlife but also for wildlife to depredate on crops and livestock hence the surrounding communities have to protect their crops and livestock. As a mechanism to reduce damage from wildlife, farmers not only fence their farms, but snare, poison or even kill wildlife.

Eburru on the other hand recorded the second lowest TRA index (29%) which is because both charcoal burning and logging/tree cutting threat affected the largest area, were most intense and required urgent mitigation measures and also these two threats were lowly mitigated by only 5 and

20% respectively (Table 6). The reason for the low mitigation could be both due to close proximity of people to the forest coupled with management failure as the forest is poorly policed. It is actually possible to walk into the forest through the official entrance without being noticed as the entrance is unmanned. People were found to move freely in and out of the forest and engage in a variety of unregulated activities some of which are a threat to the forest ecosystem. This easy accessibility and availability of this prized resource `free of charge' and with little or no obstacles to access it motivates the people from both Eburru and Kiambogo and probably from outside the area to enter into the forest to burn charcoal and log unhindered even when other sources of livelihood may be available. In other words, unlike in other sites where charcoal burning was mainly due to lack of alternative livelihood options leading to poverty and unemployment, at these two sites, it would appear that it has more to do with its free availability due to management failure than anything else. This is reinforced by the finding that the community in both areas did not site poverty or unemployment to be the reason for engaging in charcoal burning and logging activities. Kiambogo and Eburru are next to the forest where various activities provide livelihood. Charcoal production offers employment to a wide range of people along its supply chain. Within this chain, variety of niches for charcoal burners, transporters (trucks and bicycle owners), buyers (middlemen) and loaders exists and therefore one can always find a livelihood activity to engage in within this charcoal production and supply chain.

Although Otutu/Kikopey experience similar threats to those in other sites, it recorded an impressive threat reduction index of 62%, indicative of the communities and stakeholders' awareness and action to protect the biodiversity. This is attributed to the fact that the community appears to be aware of the benefits of local biodiversity, exhibit willingness to conserve and to sustainably utilize it. In fact, the ranch owners expressed desire to be supported to harness/tap the benefits of biodiversity conservation. This can be ascertained by the fact that Otutu/Kikopey ranch owners have set aside 11,000 acres of land to be used for the proposed Otutu Wildlife Conservancy.

Both Elmenteita and Kiambogo had average TRA index of 52 and 55% (Table 6) respectively despite the impressive conservation efforts at both sites by the Elmenteita Conservation and Nature and People Network groups respectively. This average index is attributed to the existence of threats that are lowly mitigated particularly water abstraction (5%), overgrazing (10%) and mining (5%) at Elmenteita and tree cutting (25%) and charcoal burning (50%) at Kiambogo

(Table 6). Additional threat to Eburru forest is its degradation through livestock grazing which destroys seedlings through browsing and debarking. The local community does not perceive this activity to be a threat and therefore is not one those they feel should be stopped. This due to the benefits they derive from it as they do not have to set aside land for grazing within their farms.

In Kedong Ranch, wildlife was observed to be threatened by poaching and competition for the diminishing forage resource by livestock from pastoralists who have migrated to the area with their large herds of livestock. In addition, several wire snares were encountered within the ranch with carcasses of both wildlife and livestock. It is thought that some residents of the neighbouring Karagita peri-urban slum could be involved in snaring/poaching and were therefore setting up these snares. We are not sure that the unusually high number of butcheries in this village is not linked to bush meat trade obtained from snaring/poaching of wildlife or even snared livestock. Our informants confided to us that bush meat from various sources is now used for both subsistence and commercial purposes. Although possession of game meat is illegal in Kenya, the situation is complicated by the fact that bush meat from animals killed through accidents is readily available to the residents making it difficult to differentiate 'legal' bush meat (obtained from accident animals) from the illegal one obtained from snaring/poaching activities. This availability together with meat being expensive appears to fuel and sustain bush meat trade and therefore increase in poaching activities. According KWS staff, wildlife poaching has increased in community areas and private ranches but the problem is minimal in protected areas. However, poaching is still a serious threat considering that most of the wildlife in the region is found in community areas and private ranches. To contain poaching, KWS has been applying both overt and co-overt approaches. However despite these efforts, poaching remains a threat to wildlife both inside and outside of Protected Areas (PAs).

Kikopey/Otutu Conservancy is also faced with similar threats of poaching and overgrazing form livestock belonging to the migrant pastoralists. Due to the sheer size of the ranch, policing the area has been difficult due to lack of resources. Additional threat in Otutu Conservancy is that of charcoal burning with the problem being so severe that both traditional and non traditional charcoal trees species are being used. Also in this area, due to scarcity of trees, the charcoal burners are using very young trees and shrubs and are also uprooting them and using their roots for either charcoal burning or as wood fuel. As a result tree has been decreasing rapidly.

Comparison of the TRA indices between the sites indicates significant differences in reduction/mitigation of all types of threats which emphasizes the effectiveness of difference strategies in threat mitigation. Overall, the results revealed that management approaches at all sites did not adequately address the threats, with some threats in certain sites being reported unmitigated. The reason for this was because the economic activities are not carried out to mitigate a specific threat but are designed to address the issue of livelihood. In fact some activities are a threat themselves. For example, the expansion of cultivation in the rangelands is a threat itself because it not only reduces the range area for wildlife but is sometimes the source fire that destroys vegetation and habitat for wildlife.

All the sites have both currently or proposed activities that are compatible with biodiversity conservation which present an excellent opportunity for Nakuru Wildlife Conservancy and other conservation organizations to upscale the current/and introduce new biodiversity threat reduction intervention strategies with success almost certain especially if they are aligned/redesigned to bring tangible economic benefits to the communities. However it is important to note that the activities proposed for Longonot may not be successful in mitigating threats unless they take into account the whole area and not just concentrate on the National Park.

6.5 CONCLUSION

The Threats Reduction Assessment has showed that the Naivasha Basin is endowed with a rich biodiversity (over 200 plant species) in various habitats, including forests, woodlands, fresh and saline aquatic ecosystems and rangeland. The communities that live within or adjacent to these ecosystems depend on their products and services for their subsistence and livelihood. Interviews showed that communities and conservation staff perceive biodiversity to be threatened by a variety of human activities as well as natural factors, such as insufficient rainfall and drought. However, the threats identified are closely linked to the overall problem of human population increase and associated activities, and these, especially among poor rural communities, lead to expansion of agriculture, even in marginal areas, to meet basic needs. Migration corridors and dispersal areas between protected areas or between a protected area and dispersal range continue to diminish especially due to rapid expansion of the lucrative horticultural farming. Good examples can be found around Lake Naivasha and Mt. Longonot National Park where migration corridors and dispersal areas have been taken by settlement and agriculture. In the process, wildlife habitats and biodiversity in general are also destroyed. This partly precipitates more human–wildlife conflicts and reinforces negative attitudes to wildlife and conservation of natural resources among local communities. It is frustrating to local communities because wildlife induced losses are never compensated. To deal with wildlife-related problems, local communities persecute wildlife through displacement, exclusion through fencing or/and illegal killing.

Overall, biodiversity at all the sites is equally threatened by charcoal burning, logging, poaching and overgrazing. Whereas charcoal burning and logging are carried out by the local communities, overgrazing is mostly as a result of the Maasai pastoralists who have migrated to the sites with their large herds of livestock even though they own no land in the area. This threat is very acute in Kedong, Longonot and Ututu/Kipopey sites. This threat is anticipated to increase in severity as the pastoralists have started to acquire land (though only ½ acre for building their manyattas) especially in Otutu area probably eyeing vast grazing land in the proposed Otutu Wildlife Conservancy. This is a serious threat considering that the herders do not own land and therefore do have any incentive to practice good husbandry and overgrazing and tree cutting will continue to be a threat unless appropriately addressed. The presence of herders and their livestock was found to scare away wildlife and confining them to some specific areas like private ranches. Though sheltered from adverse human activities, this is to the detriment of range condition due to overgrazing. At all sites, several strategies towards reduction of biodiversity threats have been put

in place but in Eburru and Kiambogo, they will have little impact unless the problem of poor enforcement of forest regulation and policing of the forest are concurrently addressed. Activities in Longonot will need to involve a wider population in order to make an impact in terms of economic returns as well as reduction in biodiversity threats.

Overall, the TRA process identified accidents and illegal access to forest resources as the largest unmitigated threats in Naivasha Basin. The TRA data show that the current management approaches, whether in community areas or PAs, do not adequately address threats to the sustainability of biodiversity in Naivasha Basin. This is partly because the approaches are not designed to mitigate a specific threat (not threat specific) and partly also due to institutional arrangements for managing wildlife and PAs that are designed to exclude people who were viewed as 'the problem' Since the colonial era, wildlife conservation policy and approach has focused on protected areas in the form of parks, game reserves and lately wildlife sanctuaries. Conservation areas are based on the Yellowstone 'Park Model' of Category II of IUCN classification. Under this model, the establishment of protected areas involving the exclusion of human beings (except for ecotourism activities and research) has been the norm. This has been the source of a myriad of conflicts and threats bedeviling biodiversity conservation initiatives in Kenya. When the boundaries of protected areas are set, rarely do they encompass entire ecosystems or animal ranges, and gradually they turn into ecological islands, a process referred to as insularisation. Further, boundaries imply that the ownership of the resources inside conservation areas shifts from local communities to governments or local authorities. This alienates communities from resources they previously conserved and depended upon (e.g. for food, medicine, construction materials, etc.) before designation as a protected area. Setting boundaries also implies that other alternative land uses outside the boundaries take priority over conservation, leading to the current incompatible land uses thriving on the edge of protected areas. It is now apparent that without the support of local communities, no meaningful wildlife conservation can be achieved in Kenya. Many threats arise from the alienation of local communities. Law enforcement mechanisms have remained the same since the western model of nature conservation was introduced in Africa, and follow up of illegal activities by rangers is ineffective. This is not helped by a wildlife management that focuses exclusively on wildlife issues, a policy approach that is not understood or shared by local people.

The current KWS design that puts emphasis on community infrastructure development such as schools, bee hives, roads, and health centers appears to have had little positive impact on

mitigating threats considering that snaring and poaching of wildlife has continued to increase in community areas. A community with schools and any other infrastructure built under the auspices of KWS's Community Wildlife Service Department will continue to snare/poach wildlife and degrade resources, if residents cannot meet their basic needs or wildlife continue to be a menace. This is because poverty is a major driver of biodiversity loss and poor people, who depend directly on natural resources, are forced for survival to use them unsustainably. They may have little voice in decision-making, and are all too often displaced or dispossessed by skewed power structures, political instability or armed conflicts. Under such circumstances, they have no choice but to use what marginal resources remain, even if weakly claimed by others—including areas 'protected' for biodiversity conservation. Migrant people are rarely able to adopt the local landuse practices that have been finely tuned over generations. They often also bring new technologies and improved access to markets, leading to further resource degradation, biodiversity loss and social conflict. This is not far from the truth in Naivasha Ecoregion.

Despite facing threats that have remained largely unmitigated, certain natural resources in Naivasha Basin are critical for viability of biodiversity because they are irreplaceable. They include the Eburru forest, both lakes Naivasha and Elmenteita and their flora and fauna and the hot steam sites in Eburru and Kiambogo. Conservation of these sites should therefore be a priority. Viability of ecotourism in Naivasha Basin depends of reducing biodiversity threats. Without efforts to mitigate the identified threats, ecotourism will not be sustainable over mid and long term. Threats that require priority are: 1) Charcoal burning, 2) Poaching of wildlife, 3) Logging, 4) Overgrazing, 5) Over abstraction of lake water, 6) incompatible land use/expansion of agriculture into rangelands and, 7) Accidents along the highway involving wildlife.

It is obvious that controlling human encroachment and associated activities is a difficult endeavour. Managing population increase, improved livelihood and poverty reduction can help reduce human impacts within and around protected areas. Involving local communities in sustainable natural resource use and conservation must be encouraged. No rural-based education about the use of such resources will succeed if local community needs and opinions are not met and incorporated in conservation practice and policies. If they do not benefit from biodiversity resources, and are not compensated for opportunity costs and wildlife-induced losses, they will not support conservation of biodiversity. To mitigate the threats, measures must be put in place to address above threat activities that cause identified threats. Such measures must meet local

communities` expectations for them to succeed. At the national level, a national land use plan can also help and will put into perspective land use practices that are compatible with the socio-economic needs, natural resource endowment, ecological and climatic constraints within different regions of the country.

Finally, NWC program should use the threat reduction approach to visually illustrate the factors causing the threats. The threat reduction concept model will show the local community and other stakeholders the need for a series of actions to mitigate threats and how local social and economic concerns are needed to establish effective ecotourism project implementation. This emphasizes to stakeholders that individual actions alone will not help to mitigate conservation threats and that what is needed is a coordinated set of ecotourism actions. For example, in the case of a threat to wildlife caused by poaching, multiple actions will be needed to address this threat. These could include, training poachers as nature guides, providing them with small micro loans to get started, and marketing their services.

6.6 RECOMMENDATIONS

In making the recommendations below, we were informed by the following:

- The immediate threats to biodiversity are ultimately caused by societal problems—including growth in human population and material consumption, widespread poverty, inequitable access to resources and an unfair global trade regime
- The various threats and threats causing activities that were identified by TRA above
- The current unsustainable livelihood activities and the efforts to develop new sustainable livelihood options by NWC in partnership with the local communities
- Conservation strategies that fail to bring incentives for local participation cannot succeed
- People's development concerns need to be acknowledged by the program through sound planning that guarantees their stake and identifies their roles
- The key to the projects success is the recognition that the communities are equal and viable partners in conservation, and that addressing their development needs is necessary for sustainably interfacing conservation with participatory development
- An inclusive and transparent process is critical in ensuring relevance, popular acceptance and community ownership of the projects. Women and youth groups are highly dependent on natural resources and need special focus
- Monitoring of different institutional mechanisms set up at the community level to ensure fair representation and equity in sharing benefits helps ensure meaningful participation
- Finally, site personnel and local stakeholders lack the resources, experience, and training necessary to use ecotourism as an effective tool for achieving long-term biodiversity conservation and hence the need for the program to create a replicable strategy for addressing these challenges

Based on the above we make the following recommendations:

6.6.1 BIODIVERSITY THREAT MITIGATION

At the five project sites the Ecotourism interventions have been chosen to help mitigate threats to biodiversity. To do this, the project will need to adapt and use the findings of the Threat Reduction Assessment (TRA). Hence the program should:

- Conceptualize in a visual model the threats to biodiversity identified by TRA
- Develop a strategic plan coupled with site workplans to suit identified individual site needs and the ecotourism activities that will most effectively help reduce biodiversity threats at the site with specific targets/outputs, milestones, verifiable indicators and means of verification and a monitoring and evaluation plan. The activities should be targeted, site/location-

specific interventions for results to be meaningful. Ecotourism activities should be designed to generate economic alternatives for local people as they simultaneously address site specific threats and build conservation awareness. Linked closely to the site workplans should be the monitoring and evaluation plans that will measure the effectiveness of both the collective and individual impact of the interventions on reducing specific threats

- The TRA data should form the benchmarks against which management-induced changes can be identified and measured and which future monitoring and evaluation will be based on
- Using a combination of biological, social and economic indicators, both qualitative and quantitative, the site monitoring plans should serve as a checklist for documenting and assessing the results and outcomes achieved during the life of the program, and for evaluating the effectiveness of the program's ecotourism projects and advocacy/awareness tools in reducing threats to biodiversity at each of the site

6.6.2 PROPOSED PROJECT'S ACTIVITIES

For each site, the various projects activities that have been proposed should be evaluated to ensure that they meet the criteria below.

Project activities should:

- build site management capacity for using ecotourism to support biodiversity threat reduction, while building the individual skills of site personnel
- use the business concept/model to generate revenue from ecotourism at each site sufficient to fund community and operating needs
- the NCEDP program should focus on increasing the resource base of the communities and diversifying their economic activities at the sites to create local income generation opportunities through a multifaceted approach e.g. involving mobilizing savings, credits and productive loans to improve socio-economic conditions. All groups should be mainstreamed in this approach to achieve the goal of poverty alleviation. As a direct impact, the number of poaching incidents, charcoal burning and other illicit activities that are a threat to biodiversity may fall through active community participation
- create an environmental and biodiversity conservation awareness necessary to support threats reduction efforts at the sites,
- place signages along the Nairobi-Nakuru to warn motorists about wildlife movement in order to reduce accidents involving wildlife

- provide local economic incentives for biodiversity conservation through training, technical assistance, and support to entrepreneurs. Hence it is imperative to build the capacity of local communities to enable them to implement self-reliant biodiversity conservation and socio-economic development initiatives in their area. Skill advancement for micro-enterprises should be complemented by micro-financing to make access to capital and technology easy to strengthen livelihood opportunities and therefore reduce stress on existing natural resources
- link regional, national, and international-level ecotourism marketing strategies and program's in each site and community needs and capabilities
- promote the sharing of experiences and best practices for linking sustainable ecotourism with biodiversity threats mitigation (exchange visits to sites within and out of Naivasha where ecotourism is being practiced)

The program should continue to work with local communities, KWS and all other stakeholders to bring together conservation education, planning, business development, training and marketing techniques to create a model for using ecotourism to promote the mitigation of biodiversity threats and community economic development. A key part of the program should be to involve tour operators in site specific activities so as to create better ecotourism products and sustainable management systems. It is hoped that the program will be unique in that it will use ecotourism to help mitigate threats to biodiversity conservation and will become a blue print for initiatives elsewhere.

6.6.3 PROJECTS IMPLEMENTATION

The program should have the following components:

1. Advocacy and awareness-raising
2. Community economic empowerment and development

Implementation

- The projects must be implemented in the most cost effective way in terms of financing, energy and natural resource use efficiency and be able to engage a large human resource.
- To ensure sustainability, projects should be financed through equity between NWC or other organizations and the local community (commercial partnership) or through soft loans from a conservancy's revolving fund. Individual members should own shares and dividends paid to each individual.
- 'Free' funds should be advanced only where it is extremely necessary but should target groups like organized self help community groups e.g youth groups, women groups and

registered associations. This should be done to strengthen community-based enterprises that offer livelihood opportunities to community members. Community members should be empowered to seek additional funding from sources such as Youth and Women Enterprise Funds, Banks etc.

- Projects must be implemented by democratically elected implementation committees (ICs) that are all inclusive and transparent in their operations. Such committees should be answerable to members through their respective site committees (SCs).
- It is imperative that community members and especially those serving in any of the committees undergo a leadership, governance and bookkeeping courses.
- Projects to be implemented must be upstream (from the local community) to promote relevance and ownership.

6.6.4 PRODUCTS

- In developing ecotourism or non-tourism products, such products must be ecofriendly, innovative, unique, should provide high returns to the communities and must therefore be competitive in terms quality, value and pricing.
- Once these products have been developed, they must be branded and marketed aggressively, effectively and extensively using the modern technologies.

Ecoturism activities should also be complemented by other non-tourism economic enterprises for example at Elmenteita setting up a 'nyama choma' ranch (a one stop shop) where people can refresh themselves as they enjoy the scenery view of the lake and the beautiful landscape. This ranch should also offer other products like curios, tree and flower seedlings, livestock salt whose value can be added through packaging. Similar efforts can be replicated in others sites where applicable or with modifications. Such settings need not use expensive materials but should instead use locally available materials but endeavour to ensure appeal through quality works. Other activities may include:

Apiculture

Seroculture

Nature farming eg aloe farming

Nature trail with tour guides who are properly trained in local species, their use and ecological role they play

6.6.5 OUTREACH

- During the capacity building, the program should reach out to non members of the conservation groups with a view of influencing them into joining the conservation efforts and move away from biodiversity threat causing activities.
- To increase/restore the range carrying capacity, advocate scientific range management to improve and counteract range condition and trend deterioration respectively. This should specifically include bush management, adjusting grazing pressure, deferred grazing, pasture conservation etc to ease pressure on the rangeland.
- The program should aim at being a model for environmentally sound ecotourism, a blue print that will show how ecotourism, as a tool for sustainable tourism, can be a means of mitigating biodiversity threats while generating the economic benefits for the local people.
- The program should also develop an exit strategy at each site embedded in its strategic plan, the project should place considerable emphasis on ensuring sustainability of project results and processes from the initial design stage.

6.6.6 MONITORING AND EVALUATION

The NWC program goal is to increase the level of economic benefits that communities realize from natural resources while addressing the causes of natural resource/biodiversity degradation. The program's monitoring and evaluation plan should therefore be able to address the two issues, economic benefits to the communities and mitigation of threats to natural resources/biodiversity. Hence the monitoring and evaluation plan should be able to

- determine whether the project interventions, such as ecolodges, apiculture or nature guide training, are being implemented as planned and are producing alternative employment that has an economic and social effect on the local populations and,
- whether the program's project activities are effective in mitigating identified threats

The project's evaluation activities should also have an adaptive management focus, emphasizing the concept that knowledge is a cyclical process to improve past actions. Through "learning portfolios" the project should compile descriptive information from the different sites providing lessons learned in adapting ecotourism principles and activity implementation.

A. THE M&E PLAN

An M&E plan should set out what monitoring activities will take place, when and by whom, and how that information will feed back into management decisions. The plan should include an estimate of costs of implementation, and identify training and capacity building needs for program staff, local communities and institutions responsible for monitoring identified indicators and

implementing the M&E plan. The plan should also describe mechanisms for feeding results back into the management process.

B. SCOPING

A first step in project design is to clarify the objectives for biodiversity management, identify the sources of threat and determine how project activities can address them and with what consequences. Specifying the relation-ships between threats and project activities designed to reduce them is an integral element of project design. Clearly identifying the assumptions for project interventions will help to identify indicators for monitoring both changes in threats and the effectiveness of project interventions in mitigating those threats.

C. EVALUATION AND FEEDBACK INTO MANAGEMENT

Based on the results of the monitoring, an evaluation should be made of the effectiveness of project interventions in meeting biodiversity threats reduction objectives, and any necessary revisions to project component identified and implemented. The effectiveness of project activities can be assessed in three ways:

- ✓ are they adequately addressing the direct and indirect causes of the threats to biodiversity?
- ✓ are they causing any unacceptable negative impacts on biodiversity values?
- ✓ and were activities adequately designed and implemented?

The results of evaluation of monitoring data will help to pinpoint where, and how, a project should be remodeled. Restructuring or redesign of project elements based on the results of M&E, will contribute to adaptive management, i.e. management which is responsive to changing conditions and project objectives. The M&E plan should set out the time intervals (mid-term, terminal) between evaluations and should state who (individual, organization, or agency) will carry out evaluations and who will be the recipients of reports. For the evaluation to have some practical effect in improving conservation management, there should be specific mechanisms for feeding the results of evaluation back into the management process, and assigned responsibilities for follow-up. As with monitoring, evaluation should be an ongoing part of biodiversity conservation management, rather than a project-based activity. Project preparation should include assessment of capability to undertake evaluation and, where necessary, capacity-building in evaluation techniques should be built into.

PROPOSED OVERALL THREAT REDUCTION MONITORING SYSTEM

Table 7. Proposed Threat Reduction Monitoring System

Threat Reduction to be monitored	Target by the end of the project	Survey Method	Indicator/survey score or result
Poaching	Reducing poaching and highway accidents by 100% with 2 years All snares removed and no new ones are placed	- Periodic TRA - Wildlife census - Reports - Field survey	-Annual (or periodic) assessment using "Threats Reduction -------- Analysis" (TRA) shows positive trends within 2 years -Populations of wildlife increases or remain at current levels -Number of accidents per month decreasing -No game meat trade -All snares removed within 2 years
Charcoal burning	-Illegal activities (grazing, hunting, settling, logging and charcoal burning, etc.) in the forest areas will be reduced by 50% by year 1, compared with baseline levels	- Periodic TRA - Field survey	-No reduction in the total area of primary forest from 2008 baseline -Participatory Forest Management introduced by year 2 -Number of charcoal kilns decreases -Annual (or periodic) assessment using "Threats Reduction Analysis" (TRA) shows positive trends throughout life of project
Logging	Manage forest remnants to maintain and improve habitat quantity and quality Reduce illegal extraction of medicinal plants, timber, firewood, wood carving, thatching and construction materials in the forest by 100% from current baseline level within 1 year	-- Habitat monitoring - Disturbance survey - Photo point of habitat condition - Assessment of habitat quality - Periodic TRA	-Participatory Forest Management introduced by year 2 -Harvesting decreased by 50% from current -No illegal resource extraction occurs -20% annual increase in the area of natural regeneration of plant species compared with baseline level, based on annual ground surveys -No illegal resource extraction -At least 10% of deforested area reafforested per year
Fire	Number and extent of human-caused fires (not part of a fire management plan) reduced by 50% compared to the average from 1998-2008 Slash and burn farming completely eliminated	- Periodic TRA - Vegetation survey	-Incidences of forest and grass fires gradually reduced to zero by the end of year 2 - No incidences of slash and burn farming
Overgrazing	A range in good to excellent condition Optimum range carrying capacity	- Periodic TRA - Vegetation survey	-Number of livestock grazing within the protected areas boundary declines to 0% by the end of year 1, compared with average numbers recorded in 2008 -Stocking rate equals to range carrying capacity within 2 years -No signs of soil erosion -Range trend upward due active range management
Land conversion	Reduce incompatible land use practices to 30% Minimize human-wildlife conflicts	- Land cover/use satellite images - Reports - Periodic TRA	-Connectivity maintained between the two National Parks with no net reduction in biological corridor beyond yr. 1980 baseline -Cases of human-wildlife conflicts reduced to 10% by year 2 -Number of ecotourism activities increases to 70% by year 2 -No illegal new settlement occurs within project sites beyond 2008 baseline
Climate change	Increase tree cover	Survey of No. trees planted	10 trees planted per household per year
Over abstraction of water	Lake level equal to 1998 mark or increased level	Lake level gauge, July 15 2008 1885.96 level baseline	No net decrease of lake level in all seasons
Papyrus fringe	Swamp will show equal to 1998 or increased cover	- Land cover/use satellite images - Field survey	Annual increase in the area of natural regeneration of papyrus fringe

	Economic and financial outcomes		
Alternative livelihoods	Increase in tree cover of local farmers' land holdings in years 2, compared with baseline levels Frequency of incidents of charcoal burning and hunting for bushmeat in project area declines by 70% by year 2, compared with baseline levels.	Periodic PRAs KWS reports	Alternative income generation plans for all sites produced by end of year 1 - At least [number] of examples of sustainable traditional resource use practices revived by yr. 2 - Specific alternative income initiatives under implementation in all site by end of year 2 - Quantifiable changes in livelihoods of local communities, reducing the frequency of environmentally damaging activities, by year 5
Improved livelihoods	Number of livestock grazing within the protected area boundary declines by 90% by the end of year 2, compared with average numbers recorded in 2008	KWS reports	- Livelihoods of beneficiaries of program's ecotourism projects improved over 2008 baseline, as measured by income levels - Provisional harvest quotas for sustainable use of non timber forest products (NTFP) established by 2009 - No net decrease in tree cover of local farmers' land holdings in years 2 compared with baseline levels
Environmental education and awareness building	Improvement of protected area management systems Support for commercial hunting among villagers within project site declines by at least 80%, based on targeted surveys conducted in year 1 and year 2	KWS reports Periodic TRA	At the end of 2 years, the number and extent of human-caused fires (not part of a fire management plan) will be reduced by 50% compared to the average from 1998-2008 Increased understanding and commitment of local authorities and communities to objectives of the Biosphere Reserve measured by tangible contributions (buildings, personnel, finances, administrative support) by year 3 Biodiversity conservation measures developed by the Project are included in the 2008 Central and local government's Four-year plans Awareness of park boundaries and regulations established in 100% of adult community members surveyed by year 5

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APPENDIX

APPENDIX 1: Discussion guide for group discussions

Discussion Issues/Topic	Comments
Introductions	Self introductions led by facilitator to act as "ice-breaker."
Community issues	Issues that could have an impact on the management of natural resources in their areas as well as the neighboring PAs such as community composition, population density and economic activities. Community skills for natural resources management explored
Community economic activities	Activities that could have impacts on natural resources, such as charcoal burning etc.
Environmental/natural resources issues	Environmental changes that took place over the years since the community settled at the site, concerns about these changes and what the communities were doing about these concerns
Future of biodiversity	In light of the past experience and current social, economic and political changes, reflections on the future of biodiversity and other natural resources.
TRA	Identify threats to biodiversity through a brain storming exercise, rank these threats according to the area, intensity and urgency. Assess the effectiveness of site activities in mitigating the threats over the past five years, by awarding scores out of 100. Later, compute the TRA-Indices
Discussion evaluations	At the end of the discussions, participants were asked to evaluate the content and quality of the discussions for the benefit of the facilitators in conducting other discussions at other sites.

APPENDIX 2 : Interview questions

Biodiversity threats (for all interviewees)

1. What are the direct threats to biodiversity in this area?
2. What are the root-causes to these threats?
3. Do you anticipate any additional threats in the near future?
4. Why are these threats on the rise?
5. Prioritize the threats to biodiversity for the site, considering the following factors:

• urgency of addressing the threat
• probability of success in mitigating the threat
• area affected by the threat
• feasibility of addressing the threat (e.g. culturally, politically, economically)
• level of agreement among the stakeholders about the threat.

6. What needs to be done to address the priority threats?
7. Can these actions be addressed by current conservation efforts?
8. How should current activities be revised to better address the priority threats?

Current biodiversity conservation efforts (mainly district/conservation staff)

9. Who are the key players in biodiversity conservation in the site?
10. If there are other efforts in the site (apart from NWC), what do they do?
11. Are there any village by-laws or district/site based plans for conservation.
12. If so, who is responsible for implementation and monitoring?

APPENDIX 3: SPECIES LIST FOR NAIVASHA BASIN

	Species	Author	Family
1	*Abutilon mauritianum*	(Jacq.) Medic.	Malvaceae
2	*Acacia brevispica*	Harms.	Mimosaceae
3	*Acacia drepanolobium*	Sjostedt.	Mimosaceae
4	*Acacia gerrardii*	Benth.	Mimosaceae
5	*Acacia seyal*	Dl.	Mimosaceae
6	*Acacia xanthophloea*	Benth.	Mimosaceae
7	*Achyranthus aspera*	L.	Amaranthaceae
8	*Aerangis thomsonii*	(Rolfe) Schltr.	Orchidaceae
9	*Aerva lanata*	(L) Juss.	Amanthaceae
10	*Aloe fibrosa*	Lavranos & Newton.	Aloaceae
11	*Amaranthus graecizans*	L.	Amaranthaceae
12	*Anthospermum welwitschii*	Hievn.	Rubiaceae
13	Anthriscus sylvestris	(L.)Hoffm.	Apiaceae
14	*Aristida adoensis*	Hochst.	Poaceae
15	*Artemsia afra*	Jacq.	Poaceae
16	*Asperlagus aethiopicus*	L.	Asparagaceae
17	*Aspilia mossambicensis*	(Oliv.) Wild.	Asteraceae
18	*Becium obavatum*	E. Mey.	Lamiaceae
19	*Bidens pilosa*	L.	Asteraceae
20	*Boerhavia coccinea*	Mill.	Nyctaginaceae
21	*Calodedrum capense*	Thumb.	Rutaceae
22	*Cekisua anthelmintica*	Asch.	Amaranthaceae
23	*Chenopodium album*	L.	Chenopodiaceae
24	*Chenopodium opulifolium*	Koch & Ziz.	Chenopodiaceae
25	*Chenopodum schraderianum*	L.	Chenopodiaceae
26	*Chloris gayana*	Kunth.	Poaceae
27	*Chloris pycnothrix*	Trin.	Poaceae
28	*Chlorophytum siliraticum*	Dammer.	Anthericaceae
29	*Clematis simensis*	Fresen.	Ranunculaceae
30	*Commelina benghalensis*	L.	Commelinaceae
31	*Commicarpus pedunculosus*	(A.Rich) Cuf.	Nyctaginaceae
32	*Conyza bonariensis*	L.	Asteraceae
33	*Conyza hochstetteri*	A.Rich.	Asteraceae
34	*Conyza newii*	Oliv. &Hiern.	Asteraceae
35	*Conyza stricta*	L.	Asteraceae
36	*Cotyledon barbeyi*	(Bak.) Schweinf.	Crassulaceae
37	*Crassula schimperi*	Fisch. & Mey.	Crassulaceae
38	*Crassula campestris*	(Eckl. & zeyh.) Walp.	Crassulaceae
39	*Craterostigma platagineum*	Hochst.	Scrophulariaceae
40	*Craterostigma pumilum*	Hochst.	Scrophulariaceae
41	*Crotalaria atropilosulus*	Schweinf.	Fabaceae
42	*Crotalaria massaiensis*	Taub.	Fabaceae
43	*Crotalaria incanum*	L.	Fabaceae
44	*Crotalaria lachnocarpoides*	Engl.	Fabaceae
45	*Crotaralia vallicula*	Bak. F.	Fabaceae
46	*Cyathula cylindirica*	Moq.	Amaranthaceae
47	*Cyathula orthacantha*	Schinz.	Amaranthaceae

48	*Cyathula unicinulata*	(Schrad) schinz.	Amaranthaceae
49	*Cycnium tubulosum*	O. J. Hansen.	Scrophulariaceae
50	*Cynanchum altiscandens*	K. Schum.	Asclepiadaceae
51	*Cynbopogon nardus*	Rendle.	Poaceae
52	*Cynodon dactylon*	(L) Pers.	Poaceae
53	*Cynodon nlemifuensis*	Venderyst.	Poaceae
54	*Cyperus bulbosus*	Vahl.	Cyperaceae
55	*Cyperus divens*	Del.	Cyperaceae
56	*Cyperus lanneriffae*	Poir.	Cyperaceae
57	*Cyperus papyrus*	L.	Cyperaceae
58	*Cyperus rigidifolius*	Steud.	Cyperaceae
59	*Cyphostemma jiquii*	Verda.	Vitaceae
60	*Delosperma nakurense*	Eng) Herre.	Aizoaceae
61	*Digitaria abyssinica*	A. Rich.	Poaceae
62	*Digitaria milanjiana*	Stapf.	Poaceae
63	*Digitaria scalarum*	Chiov.	Poaceae
64	*Dodonea angustifolia*	L. F.	Sapindaceae
65	*Dodonea viscosa*	Jacq.	Sapindaceae
66	Dombeya burgessiae	Gerrard.	Sterculiaceae
67	Dombeya kirkii	Mast.	Sterculiaceae
68	Dombeya rotundifolia	(Hoecst) Pklanch.	Sterculiaceae
69	*Dovyalis abyssinica*	(A.Rich) Warb.	Flacourtioaceae
70	*Dyphoriste radicans*	Nees.	Acanthaceae
71	*Ehrharta erecta*	(Holcht.) Pilger.	Poaceae
72	*Eragrostis braunii*	Schweinf.	Poaceae
73	*Eragrostis cilianensis*	Lut.	Poaceae
74	*Eragrostis olivacea*	K. Schum.	Poaceae
75	*Eragrostis superba*	Peyr.	Poaceae
76	*Eragrostis tenuifolia*	A. Rich (Steud).	Poaceae
77	*Erica arborea*	L.	Ericaceae
78	*Erucastrum arabicum*	Fisch. & Mey.	Brassicaceae
79	*Euclea divinorum*	Hiern.	Ebenaceae
80	*Euphorbia buseii*	S.Carter.	Euphorbiaceae
81	*Euphorbia candelabrum*	Kotschy.	Euphorbiaceae
82	*Euphorbia crotonoidis*	Boiss.	Euphorbiaceae
83	*Euphorbia tirucalli*	L.	Euphorbiaceae
84	*Farsetia undulicarpa*	Jonsell.	Brassicaceae
85	*Faurea saligna*	Harv.	Proteaceae
86	Ferula communis	L.	Apiaceae
87	*Ficus bussei*	Mild. & Burret.	Moraceae
88	*Ficus sycomorus*	L.	Moraceae
89	*Ficus wakefieldii*	Hutch.	Moraceae
90	*Fuerstia africana*	T.C.E.Fries.	Lamiaceae
91	*Galinsoga paviflora*	Car.	Asteraceae
92	*Geranium ocellatum*	Cambess.	Geraniaceae
93	*Geranium vagans*	Bak.	Geraniaceae
94	Gnidia subcordata	Meissn.	Thymelaeaceae
95	*Grewia similes*	K. Schum.	Tiliaceae
96	*Grewia virosa*	Willd.	Tiliaceae
97	*Helichrysum glumaceum*	DC.	Asteraceae

98	*Helinus mystacinus*	(Ait) E.mey&Steud.	Rhamnaceae
99	*Heliotropium steudneri*	(Valtke) Verdic.	Boriginaceae
100	*Heteromorpha trifoliata*	(Wendl) Eckl & Zeyl.	Apiaceae
101	*Hibscus fuscus*	Garke.	Malvaceae
102	*Hirpicium diffusum*	Roess.	Hypericaceae
103	*Hyparrhenia hirta*	(L.) Staff.	Poaceae
104	*Hyparrhenia rufa*	Stapf.	Poaceae
105	*Hypericum annulatum*	Moris.	Hypericaceae
106	*Hypoestes forkeolii*	(Vahl.) R.Br.	Acanthaceae
107	*Indigofera arabica*	Jaub. &Spach.	Fabaceae
108	*Indigofera brevicalyx*	Bak. f.	Fabaceae
109	*Ipomoea cairica*	(L.) Sweet.	Convolvulaceae
110	*Juniperus procera*	Endl.	Cupressaceae
111	*Justicia anagalloides*	(Nees) T. Anders.	Acanthaceae
112	*Justicia exigua*	S.Moore.	Acanthaceae
113	*Justicia flava*	Vahl.	Acanthaceae
114	*Justicia lorata*	Ensermu.	Acanthaceae
115	*Kalanchoe densiflora*	Rolfe.	Crassulaceae
116	*Kalanchoe glaucescens*	Britten.	Crassulaceae
117	*Lantana trifolia*	L.	Verbenaceae
118	*Leonotis mollissima*	Gurke.	Lamiaceae
119	*Leonotis nepelifolia*	(L) E. BV.	Lamiaceae
120	*Lepidium africanum*	(Burm .f.) D.C.	Brassicaceae
121	*Leucas martincensis*	R.Br.	Lamiaceae
122	*Leucas calostachys*	Oliv.var.fasciculate. (Bak)Sebald	Lamiaceae
123	*Leucas glabrata*	(Vahl) R.Br.	Lamiaceae
124	*Lippia javanica*	(Burm.f)Spreng	Verbenaceae
125	*Lippia ukambensis*	Vatke & Bakeretal.	Verbenaceae
126	*Lotus corniculatus*	L.	Fabaceae
127	*Ludwigia stolonifera*	(Guill. & Perr) Raven.	Onagraceae
128	*Lycium europaeum*	L.	Solanaceae
129	*Maerua triphylla*	A. Rich.	Capparidaceae
130	*Mamscus macrocarpus*	L.	Asteraceae
131	*Mariscus amauropus*	(Steud) Cuf.	Cyperanaceae
132	*Maytenus senegalensis*	(Lam) Exell.	Celastraceae
133	*Melhania ovata*	(Car.)Spreng.	Malvaceae
134	*Monechma debile*	Forsk. Nees.	Acanthaceae
135	*Nothosaerva brachiata*	(L.) Wight.	Amaranthaceae
136	*Ocimum gratissimum*	L.	Lamiaceae
137	*Ocimum lamiifolium*	Benth.	Lamiaceae
138	*Ocimum suave*	Willd.	Lamiaceae
139	*Olea africana*	Mill.	Oleaceae
140	*Oleae uropaea* subsp*. cuspidata*	L.	Oleaceae
141	*Olinia usambarensis*	Gilg.	Oliniaceae
142	*Opuntia vulgaris*	Mill.	Cactaceae
143	*Osteospermum vailantii*	(Decne) T. Norl.	Asteraceae
144	*Osyris lanceolata*	Hochst. &Steudel.	Santalaceae
145	*Oxalis coniculata*	L.	Oxalidaceae
146	*Pennisetum clandestinum*	Chiov.	Poaceae
147	*Pennisetum squamulatum*	Fresen.	Poaceae

148	*Pentas pavifolia*	Hiern.	Rubiaceae
149	*Pentas schimperana*	A. Rich.	Rubiaceae
150	*Pentas zanzibarica*	(Klotzch) Valtke.	Rubiaceae
151	*Peperomia blanda*	(Jacq.) Kunth.	Piperaceae
152	*Peponium vogellii*	Engl.	Cucurbitacae
153	*Phyllanthus spialis*	Muell & Arg.	Euphorbiaceae
154	*Physalis peruviana*	L.	Solanaceae
155	*Phytolacca dodecandra*	L'H'erit.	Phytolaccaceae
156	*Plectranthus barbatus*	Andr.	Lamiaceae
157	*Plectranthus caninus*	(Roth.) Vatke.	Lamiaceae
158	*Plectranthus longipes*	Bak.	Lamiaceae
159	*Plectranthus psedomarruli*	Oides.	Lamiaceae
160	*Podocarpus falcatus*	Mirb.	Podocarpaceae
161	*Polygala abyssnica*	Fresen.	Polygalaceae
162	*Polygala sphenoptera*	Fresen.	Polygalaceae
163	*Polygonum aviculare*	L.	Polygonaceae
164	*Persicaria senegalensis*	Meisn.	Polygonaceae
165	*Polyscias campestris*	Ait.	Araliaceae
166	*Polyscias fulva*	Harms.	Araliaceae
167	*Portulaca kermesina*	N.E.Br.	Portulacaceae
168	*Portulaca quadrifida*	L.	Portulacaceae
169	*Protea gaguedi*	J.F.Gmel.	Proteaceae
170	*Prunus africana*	(Hook.f) Kalkm.	Rosaceae
171	*Pseudognaphalium luteo*	Hilhard & Burtt.	
172	*Psiada punctulata*	Vatke.	Asteraceae
173	*Rhamnus prinoides*	L'Herit.	Rhamnaceae
174	*Rhus longipes*	Eng.	Anacardiaceae
175	*Rhus natalensis*	Krauss.	Anacardiaceae
176	*Rhus ruspolii*	Engl.	Anacardiaceae
177	*Rhynchosia elegans*	A. Rich.	Fabaceae
178	*Rhynchosia hirta*	(Andr.)Meikle &Verd.	Papilionaceace
179	*Ricinus communis*	L.	Euphorbiaceae
180	*Rubus niveus*	Thunb.	Rosaceae
181	*Rumex usambarensis*	Dammer.	Polygonaceae
182	*Saturaja biflora*	(D.Don) Benth.	Lamiaceae
183	*Schefflera volkensii*	(A.Rich) Harms.	Araliaceae
184	*Sebaea brachyphyla*	Griseb.	Gentianaceae
185	*Senna didymobotrya*	Fres.	Caesalphiniaceae
186	*Senna multiglandulosa*	(Jacq) Barneb& Irwin	Caesalpiniaceae
187	*Sesbania sesban*	(L) Merr.	Fabaceae
188	*Setaria pumila*	(Poir) Roem&Schult.	Poaceae
189	*Setaria sphacerata*	(Schumach) Stapf. & Hub.	Poaceae
190	*Setaria verticillata*	Beavr.	Poaceae
191	*Sida acuta*	Burm.f.	Malvaceae
192	*Sida cuneifolia*	Roxb.	Malvaceae
193	*Sida massaica*	Vollesen	Malvaceae
194	*Sida schimperiana*	A. Rich.	Malvaceae
195	*Silene gallica*	L.	Caryophyllaceae
196	*Solanecio angulatus*	C. Jeffrey	Asteraceae
197	*Solanum incanum*	L.	Solanaceae

198	*Solanum nakurense*	C.W.Wright	Solanaceae
199	*Solanum nigrum*	L.	Solanaceae
200	*Sonchus olearaceus*	L.	Asteraceae
201	*Sphaeranthus suaveolens*	(Forsk) D. C.	Asteraceae
202	*Sporobolus fimbriatus*	Nees.	Poaceae
203	Struthiola thomsonii	Oliv.	Thymelaeaceae
204	*Swertia usambarensis*	Eng.	Gentianaceae
205	*Taraxacum officinale*	Wiggi.	Asteraceae
206	*Tarchonanthus camphoratus*	L.	Asteraceae
207	*Tagetes minuta*	L.	Asteraceae
208	*Teclea nobilis*	Del.	Rutaceae
209	*Teclea simplicifolia*	Engl) Verdoorn.	Rutaceae
210	*Tephrosia interrupta*	(Hochst &steud)Engl.	Fabaceae
211	*Thalictrum rhynchocarpum*	Dill. & A.Rich.	Ranunculaceae
212	*Themeda triandra*	Forssk.	Poaceae
213	*Trichodesma zeylanicum*	(Burm.f.) R.Br.	Boriginaceae
214	*Tricholaena teneriffae*	Link.	Poaceae
215	*Trifolium semipilosum*	Fresen.	Fabaceae
216	*Trimeria grandifolia*	(Hochst.) Warb.	Flacourtiaceae
217	*Triumfetta rhomboidea*	Jacq.	Tiliaceae
218	*Verbena brasiliensis*	Vell.	Verbenaceae
219	*Vernonia auriculifera*	Hiern.	Asteraceae
220	*Vernonia galamensis*	(Cass) Less.	Asteraceae
221	*Vernonia lasiopus*	O. Hoffm.	Asteraceae
222	*Veronica abyssinica*	Fresen.	Scrophulariaceae
223	*Veronica anagallisquatica*	L.	Scrophulariaceae
224	*Wahlenbergia abyssinica*	Thunb.	Campanulaceae
225	*Wahlenbergia virgata*	Engl.	Campanulaceae
226	*Zehneria scabra*	(L.F) Sond.	Cucurbitaceae

APPENDIX 4: TRA LIST OF PARTICIPANTS

9th June 2008

A Lake Elemementaita

1. Charles Mwangi
2. Joseph Mwangi
3. James Waweru
4. David Kariuki
5. Francis Kimani
6. James Muiruri
7. George Njoroge
8. John Ndiego
9. John Wanyiri
10. Jane Wangui
11. Nancy Njeri
12. Tabitha Nyambura
13. Margaret Wanjiru
14. Phillis Wangui

B Ututu Conservation programme Trust

1. William Murai
2. Benson Mugo
3. Mary Wangui
4. Phillip Mwangi
5. Lesso Wambui
6. James Mbuthia
7. Stanley E. Karanja
8. Ann Wambui
9. Serah Nyambura
10. Moses Serenge

10th June 2008

C KIMBOGO/Eburru community

1. Joseph N. Kamondo
2. Maurice K. Lukaro
3. Charles K. Sirongo
4. Nahashon W. Gituroh
5. Geffrey M. Kanyoro
6. Evans Omandi Ndemo
7. Kenneth Mogaka
8. Ruth Bosibori Arabu
9. Beatrice Ruto
10. Jane Mwangi
11. Paul Musyimi
12. Naftali Leting
13. Eliphaz Onyancha

D Eburru Settlement Community

1. Samuel Wainaina
2. David Njenga
3. Geoffrey Mbugua
4. Josephat Ngigi
5. Jecinta Wangui
6. Freshia Wairimu
7. Samuel Wainaina
8. Joseph Kimani
9. Samuel Waweru

11TH June 2008

E Mount Longonot

1. Michael Chira
2. Hannah Wairimu
3. Teresa Muthoni
4. Geoffrey Kamau
5. John Kamau Kinuthia
6. Margaret Njeri Njoroge
7. Gabriel Kahiga Chege
8. Daniel Gitaranga Macharia
9. Joseph Njenga Mihiu