

Challenges Facing the Conservation of Lake Naivasha, Kenya

Caleb Mireri

Dept. of Environmental Planning & Management, Kenyatta University
P.O. Box 43844 – 00100 Nairobi, Kenya
E-mail: calebmireri@hotmail.com

Abstract

This paper shows that sustainability of Lake Naivasha is threatened by the land use transformation in the watershed. Lake Naivasha is the only freshwater lake in the Kenyan Rift Valley. The basin extends 6° North from the equator and lies between 36°07' and 36°47' east of Greenwich Meridian. It is a shallow lake located at an altitude of about 1885m above sea level. Its watershed measures approximately 3400km². The population in the area surrounding the lake has rapidly grown from 43,867 in 1969 to the current figure of about 250,000. The lake is located in a semi-arid environment and it is drained by only two perennial rivers - Malewa and Gilgil. Lake Naivasha area plays a very important role in national development. The area contributes to about 70% of Kenyan flower export, 15% of Kenyan electric power and is home to attractive tourist sites. Since independence in 1963 the area has witnessed rapid land use transformation from commercial ranching to a mixture of commercial ranching and rapidly growing smallholder (rural and urban) settlements. As a result the area has witnessed a high increase in demand for the hitherto scarce environmental resources and services (for example water, sanitation and forestry) leading to unsustainable utilisation of the lake. Although water is abstracted from both, the lake and underground sources, there is no metering. Sustainable management initiatives of the lake should focus on: institutional framework and human resources; monitoring of the abstraction of water resources; waste management, physical infrastructure; soil and forestry conservation and farming technologies.

Introduction

Lake Naivasha is located within the Kenyan Rift Valley and the watershed covers parts of both, the Rift Valley and the Central Provinces. The watershed is a unique ecosystem because Lake Naivasha is the only fresh water lake within the Rift Valley. Lake Naivasha was declared a Ramsar site in 1995. Its watershed is mainly a semi-arid environment with scarce surface and underground water resources. The area around the lake has witnessed major land use transformation following colonisation of Kenya. At the beginning of 1900s the land use in the watershed changed from pastoral economy to large scale white settler farming and since independence (1963) the area has registered rapid land subdivision. The land use changes since independence have led to rapid growth in population, human settlement, intensive commercial farming, tourism and geothermal production. These have put intense pressure on natural resources in the watershed, which threaten the sustainability of Lake Naivasha. Increased demand for scarce environmental resources such as water and biomass may lead to the excessive abstraction of surface and ground water resources, depletion of forestry resources, pollution of water bodies and siltation of the lake.

Research Methodology

This study makes use of both secondary and primary data. This study benefited from a report written by the National Environment Management Authority on the watershed and the gazetted Lake Naivasha Management Plan. Primary data was obtained from a sample of 150 households within Lake Naivasha watershed, a sample of resource persons and field observation. A combination of stratified-random sampling and triangulation was used to sample 70 and 80 urban and rural households respectively. The sample of urban residents was obtained from the Naivasha municipality because of its proximity to Lake Naivasha, while rural residents were sampled immediately after the built-up urban areas of Naivasha municipality. A sample of one tourist hotel and one large-scale commercial farm were taken for detailed study and site visit. The resource persons interviewed included those from the Naivasha Municipal Council (Town Clerk, Municipal Engineer, and Environmental Officer); the

Ministries of Agriculture, Environment and Provincial Administration; Lake Naivasha Riparian Owners Association; and Kenya Electricity Generation Company. Primary data was collected, using household questionnaires and interview schedules for the respective resource persons.

Location and Size

The study area falls within the confines of four administrative districts namely: Nakuru, Kiambu, Narok and Nyandarua in Kiambu district. Lake Naivasha watershed covers an area of approximately 3,400km². The basin extends 6° North from the Equator and lies between 36°07' and 36°47' east of Greenwich Meridian. The basin is bounded to the west by the Mau Escarpment, to the south and south-east by the Olkaria and Longonot volcanic mountains, to the east by the Kinangop Plateau and to the north and north-east from the Aberdare Mountain Range and finally to the north-west by the Eburu volcanic pile. Lake Naivasha is the only freshwater lake situated in the floor of the Eastern Rift Valley in Kenya at a mean altitude of 1885m above sea level. It is located at latitude 36° 22'E in Nakuru District, about 100 km north-west of Nairobi.

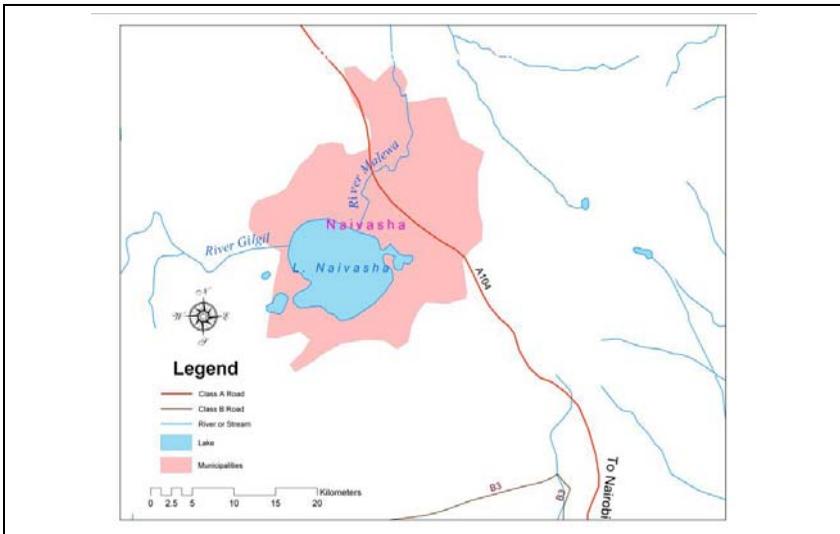


Figure 1: The location of Lake Naivasha (*Mireri, 2004*)

Lake Naivasha is located in the rain shadow of the Aberdare Range with a mean annual rainfall of about 650mm. The mean annual rainfall in the Aberdare Range is 1350mm. The mean temperature around Lake Naivasha is approximately 25⁰c with a maximum temperature of 30⁰c, with December – March as the hottest period. July is the coldest month with a mean temperature of 23⁰c. The Lake Naivasha watershed is drained by only two perennial rivers, namely Malewa River and Gilgil River with catchment areas of 1700km² and 400km² respectively. The rivers and ground water sources are a key to the provision of water to the Naivasha and Nakuru municipalities as well as other adjoining human activities.

Population and Human Settlement

The area surrounding Lake Naivasha was occupied by the pastoralist Masai community prior to colonisation of Kenya. In 1900 the Ugandan railway was built down through the Rift Valley and along the shores of Lake Naivasha. The centre that had begun as a tiny railway station grew into what is now known as Naivasha Municipality. In 1905, through a colonial agreement with the Masai, the Masai were moved south of the railway line to make way for European settlement in the area. Most of the land around the lake was settled by Europeans who practiced mixed livestock and agricultural farming.

Since independence in 1963, the Lake Naivasha catchment area registered rapid population growth and land use transformation. As a result, much of the catchment area around Kinangop and Kipipiri was settled by indigenous Kenyans. This trend has continued over the years as large farms are sold to land buying companies, which later subdivided the land into smallholding. Field survey results show that 92% of the sampled rural households own up to a maximum of 10 acres of land.

The population of those currently living around the lake is estimated at 250 000 people. The population of the Naivasha division, within which the lake falls, has registered a rapid increase in population. The population of the division rose from 43 867, 95 339, and 105 458 to 158 679 in 1969, 1979, 1989 and 1999 respectively.

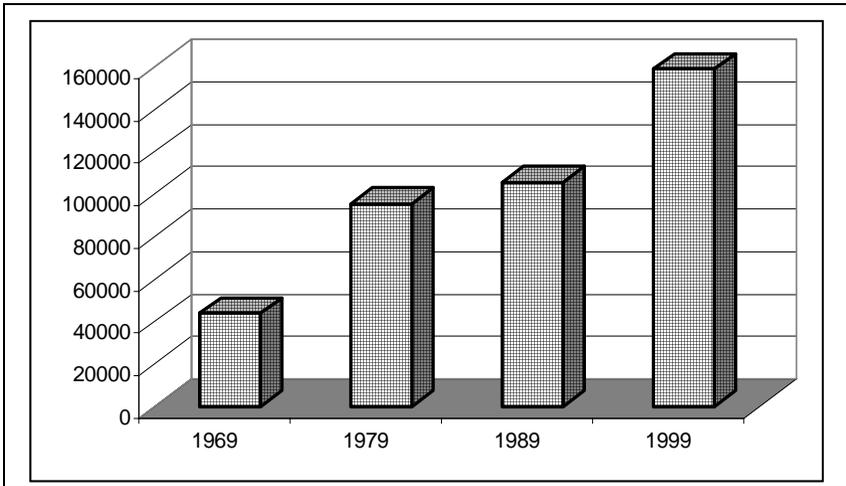


Figure 2: The Population Growth of Naivasha Division (*Field Survey, 2005*)

The Lake Naivasha drainage basin is an important source of agricultural production, tourism and electric power, which cluster mainly around the lake. About 70% of Kenyan flower export (earning about Ksh. 20 billion foreign exchange per year) is produced around Lake Naivasha, while 15% of Kenyan electric power is generated from the geothermal power generation plants (at Ol Karia) located to the western parts of the lake. It is estimated that the total area under commercial irrigation around the lake is between 3000 and 5000ha with farm sizes of over 5ha. Also, there are large farms of over 60ha, which are engaged in flower production. The rapid growth of population and the associated (particularly unplanned) human settlements have led to increased demand for environmental resources (water and land) and degradation (soil erosion; increased siltation and nutrient enrichment). During the last 10 to 15 years, the horticultural/floricultural farming has dramatically expanded around Lake Naivasha.

Waste management remains a great challenge to sustainable management of the Lake Naivasha watershed. Only a small section of the Naivasha Municipality is covered by conventional sewerage systems, the treatment of which works broke down ten years ago. Therefore, the waste disposed from the sewerage system remains a

potential source of water pollution. Further, the majority of the sampled households (78%) use pit latrines to dispose human waste, while hotels and flower farms around Lake Naivasha use mainly septic tanks to dispose of human wastes with serious risk of environmental pollution.

Increased demand for household energy may heighten the degradation of the Lake Naivasha watershed. The majority of the sampled households depend on firewood and charcoal as the main sources of energy. Charcoal and firewood combined are the dominant source of energy for 52% of the sampled households. Paraffin is used by over 30% of the sampled households. There are four main forest blocks within the watershed Aberdares, Kipipiri, Eburu and Mau. The rising population has led to an increasing demand for forestry resources, specifically for firewood, charcoal, timber, other construction materials and the settlement with attendant threat to environmental degradation.

Water Budget

Lake Naivasha is a relatively small lake compared to the other Rift Valley Lakes. The Lake Naivasha catchment is approximately 3400km². The area of the lake is prone to major fluctuations, varying from 102km² during the dry cycles to 150km² during wet cycles. The lake is shallow, deepening towards its south-western part to a maximum of 8m in depth, though the deepest part of the lake is at 16m off Crescent Island. The lake level has registered a major decline during the last 100 years. Available data shows that the lake levels stood at 6210, 6206, 6210, 6200, 6187, 6190, 6195, 6191 and 6191 feet in 1906, 1916, 1926, 1936, 1946, 1956, 1966, 1976 and 1986 respectively. The decline in the lakes water level is attributed to rapid increase in demand for lake waters, rivers waters and clearance of the catchment areas for human settlement and associated activities, which have intensified since the 1990s. Papyrus, which has been an important part of the lake wetland ecosystem, has declined in acreage from 1200 ha to 200 ha during the last four decades (Lake Naivasha Management Plan, 2004).

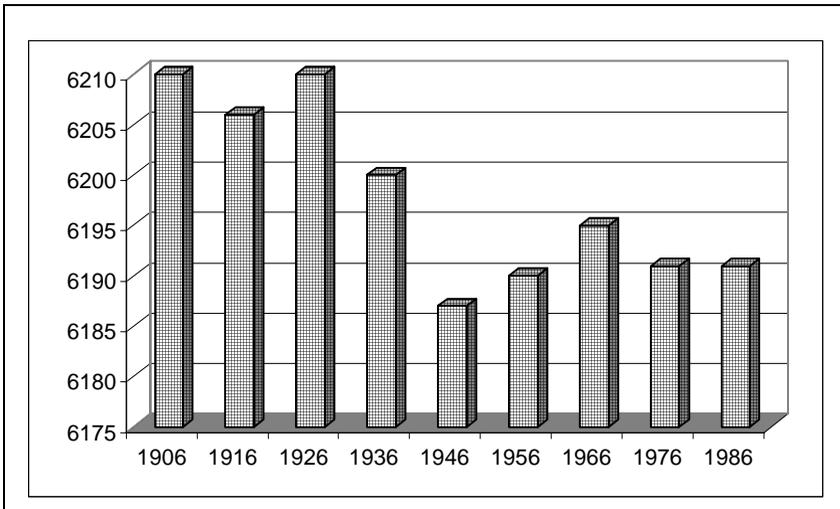


Figure 5: The Changes in the Lake Naivasha Water Levels

Lake Naivasha has no surface outlet. It has underground water inflows and outflows and the freshness of the water is largely as a result of such flows from the lake. The water inputs to the lake include rainfall that occurs directly over the lake, inflows from the rivers and surrounding area (runoff) and also through underground water movement from the catchment (seepage-in). The results are direct evaporation from the water body and transpiration from the swamp area and other aquatic vegetation (the combined outputs of evaporation and transpiration is referred to as transpiration). The other outputs are the underground seepage out of the lake and water abstraction for human activities. According to the Naivasha Management Plan (2004) the water budget of the Naivasha watershed is water surplus and deficit of 415.8m^3 and 117.2m^3 million during wet and dry season respectively. Water surplus during the wet season occurs as a result of runoff, which can only be tapped for use during dry season if there are storage facilities. Future increase in water demand will heighten water deficit with serious ramification on the sustainability of the lake.

Water abstraction from and around the lake is estimated at 3 to 5×10^6 m^3 per month. The boreholes around the lake are about 250 (Rural Focus, 2002). Water abstractions of over 5×10^6 m^3 per month greatly

threaten the sustainable use of the lake (NEMA, 2004b). Most of the water abstractions are not metered, thus it is impossible to determine the rate of abstraction.

The Relationship between Water Act and Lake Naivasha Watershed Management

The Water Act No. 8 (2002) provides a comprehensive institutional framework for the management of water resources in Kenya. The Sessional Paper No. 1 (1999) on *National Policy on Water Resources Management* highlights the following problems that constrain the development of the water sector and those requiring attention to generally include but not be limited to: (a) the shortage of funds for development, operation and maintenance of water supplies and management of water resources; (b) institutional weaknesses especially the scarcity of manpower and the lack of skills of the users to properly operate and maintain water supplies; (c) water resources availability due to its uneven distribution both in space and time; (d) poor choice of technology in water supply development and inconsistent project selection criteria that has resulted in the adoption of technologies and delivery mechanisms, which are not well suited to sector development; and (e) lack of proper co-ordination of the various actors in the sector. Finally: the lack of proper inter-linkages with other water related sectors.

The government is currently implementing the Water Act. The Act states that abstraction is permitted only during flood flow periods on condition that 90 days storage is provided. The irrigation water is in some cases required during the low flow and in the absence of adequate storage facilities. To store water during flood flow for use during the low flow, it is expected that water consumers will abstract water during the low flow. Currently those authorised to abstract irrigation water during the flood flow do not have the requisite storage facilities. Though the Water Act regulates abstraction of lake water through permits the law does not specify the abstraction limit. This is characteristic of open access to lake water with a serious threat to sustainability.

Naivasha watershed management is affected by numerous and sometimes conflicting legislative frameworks. For example, the Water

Act, the Environmental Management and Coordination Act and the Local Government Act have an expressed mandate to conserve the catchment areas, with each institution claiming the leadership role. During the field survey it emerged that the Naivasha Municipal Council is opposed to the Lake Naivasha Management Plan's structure in which the Lake Naivasha Riparian Owners Association is responsible for the implementation of the plan.

Conclusions and Recommendations

Lake Naivasha is at risk of extinction because of the human-induced land use changes. The heightened demand for environmental resources especially land, water and forestry for human settlement threaten to irreversibly damage the watershed. The watershed suffers from water deficit during the dry season. Therefore rising demand for water either from within or outside the basin poses serious threat to its sustainability. The watershed continues to register a rapid growth of population and socio-economic activities and must continue meeting the rising water demand from neighbouring settlements specifically Nakuru Municipality that falls outside the basin.

The water bodies in Lake Naivasha Watershed face serious risks of pollution and nutrient enrichment, because of rapid growth of (rural and urban) human settlements and intensive/extensive commercial and small scale agriculture. Rapid growth of human settlement occurs in the absence of appropriate infrastructure such as water and sanitation.

Inadequate planning and development control in the watershed has exposed the area to a serious threat of environmental degradation. For example, as the lake recedes human settlements and related activities have led to reclamation of wetland, construction of dykes (to prevent the lake from attaining its natural level) and the construction on the riparian reserve.

This paper recommends the following initiatives for the sustainable management of Lake Naivasha Watershed:

1. To develop appropriate institutional frameworks and human resources for effective and efficient watershed management.
2. To meter all major water abstractions, determine sustainable abstraction rates and effectively enforce approved abstractions.

3. To prepare and effectively enforce integrated watershed management plan. This must include: land use zoning specifications, minimum land sizes and riparian reserve conservation.
4. To develop and maintain appropriate physical infrastructure for effective management of the watershed. E.g. in the absence of effective solid and liquid waste management systems it may be extremely difficult to prevent pollution of Lake Naivasha from human and agricultural activities.
5. To promote soil and forest conservation measures in the watershed to reduce soil loss and siltation of Lake Naivasha.
6. To promote efficient farming practices that will conserve water, guarantee safe use and disposal of agro-chemicals. These will release water for increasing water demand and reduce environmental pollution from agricultural activities, respectively

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