

## Ecosystem Services and Livelihoods for the African Great Lakes: Overview and Case Studies



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## **1.0 Introduction**

### **1.1 Overview of report**

This report forms one of the contributions of EAGLO Working Group 3 (Ecosystem Scenario Simulation and Analysis) to the overall EAGLO objectives and deliverables. Specifically, the Ecosystem Services Sub Group (sub group 2) arose from the Scientific Meeting and Second Scenario Workshop in Nairobi, April 2012, along with sub groups dedicated to analysis of co management issues (sub Group 1) and climate change adaptation (sub Group 3). A full report of workshop activities and outputs is provided in the Workshop 2 Report (EAGLO, April 2012; previously supplied to ESPA).

The Ecosystem Services (ES) sub group discussed and produced the following basic remit, within the overall objectives of EAGLO and ESPA, and as agreed with other workshop participants (EAGLO, April 2012):

- i) Production of summary matrix of key ES for EAGLO lakes, based on primary inputs from EAGLO network and analysis of secondary sources.
- ii) Local case studies to explore, analyse and illuminate suites of ES and their livelihood contributions, through empirical work by EAGLO team members. This necessarily engages with issues of value and valuation of ES. Non-economic valuation with local community members is explored, offering a methodological contribution to wider debates (e.g. Fish, 2011; Kenter *et al.*, 2011). Regional scale scenarios, a core strand of EAGLO work, are also downscaled and explored with local stakeholders as part of these case studies, above and beyond the original EAGLO remit.

These elements form the main body of the subsequent report. Prior to this, a brief analysis of wider theoretical concepts and framings is presented in 1.2 below.

### **1.2 Ecosystem Services, livelihoods and valuation**

*1.2.1 Values and valuation:* Recent work on ES/ wider dimensions of wellbeing highlights vigorous and ongoing debates around issues of value and valuation, especially with respect to cultural services and to non-economic valuations. In particular, conceptual and methodological limitations of current especially economic approaches are highlighted (e.g. Infield, Morse-Jones

and Upton, 2012; Kenter *et al.*, 2011). Specific issues relate to group vs. individual valuations and shared values, insights gained from deliberative, participatory approaches, and the relative neglect of cultural services in many ES assessments (*ibid*; Atkinson *et al.*, 2012; Schaich *et al.*, 2010). Ongoing work commissioned through the UK National Ecosystem Assessment follow on phase (2012-2014), confirms these issues as important lacunae in understanding and conceptualisation of ES/ livelihoods linkages and in their wider policy transfer (UK NEA, 2013). It is beyond the scope of the current report to explore these wider contexts in detail. Nonetheless they are highlighted here as important framing considerations for the issues, approaches and contributions of local case study work under EAGLO. Pertinent aspects are highlighted as part of the analysis in Section 4 below.

### 1.2.2 *Aspects of wellbeing*

In accordance with current thinking on the conceptualisation of ‘poverty’ and wellbeing (e.g. DFID, 2012; Fisher *et al.*, 2012; Suich, 2012), we focus on the wider dimensions of wellbeing herein, encompassing not only monetary aspects, but multiple, including non-material dimensions. As highlighted in Section 4, these are derived in the main case study locations at Lake Naivasha, Kenya, through participatory analysis and disaggregated by gender. They thus reflect subjective poverty measures, as per Suich’s definition, supported by and within the wider context of objective poverty measures from local statistics and other secondary data sources.

### 1.2.3 *Frameworks and linkages*

Mapping ES/livelihood relationships by necessity engages with issues of institutions, governance contexts, wider drivers of change, for example climate, population growth, and ways in which these are mediated through diverse social arrangements. As highlighted elsewhere in the overall EAGLO report, the DPSIR framework is widely used in analysis of evolving environment/ society relationships and consequences under specific conditions and contexts. In this particular report we engage with work conducted under another ESPA Framework Grant, ‘*A socio-ecological systems analysis of the political economy of Ecosystem Services for Poverty Alleviation*’ (Patenaude *et al.*), following discussion and agreement with the PI of that project, and to further illuminate and contextualise ES-PA linkages. Aspects of the latter framework are reproduced in the analysis sections below (e.g. Section 4.6), with the explicit permission of its authors, based on a number of discussions with them and on Fisher *et al.* (undated, forthcoming). Through this and informed by existing concerns with institutions, power and governance in case

study areas (e.g. see Harper *et al.*, 2011; Morrison *et al.*, 2011), issues of (differential and evolving) access to resources are highlighted as central in understanding wellbeing and the contributions of ES therein.

## 2.0 Ecosystem Services and EAGLO lakes

A summary table of key ES for all EAGLO lakes, based on primary data from the EAGLO network and analysis of secondary sources is presented overleaf (Table 1).

As outlined above, this is drawn from a range of published secondary sources and input from EAGLO core team members and the wider network of policy/ decision makers who participated in the two main EAGLO workshops (Kisumu, 2010; Nairobi, 2012). A version of the table is reproduced on the website EAGLOnet, wherein embedded links provide more detailed data for specific lakes. The data focuses on the lakes themselves and immediately surrounding areas, e.g. riparian zone and wetlands, and does not aim to provide a comprehensive overview of whole drainage basins for specific lakes. Specifically, we adopted an expert-opinion driven approach augmented with the scientific literature and other "grey" literature to populate the Ecosystem Services Matrix:

- 1. EAGLO Network of Experts:** A survey was sent to all EAGLO members (as listed in Workshop documents) asking each to fill in the matrix for lakes for which they have experience. For Lake Naivasha, information was also taken from the detailed empirical work set out under Section 4 below;
- 2. Other non-EAGLO experts:** The following outside experts were also contacted to further expand the matrix. For lakes Chilwa and Malawi: Chikondi Mbemba and Ganizani Matiki, Ministry of Water Development and Irrigation Services, Government of Malawi. For lakes Albert, Edward, Kyoga and Victoria: Annette Nantongo, Ministry of Water and Environment, Government of Uganda. For Lake Kariba: Gregory Hamuzofi Myaguse, Parks and Wildlife Management Authority, Government of Zimbabwe;
- 3. Scientific Literature.** Each lake name was searched in complete archives of the following journals: *Hydrobiologia*, *Journal of Great Lakes Research*, *Journal of Palaeolimnology*, *Lakes and Reservoirs: Research and Management*, *Limnology and Oceanography*. Papers contain the name were examined and relevant information was used to further expand the matrix;
- 4. Grey Literature/Internet:** Another source of information for some of the lakes was the World Lake Database (<http://wldb.ilec.or.jp/>) as well as information available on travel websites (particularly regarding recreation/tourism values).

**Table 1: Indicative Matrix of Key Ecosystem Services at EAGLO Lakes**

ES	Supporting Services		Provisioning Services										Regulatory Services			Cultural Services		
			Water for consumptive use		Water for non-consumptive use		Aquatic Organisms for Food or other use			Minerals, fuels, etc.			Waste Assimilation <sup>2</sup>	Flood Moderation <sup>3</sup>	Climate Regulation <sup>4</sup>	Recreation/Tourism <sup>1</sup>	Cultural/Spiritual/Existence <sup>1</sup>	Education/Research <sup>1</sup>
			Drinking Water <sup>1</sup>	Irrigation Water <sup>1</sup>	Hydropower <sup>1</sup>	Trans./navigation <sup>1</sup>	Fish/Shellfish <sup>1</sup>	Plants/Fibres <sup>1</sup>	Sand/Gravel <sup>1</sup>	Methane <sup>1</sup>	Geothermal <sup>1</sup>	Oil <sup>1</sup>						
<b>LAKES</b>																		
Albert	O	O	Δ	O	X	Δ	O	X				O	O	O	Δ	O	X	O
Chilwa	O	O	Δ		X	O	O	O	O			X	O	X	X	X	O	Δ
Edward	O	O	O	X	X	X	O					X	O	O	Δ	O	X	O
Kariba	O	O	O	O	O	Δ	O	X	O				Δ	O	O	O	O	O
Kivu	O	O	Δ		O		O				O		O	O	O	O	O	O
Kyoga	O		O		X	X	O	O				X	O	X	X	X	X	O
Malawi	O	O	O	O	O	O	O	X	O			Δ	Δ	O	O	O	O	O
Mweru	O				X	O	O						X	X	Δ			Δ
Naivasha	O	O	O	O	X	O	O	O					O	O	O	O	O	O
Rukwa	O	O	O		X		O						X	X	Δ	O		O
Tana	O	O	O	O	O	O	O	O					O	O	Δ	O	O	O
Tanganyika	O	O	O		X	O	O						O	O	O	O	O	O
Turkana	O	O	X	O	X	O	O					O	Δ	X	O	O	O	O
Victoria	O	O	O		O	O	O	O	O			X	O	O	O	O	O	O

**Basis for rank:**

O = Important

Δ = present

X = not present  
blank = not reported in available sources

**Sources:**

<sup>1</sup> EAGLO network and literature sources (including control of outlet for hydropower)

<sup>2</sup> EAGLO network/ analysis of basin population density

<sup>3</sup> EAGLO network/ literature sources/ evaluation of volume and outlet control

<sup>4</sup> Based on evaluation of area/ volume

In summary, the table illustrates the range and importance of ES derived from East African Great Lakes, albeit without facilitating detailed analysis of inequalities in access or of linkages between specific ES and aspects of wellbeing. These issues are explored further for case study lakes in Section 4. At an aggregate level, key provisioning services common across all lakes comprise water (drinking, livestock, irrigation), food sources especially fisheries, plus a range of regulatory and supporting services. Cultural services are also widely reported, although primarily linked to tourism/ education. Spiritual/ existence values are less widely recognised. ES from the lakes and riparian zones alone thus contribute to multiple dimensions of wellbeing, notably basic needs such as adequate livelihoods; health related attributes such as (clean) water, and wider dimensions of health and a healthy environment (clean air, lack of pollution/ pollution control e.g. through waste assimilation). The importance of cultural services also suggests contributions to leisure as a dimension of wellbeing.

To move beyond the static ‘snapshot’ offered by Table 1, as highlighted in EAGLO workshop reports, ES and associated livelihoods in the Great Lakes are undergoing significant processes of change. Common drivers of change across the region include population growth, urbanisation and climate variability. These typically precipitate degradation of key ES, with consequent adverse effects on livelihoods. The most recent Global International Waters Assessment (GIWA, 2006) for the East African Rift Valley lakes draws on established GIWA categories of freshwater shortages, pollution, habitat and community modification, unsustainable exploitation of fish and global change to highlight common experiences of ES degradation across Turkana, Victoria, Tanganyika and Malawi lake basins. Recommended policy responses unsurprisingly vary spatially, according to the particular contexts, but governance issues, ES values and valuation emerge as critical aspects of tools and responses. For specific lakes, trends in particular ES and livelihoods, wider drivers of change and governance/ institutional responses highlight policy lessons for supporting the ES/PA nexus into the future. Dimensions of these are explored briefly below with respect to Lakes Tana and Kivu, as EAGLO case studies and based on expert contributions from EAGLO members (Boxes 1 and 2). More in-depth analysis of the Naivasha case study is presented in Sections 3 and 4, to highlight i) livelihood contributions of specific ES, ii) access, governance and distributional issues, iii) values and valuation and iv) local relevance of regional scenarios.

## Box 1: Lake Tana, Ethiopia: Key ES under threat (Adgo, 2012)

### 1. Introduction

Geographically situated between latitude 10°58'–12°47' N and longitude 36°45'–38°14' E, the watershed consists of 347 Kebeles (Peasant Associations) and 21 Woredas (districts) in four administrative zones (IFAD 2007). Located at an elevation of 1840 masl it is the highest lake in Africa. Its maximum depth is 14m with a decreasing trend due to siltation and lowering water level. Lake Tana, the source of Blue Nile, is the largest lake in Ethiopia and the third largest in the Nile Basin. It accounts for nearly 50% of the total inland water area in the country. The lake comprises 37 islands and 16 peninsulas, which are home to 21 churches and monasteries with strong cultural and religious heritage. It contributes some two thirds of the total flow of water to the Nile (SMEC, 2007). Lake Tana receives its water from 60 rivers and streams that flow from the catchment area of 16,500 km<sup>2</sup>; four large rivers, Gilgel Abay, Gumara, Rib and Megech account for the major water inflow (Kebede et al., 2006).

### 2. Main Livelihood/ Demographic issues

Lake Tana basin has an estimated population of 3 million with an average population density of 258 persons/km<sup>2</sup> (Berhanu et al., 2001). Rain-fed farming is the mainstay of the economy for the mainly rural population in the basin. The Lake Tana basin is one of the major food producing areas of Ethiopia, and hence has critical regional and national significance. Crop production and livestock raising are closely integrated. The main crops are cereals (*Eragrostis tef*, finger millet, maize, rice, etc), pulses (faba bean, field pea, chick pea and grass pea), oil crops (noug - *Guizotia abyssinica*), Ethiopian mustard (*Brassica carinata*), lentil, flax and others) and some vegetables. There is a cereal dominated (over 70% of the cropland) crop production system and a notable absence of perennials. The fine grained cereal teff in particular requires repeated cultivation for a fine seedbed preparation and provides little ground cover during the most erosive storms of June, July and early part of August that exacerbates soil erosion and soil structure collapse.

### 3. Main environmental/ climatic issues

Extensive catchment degradation driven by population growth, deforestation, overgrazing, low levels of technology and improper land management practices have reduced the productive capacity of land in the basin and its carrying capacity (Nyssen et al., 2004). This problem results also in high sediment loads, lake level fluctuations and decreasing water storage capacity of the lake. The seasonal rains cause the lake level to fluctuate yearly by about 1.5 m (Kebede et al., 2006). The largest lake level fluctuation recorded was about 2.5 m in 1997. Variations in lake levels causes also conflicts among the different users (hydropower, navigation, tourism, fisheries and environment). The Tana-Beles Hydropower Scheme that transfers water from Lake Tana, through a tunnel, to downstream reaches of the Blue Nile may further compromise some ecosystem services of the lake if not properly managed. The newly planned and partly constructed reservoirs in the basin, designed to generate additional electric power and to enable irrigation of more arable land, could significantly affect the water and sediment inflow in the lake in future, as well as other ecosystem services. Furthermore, trends in urbanisation, as well as agricultural practices are linked to increased concerns with waste and associated pollution of the lake ecosystem (Ligdi et al., 2010), all within the wider context of climatic variations.

### 4. Summary of main ecosystem services associated with the lake and its immediate environs

The lake is used for transportation, hydropower, fisheries, ecotourism, wetland products and it has a large diversity both in flora and fauna with 15 endemic fish species (Eshete, 2003). It has rich aquatic biodiversity such as endemic fish species (15 types) and other important species (cf. Dejen 2003, Getahun et al. 2008, Nagelkerke 1997) with the last flocks of Barbus; habitats for hippopotamus and reptiles like the Nile crocodile; rich in invertebrate diversity. The wetland area around the lake is also habitat of the Fogera cattle breed: one of the best native Ethiopian milk cow breeds which is at risk of genetic dilution. Important bird nesting and sanctuary areas of global importance (cf. Francis & Aynalem 2007, Tassie 2007, Tassie & Bekele 2007): 500,000 ha are estimated Important Bird Areas (IBAs) that qualify as Ramsar sites (Birdlife International, 2002). Many indigenous medicinal plants are also found in the basin such as endod (*Phytolacca dodecandra*), kosso (*Hagyinia abyssinica*), gesho (*Rhamnus prinoides*), wanza (*Cordia africana*) and girawa (*Vernonia amygdalina*) (IFAD 2007: 15) and with 67 documented plants from the natural forest of the Zegie Peninsula alone (Teklehaymanot & Giday 2007).

### 5. ES and livelihoods: key issues

These diverse ES are critical to supporting local livelihoods. Two hydro dams provide a total capacity of more than 290 MW. The recession agriculture around the Lake is sustaining millions of people. Fishery, navigation and tourism are also major services of the Lake. It has also century old monasteries which are important from religious perspectives as well as tourist attractions. Many people also earn their livelihoods through the selling of papyrus leaves. The lake basin also constitutes a major biodiversity hotspot area. A feasibility study has been conducted for a potential Biosphere Reserve at Lake Tana, published by the German Federal Agency for Nature Conservation (BfN) (available at <http://www.succow-stiftung.de/>). Soil and water conservation activities are ongoing in the basin, designed to help curb the problems of siltation and volume reduction of the Lake. Nonetheless at present critical ES are at risk from population growth, poor land management and associated siltation of the lake, hydropower and pollution. According to a number of studies (e.g. Ligdi et al., 2010, p.112; Tesfahun and Demessie, 2004), despite the importance of ES for livelihoods, hydropower etc within the basin and beyond, in recent years management has been flawed, 'unsustainable and barely controlled'. These trends in ES degradation are generating conflicts between resource users linked to net scarcity of, but critically also, differential access to key ES. Attempts to mediate and resolve these conflicts call for attention to enhanced management practices, incorporating the principles of ecohydrology (Ligdi et al, 2012).

### 6. Governance responses

To curb these problems a number of development and research initiatives are currently being carried out. Based on the lessons of previous soil and water conservation efforts of the last 30 years and pilot watershed development initiatives of different organizations, a Community-Based Participatory Watershed Management approach has been adopted as a policy to land management and community development by the Ethiopian government since 2005. Since 2010 land resource management has been taking place in the form of Natural Resource Development Campaign in many regions. Accordingly, each Kebele (smallest administrative unit) is supposed to have at least one pilot micro watershed site (with an area of maximum 500 ha) and implement natural resource management activities including rural road construction, spring development, afforestation etc. Each household is supposed to contribute at least 21-days/year free labour for such works during slack periods of the year (January to March). For example, in Amhara region, close to 7.2 million people were participated in the campaign with an equivalent value of close to \$0.65 billion in this year alone. Communities are being organized in working groups and development groups. Chains of technical and organizational supports are given to the community from the kebele up to the regional levels. In some cases communities have developed their own bylaws to be enforced whenever members violate agreements and working modalities. Though not yet at wider scale, positive outcomes are being observed in different places that give hopes for effective reversal of the alarming degradation of natural resources in the Basin as well as in the country at large.



Lake Tana (Agdo, 2012)

## **Box 2: Lake Kivu, Rwanda (Ngendahayo, 2012)**

### ***Governance issues: Nutrient Management Success***

Environmental management in Rwanda has drawn consistent attention and support from the Government and various donors. Having noted that natural resources upon which communities depend for their livelihoods are being degraded and depleted with loss of income levels among resource users, it was imperative for the Government to take affirmative action to protect and conserve these resources. The Government developed the Decentralization and Environment Management Project (DEMP) among other initiatives, to address some of the top priorities of environmental management and poverty reduction through decentralization. Decentralization is here recognized as a mechanism to empower citizens to conceptualize, plan and manage their own development activities, since they know better than anyone else, the problems that affect them. Local communities and their leaders are more knowledgeable about and have bigger stake in the natural resources in their areas. Environmental protection and sustainable natural resources management is more effectively and efficiently realized by actions at local level where degradation occurs. Lake Kivu and the entire hydrological system in the Western Province were threatened by the degradation of lakeshores and river banks, resulting in siltation and pollution. This area was faced with high degradation pressures, which threaten livelihoods of the riparian communities. Nutrients loading and concentration in Lake Kivu could enhance eutrophication of the aquatic system as a consequence of human activity, with increased inputs of urban and industrial wastewater and agriculture runoff containing C, P and N. This leading to many changes in the structure and function of the ecosystem and thus the services it provides.

The DEMP has contributed to the successful decrease of nutrients loading to the Lake Kivu through the establishment of the 50 meters buffer zone as provide by the Organic Law n° 04/2005 of 08 May 2005 determining modalities of protection, conservation and promotion of environment in Rwanda, particularly articles 85,86 and 87 gives a provision of a setback line of 50m from the present shoreline in which no development activities are allowed. DEMP facilitated the districts in contracting and supervising local enterprises to establish protection belts along the Lake Kivu shores and on the banks of main rivers and streams draining into Lake Kivu. The project has assisted the districts to prepare tender documents, hiring and supervision of contractors, and of course providing the funds. The activities undertaken by the contractors are: surveying and clearing the land, identification and purchase of planting materials, planting and tending to the vegetation (i.e. elephant grass, pasparum and bamboo belts on the lake Kivu shores and along the river banks for rivers and streams draining into Lake Kivu. DEMP has been arguably, one of the few interventions that attempted to address environmental sustainability through capacity strengthening at all levels in a complementary way.

The above brief case studies share some critical commonalities:

- Both highlight the diversity of basin ES and their critical roles in livelihood support for multiple local stakeholders, against a wider background of resource depletion, climate change and demographic pressures.
- Both highlight the importance of devolved governance and co-management in shaping evolving ES/livelihood relationships. Effective stakeholder participation encompasses multiple issues such as access rights and enforcement, ‘ownership’ and knowledge exchange. Co-management and community participation by no means constitute a panacea to downward trajectories in ES and livelihoods, but can support constructive, adaptive responses. Enabling contexts and conditions and transferability of local success stories are explored further in the final EAGLO Co-management report and in the EAGLO Nairobi 2012 workshop report. They are also highlighted for the Naivasha case study, below.

## **3.0 Lake Naivasha, Kenya: Socio-economic and environmental contexts**

### **3.1 Introduction**

According to Kenya’s flagship ‘Vision 2030’, aspirations for well-being and prosperity are intrinsically linked to sustainable and equitable poverty alleviation, premised not only on

economic growth, but on environmental protection, with increasing recognition of the role of ES in supporting livelihoods (Kenya Vision 2030, 2012). The latest reports on Kenya's progress towards the Millennium Development Goals highlight environmental issues, notably deforestation and loss of ES as critical areas of concern and despite progress elsewhere (UNEP, 2012). Diverse policy and donor initiatives emphasise the role of ES (e.g. DFID, WRI etc), not least through PES schemes in supporting livelihoods.

It is within this wider national context that the EAGLO Lake Naivasha case study enables further insights into spatially and socially differentiated contributions of diverse ES to aspects of livelihoods/ wellbeing. As argued by Upton (2012) it epitomizes aspects of contemporary challenges in resource governance, livelihoods and the utilization and conservation of ecosystem services in the EAGLO region. It thus offers an ideal local case study for exploration of aspects of the EAGLO and wider ESPA agenda. Multiple, diverse stakeholders in the lake environs encompass pastoralists, small and large scale farmers throughout the catchment, fishermen, flower farms and their workers and lakeside communities. Recent challenges, as documented in Harper *et al.* (2011), include anthropogenic factors such as over-exploitation of lake waters and human-induced degradation of natural capital in the catchment. Coupled with population pressure and climate variability, these challenges have given rise to the perceived need to 'save the lake', often linked to the very recent development of new governance structures and initiatives such as *Imarisha Naivasha* (Harper *et al.*, 2011). Furthermore, recent transformations of local environmental governance structures, the latter facilitated by devolution of rights under Kenya's Water and Forest Acts (2002 and 2005 respectively), have created opportunities for new participatory responses to ES degradation and conflicts in the basin and for reshaping the politics and practices of resource access (Harper *et al.*, 2011; Morrison *et al.*, 2011). Their efficacy and limitations offer valuable, transferable lessons for policy makers.

### **3.2 Lake Naivasha: overview and challenges**

According to the Naivasha District Development Plan (2008-2012) key challenges and constraints in the district comprise rural-urban migration and associated population growth, low income and poor food security, inadequate infrastructure, health issues (especially HIV/AIDS) and high levels of environmental degradation (Ministry of State for Planning, National Development and Vision 2030, 2009; KWS/WWF 2012). The latest draft Integrated

Management Plan, released in 2012, confirms critical issues, or as they describe it ‘glaring conflict issues’ in the Basin as:

- Population pressure and land fragmentation
- Land use/NRM practices (forest clearance, overstocking etc)
- Protected Area (PA) issues – illegal encroachment and gazettement without local consultation
- Struggles over riparian land tenure and exclusion of some stakeholders from resource access (e.g. pastoralists from access to lake water)
- Water allocation: equity and conflict
- Equitable benefit sharing from NRM
- Poor regulation and compliance
- Lack of access to information for many stakeholders

(After *Lake Naivasha Basin Integrated Management Plan [Draft], 2012-2022*, KWS and WWF)

Recent poverty estimates classify some 39% of District residents as poor (i.e. ‘unable to afford minimum basic human needs, composed of basic food and non food items’) with a trend towards increasing poverty (*ibid*, p. 39; Wandera, 2008). Within the District, Naivasha Division, encompassing the Lake and its environs, has the highest population density (estimated 207 persons per sq. km, 2012), associated with the sprawling, often informal urban settlements around the lake edge, housing many of the districts flower farm workers. Urbanisation notwithstanding, agriculture (including commercial and small holder farming, pastoralism and horticulture/ floriculture), comprises the main economic activity, employing more than 70% of the population and typically contributing some 80% to household incomes (*ibid*). Reliance on rain fed crop farming, typical of smallholder farming and in harsh and increasingly variable climatic conditions, has been identified as a major contributor to food insecurity in the District. Available disaggregated statistics classify 48% of urban and 36% of rural residents as poor, with 36% of all residents experiencing food poverty (*ibid*). According to the Naivasha District Development Plan aspects of poverty in the district are highly gendered, with female-headed households over represented in official poverty statistics and women generally suffering particular constraints such as lack of access to credit and lack of control of income from agricultural production, despite their central roles in small scale agriculture across the Basin. A

further dimension of ‘ill being’ is the paucity of women in leadership roles in new, devolved community-based and co-management organisations such as WRUAs. These interlinked trends of growing poverty and degradation of ES are occurring with wider contexts of recent rapid population growth (from 238,000 in 1977 to 650,000 by 2009), urbanisation and growing climate variability.

Preceding attempts to tackle poverty and environmental degradation in the District, for example through the 2002-2008 District Development Plan, linked to the national Poverty Reduction Strategy Paper, were reportedly constrained by factors including insufficient resources, poor physical infrastructure, lack of technical personnel and poor community engagement (Ministry of State for Planning, National Development and Vision 2030, 2009). Environmental degradation also constitutes both a constraint on and an outcome of development efforts, where these have been linked to deforestation, overgrazing, pollution and soil erosion. Future development visions focus on sustainable agriculture and resource use in explicit recognition of links between poverty reduction and environmental sustainability. However these are typically sectoral approaches and do not entail an ES based analysis. As recent donor initiatives in the basin have recognised, (lack of) access to natural resources and resource utilisation constitute the main drivers of local poverty, given high levels of reliance on natural resources and increased pressure on these resources; thus emphasising the importance of locally relevant, sustainable development in the future (Wandera, 2008).

**Box 3: Lake Naivasha, Kenya: envisioning sustainability (Pacini, 2012)**

<p><i>Goals, attributes and aspects of sustainable development at Naivasha (after Pacini, 2012)</i></p> <ul style="list-style-type: none"> <li>• Supporting local communities to become richer, healthier, better educated, and more aware of the challenges and opportunities offered by their surrounding environment and their use of ES.</li> <li>• Intensifying sustainable outputs from resource use, careful planning of inputs, to obtain higher revenues (conservation farming, water recycling, agroforestry, ‘precision agriculture’).</li> <li>• Identify, protect and restore ecosystems that provide key regulatory and supporting services, such as: 1. Pristine forests in highlands, 2. Riparian vegetation around the lake, 3. Desertification-prone rangelands providing grazing resources and, 4. A healthy lake.</li> <li>• A number of existing and emergent spontaneous sustainable and livelihood supporting practices able to enhance Ecosystem Services for the benefit of a greater number of people, can already be found in the Lake Naivasha catchment:             <ul style="list-style-type: none"> <li>○ Upper catchment farmers practicing agroforestry under PES scheme to reduce soil erosion.</li> <li>○ Dryland farmers practicing water harvesting (runoff and roof-tops) and enhancing soil infiltration.</li> <li>○ Communities are restoring and protecting small rural dams to enhance supply of clean water.</li> <li>○ Large-scale farmers around the lake reserving riparian land for the benefit of wildlife and for the preservation of the riparian vegetation, which controls lake water quality.</li> <li>○ Lakeside communities restoring Papyrus to enhance its multiple ecosystem benefits.</li> <li>○ Pastoralist communities protecting pristine forests in a shared resource management mode.</li> <li>○ Flower farms reducing water abstraction from the lake and pollution release.</li> </ul> </li> <li>• New and emergent governance mechanisms offer both challenges and opportunities in this respect (Harper <i>et al.</i>, 2011).</li> </ul>
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Water allocation emerges as a critical and particularly contentious issue in the Naivasha Basin. New participatory mechanisms such as Water Resource Users Associations (WRUAs), created through the 2002 Water Act, were an important step in enabling devolved governance and co management. However, ongoing issues include legitimacy of stakeholders, limited participatory processes and marginalisation, linked to differential resources access. As highlighted in Harper *et al* (2011), pastoralist groups in particular have experienced restricted water access in riparian areas, albeit within rapidly evolving institutional contexts, shaped by policy/donor interventions. The recently published Naivasha Basin Water Allocation Plan (WRMA, 2011) re emphasises the need for sustainable and equitable water rights and access, but realisation of these goals continues to present a challenge; governance and access issues, with specific attention to the needs of the poor, continue to be highlighted as ‘priority water related challenges’ for the Basin (e.g. in Alliance for Water Stewardship, undated). It is within this wider context that a series of interviews, workshops and focus groups were held in the Basin as part of EAGLO ESPA work between 2011 and 2012.

#### **4.0 Lake Naivasha, Kenya: ES and livelihoods**

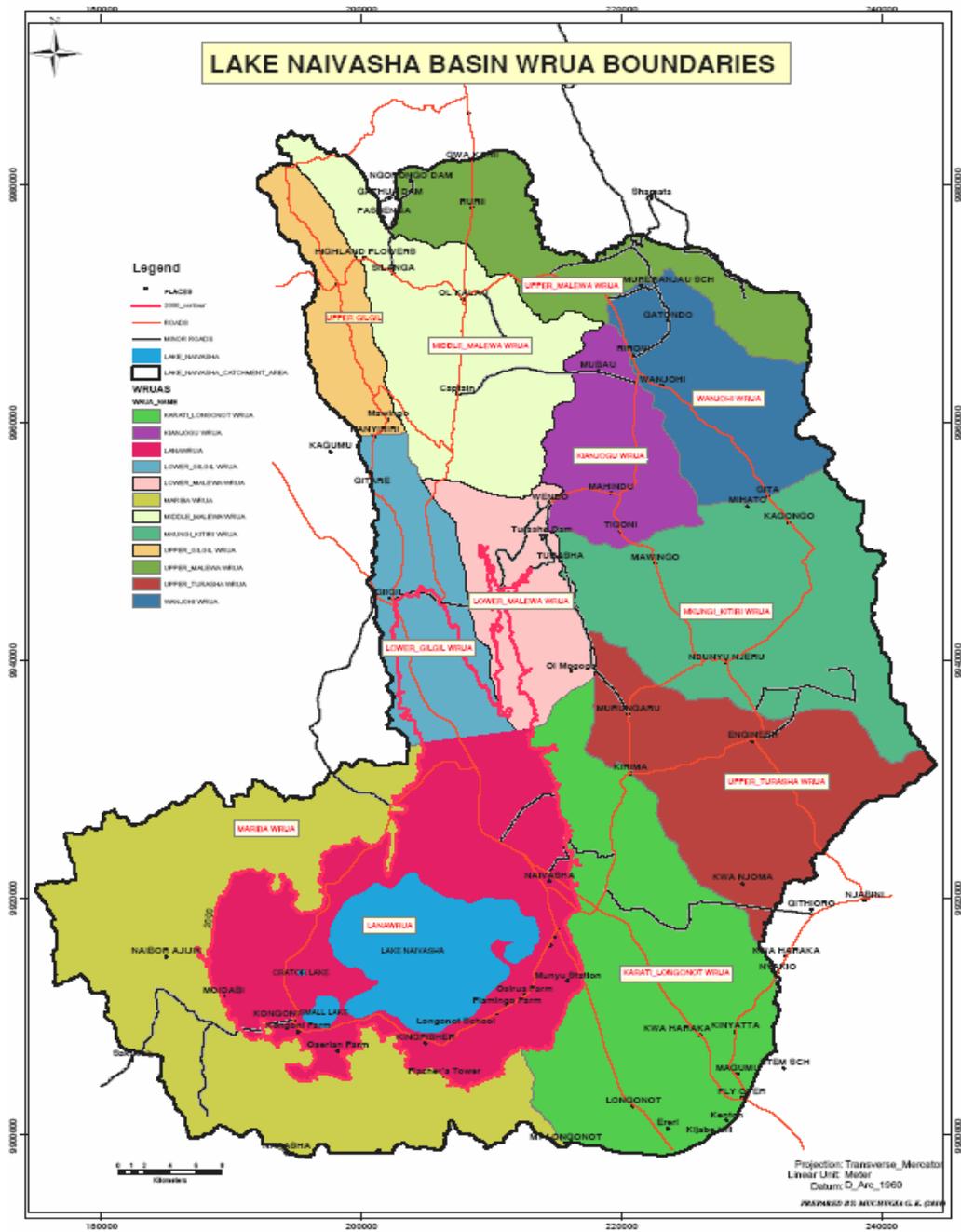
The following sections present primary data from EAGLO activities with stakeholders in the Naivasha Basin, supplemented by work at Lake Victoria (specifically on papyrus use and restoration). In accordance with EAGLO objectives and ESPA goals, the data presented herein aims to i) explore and identify key ES for diverse stakeholders, ii) identify trends in ES and drivers of those trends, iii) examine (changing) contributions of particular ES to aspects of well being for diverse stakeholders, including analysis of local perceptions/ meanings of ‘wellbeing’ iv) elicit non economic values of ES from stakeholders, and v) downscale scenarios to examine local narratives, visions and tradeoffs.

##### **4.1 Lake Naivasha: Preliminary identification of ES**

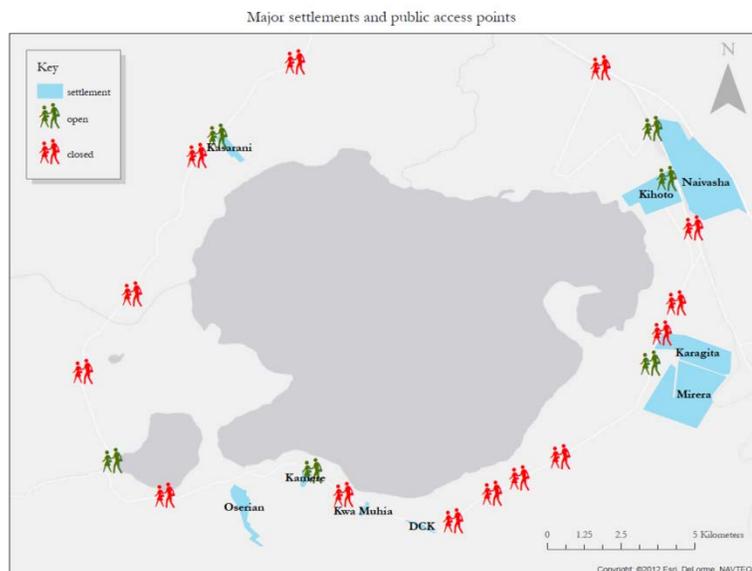
Preliminary identification of key ES was undertaken with >100 stakeholders at locations across the Naivasha basin in August 2011. Selection of study locations was based on geographical characteristics and coverage, livelihood strategies and livelihood levels (poverty) and designed to explore key manifestations of diversity in ES/livelihood linkages within the basin. Further analyses of these issues, including gendered dimensions, and based on follow up workshops, is presented in Sections 4.2-4.4.

Map 1 shows Lake Naivasha's Water Resource User Association (WRUA) areas. Locations of Karagita, Kamere, Kihoto and Naivasha Town are indicated in Map 2 (overleaf).

Of the WRUA areas included in the initial survey, Mariba WRUA is dominated by Maasai pastoralists, with Upper Gilgil in the upper catchment dominated by sedentary, subsistence farmers. According to district poverty statistics these are some of the most marginalised residents in the Basin, located in areas of key environmental challenges and degradation (notably deforestation, soil erosion etc). Karagita, Kamere and Kihoto are lakeshore settlements, located in LaNaWRUA, wherein ES are heavily affected by upper catchment activities, for example through sedimentation linked to up gradient soil erosion, water availability/ off take etc. As for the rural WRUAs, local statistics indicate high levels of poverty, in these latter cases in the context of rapid urban development around the lake area. Residents exhibit diverse livelihood strategies, with Karagita residents being mainly flower farm workers and families, while Kamere residents include workers at the nearby geothermal plant, plus flower farm workers and families. Thus waged labour typically provides a contribution to livelihoods for members of these groups as part of a portfolio of strategies, although unemployment levels are high (Ministry of State for Planning, National Development and Vision 2030, 2009). Kihoto respondents are small scale farmers, who cultivate lakeshore/ riparian plots. A small number of urban Naivasha Town residents were also included in the study.



Map 1. Lake Naivasha Water Resource User Associations (WRUAs).



Map 2. (Source: Morrison, 2013)

Methodologically, participatory approaches to non-monetary valuation, as advocated in Fish *et al* (2011), were used to initiate ES evaluation. Specific research activities comprised short structured interviews with individuals (both male and female), designed to examine recognition of particular types and categories of ES. Results, disaggregated by location and stakeholder livelihood strategies, are summarised in Table 2, overleaf. Respondents were also encouraged through informal discussion to elaborate on key ES, how these contributed to their livelihoods/well being, and key challenges and/ or trajectories of change. Gendered dimensions of wellbeing, resource use and access, are explored further for workshop participants in Section 4.2-4.4 below.

#### 4.1.1 Results

*i) For farmers in the upper catchment* (Upper Gilgil WRUA), ES support livelihoods based on small scale agriculture, through growing of food crops (potatoes, maize, green vegetables and fruits etc) for domestic consumption and local sale of cash crops (potatoes, peas, cabbage etc). The sale of excess milk from domestic cattle provides another income supplement. Fish are caught locally (carp from local dam) and also imported. Drinking/ domestic water is derived from wells and rainwater harvesting, with reliance on low quality stream sources in the dry season. Irrigation where present is small scale, used during the dry season, to extend the growing season and maximise income. Agroforestry, using traditional tree species, is an important strategy with localised planting between private plots. Medicinal plants and other NTFPs are



recognised contributions to livelihoods, although the former are not traded, but used personally, despite diminishing knowledge of herbal plants. Soil erosion and declining fertility are key issues, with increasing reliance on manure as a fertiliser as prices of commercial fertilisers increase. A variety of cultural services were widely recognised in Upper Gilgil, with local water bodies used for baptism, the association of indigenous trees with traditional culture and recreational uses. Aesthetic values nonetheless prioritise ordered farmland, over ‘natural’ landscapes.

Critical ES/ livelihood linkages in this upper catchment WRUA were cited by respondents as population increase, linked to natural growth rates and to influxes from other areas in the aftermath of tribal violence; associated issues of land scarcity and diminishing plot sizes; decreasing water levels in wetlands due to over-abstraction and siltation; general water scarcity for livestock and domestic use; food security. Low market prices for crops, associated with poor transport links and thus widespread reliance on middlemen who pay low prices, were cited as key aspects of poor livelihoods. Recent market surveys support the impact of low margins and poor ‘farm gate’ prices on small scale farmers livelihoods in the upper catchment: as highlighted in Wandera (2008) for one acre of land and production of basic staple crops such as potatoes or cabbages, costs (land preparation, labour, fertiliser etc) may outweigh income, given low productivity, little opportunity for ‘scaling up’ and influence of agents or middlemen in determining prices.

*ii) For Maasai respondents in Mariba WRUA a comparable range of key ES are identified, although cash crops are largely absent, with the recent exception of some snow pea production in the upper part of the WRUA. Many foodstuffs are bought from other farmers, although some Maasai have adopted agro pastoralist lifestyles, while others lease their land to Kikuyu farmers. Wild plants and vegetables are also commonly used to supplement diets. Irrigation is generally absent, with domestic water supplies derived from a local river. Herbal medicines are widely used, typically from local forest plants. Regulatory ES are recognised and valued, especially flood moderation, climate regulation and erosion control. Cultural services including sacred trees, contributions to cultural identity, recreational uses, aesthetic and educational values were*

widely recognised. Critical ES/ livelihood related linkages in this WRUA were cited as



All images in this section: Upper Mariba WRUA (N. Pacini, 2011)

deforestation by Kikuyu, diminished rainfall, lack of land, need to conserve biodiversity, growing water scarcity and need to protect water sources. The issue of deforestation/ forest degradation was highlighted as the key challenge, where people migrate to and clear the forest for cultivation, resulting in erosion during the rainy season.

*iii) For Kihoto farmers in the lower catchment, cash crop production makes an important contribution to livelihoods, with local production of crops such as French beans, tomatoes, onions etc. Livestock are few, so meat and milk products are usually purchased, as are fish. Drinking water is typically purchased from water vendors, boreholes or procured by rainwater harvesting, with quality of borehole water often poor. Charcoal for fuel is produced in Kihoto with significant adverse impact on local acacia stands. Decreasing water levels, erosion control and reductions in soil fertility were highlighted as key issues. Cultural services were accorded less importance than elsewhere; according to local farmers because of increasing heterogeneity of the population, linked to lesser place attachment, and absence of sacred sites. Wild animals, especially hippopotamus and water buffaloes, were seen as threats to riparian farms, with papyrus providing a habitat for the latter.*



All images in this section Kihoto/Lana WRUA (N. Pacini, 2011)

iv) For urban residents in Kamere and Naivasha Town, critical concerns centred around pollution of the lake, e.g. from sewage, pesticides; population growth and invasive plants in the lake preventing boating (especially water hyacinth).

v) *Papyrus/ Riparian ES*. As indicated in Table 2, aquatic plants and fibres were widely recognised as an important ES amongst lakeshore LaNaWRUA respondents. Papyrus (*Cyperus papyrus*) is notable here, albeit primarily for perceived links between papyrus wetlands and clean water provision. Recent analysis through EAGLO has highlighted differing perceptions and uses of papyrus ES amongst stakeholders at Naivasha and in a comparable study at Lake Victoria.

#### **Box 4. Riparian ES: papyrus (Harper 2013)**

As part of the EAGLO strategy of developing parallel case studies to support the regional lake management approach, Harper *et al* focused upon the ecosystem services actually and potentially available for poverty alleviation (livelihoods improvement and wellbeing) from the riparian ecotone at the Naivasha catchment, Kenya. This is expected to provide approaches and methods which can be applicable region-wide. The main approach was to riparian vegetation and its utilisation and most work was focused upon *Cyperus papyrus*, common name papyrus, which forms single-species communities at lake edges and in swamps. Papyrus is among the most productive plants in the world. Above ground papyrus net primary production in Naivasha had been earlier estimated to 2.51 kg C m<sup>-2</sup> year<sup>-1</sup> and was characterised by high turnover of 1.7 kg C m<sup>-2</sup> (Muthuri et al. 1989); under optimised conditions papyrus productivity can become much higher (Jones & Humphries, 2002).

We have quantified the use of papyrus by local communities elsewhere – it is exclusively harvested by poor riparian communities in the Kenyan part of Lake Victoria (Morrison *et al.*, 2012). This has enabled us to evaluate the socio-ecological barriers to promoting its sustainable use at Lake Naivasha (Morrison et al., in press a), where the papyrus swamps have been reduced from 60km<sup>2</sup> to <0.67 km<sup>2</sup> (Morrison & Harper, 2009); incorporate them into a management strategy (Harper *et al.*, 2011; Morrison *et al.*, in press b) in the 5-year management plan of the lake para-statal, ‘Imarisha’ (Anon, 2012). Structured comparisons between Lake Naivasha and Lake Victoria highlights local recognition of a much wider range of ES associated with papyrus at the latter, wherein consumptive uses of papyrus as fuel; livestock fodder; baskets, mats etc for local sale occur in conjunction with recognition of provisioning services such as clean water at both lakes (Morrison *et al.*, in press a). We have further evaluated the socio-ecological possibilities of restoring papyrus by developing its sustainable use for harvesting to make fuel briquettes at Naivasha (Morrison *et al.*, in press c) since both urban and rural poor primarily use charcoal, most of which is illegally cut from forest reserves in this area. Critical issues for future monitoring will be sustainable and equitable resource utilisation, given that new perceptions of resource value may trigger competition, disputed access rights and over exploitation in the absence of robust, (co)management mechanisms.

#### **References (EAGLO project):**

Harper, D.M, Morrison, E.H.J., Macharia, M.M., Mavuti, K.M., Upton, C. (2011). Lake Naivasha, Kenya: ecology, society and future. *Freshwater Reviews* 4, 89-114.

Morrison, E.H.J. & Harper, D.M. (2009). Ecohydrological principles to underpin the restoration of *Cyperus papyrus* at Lake Naivasha, Kenya. *Ecohydrology & Hydrobiology* 9, 83-97.

Morrison E.H.J, Upton, C., Odhiambo-K’oyooh, K. & Harper D.M., (2012). Managing the natural capital of papyrus within riparian zones of Lake Victoria, Kenya. *Hydrobiologia*, 692; 5-17

Morrison, E. H. J., Upton, C., Pacini, N., Odhiambo-K’oyooh, K. & Harper, D. M. (in press a) Public perceptions of papyrus: community appraisal of wetland ecosystem services at Lake Naivasha, Kenya. *Ecohydrology & Hydrobiology*

Morrison E.H.J., Upton C., Pacini N., Mavuti K.M. Chege N.E., Ole Kiminta E. & Harper D.M. (in press b). Integrated Ecohydrology for Integrated Catchment Management: Lake Naivasha, Kenya, a global reference project. In Khan, S (Eds) *Ecohydrology*, Cambridge University Press.

Morrison, E.H.J. Banzaert, A. Upton, C., Pacini, N., Pokorný, J. and Harper, D.M. (in press c) Biomass briquettes: a novel incentive for managing papyrus wetlands sustainably. *Wetlands Ecology & Management*.



Naivasha lakeshore and papyrus (E. Morrison, 2012/2013)

**4.2 Further evaluation of ES** was undertaken in follow up focus group discussions across the Basin in 2011 and primarily as part of a series of residential workshops at the University of Leicester (UOL) camp at Lake Naivasha in 2012. The latter form the focus of the following section.

Workshop activities focused on identification, ranking and trend analysis for key ES, followed by discursive exploration of wellbeing and wellbeing-ES linkages; through a sustained series of focus group and deliberative in-depth discussions and activities over 1-2 day periods in April/ May 2012. Methodologically, these techniques follow emergent thinking on the importance and efficacy of participatory approaches to (non-economic) valuation of ES and to explorations of multiple aspects of wellbeing and ES contributions therein (DFID, 2012; Fish *et al.*, 2011; Suich, 2012). Economic valuations are outwith the scope of this project; rather we focused on elicitation and exploration of local values, perceptions and voices, within the wider context of secondary data on poverty and ES trends in the Basin (*ibid*).

Participants at Workshop 1 were women from Upper Gilgil, Middle Malewa and Mariba WRUAs; while Workshop 2 comprised male participants, including Kihoto farmers, Karagita residents and fishermen/ boat operators, the latter being based in various settlements around the lake. Workshop composition was thus designed to build on earlier surveys through enabling exploration of geographical and livelihood-based differentiation, whilst also bringing gender issues into more explicit focus. For both male and female workshops, 12 participants for each were invited through and identified in conjunction with local research partners to include the poorest and most resource dependent households across the spectrum of geographical locations, gender and livelihood activities. Fishing and boat operation are almost exclusively male occupations.

### **4.3 ES at Naivasha: trends and ranks**

Following Fish *et al.* (2011) and Lamarque *et al.* (2011), workshop participants were asked through discussion in WRUA/ livelihood related sub groups, to identify the key benefits derived

from the environment for their livelihoods/ wellbeing. Results disaggregated by gender and WRUA/ livelihood strategy are summarised in Table 3 overleaf, according to categories of ES.

These were then ranked from 1-10 by participants according to the perceived value of the ES (where 10 is high). Respondents deliberated the identification and valuation of ES by sub groups within each workshop, according to WRUA for the women's' workshop, and occupation/ residence for the men's' group. They were not required to achieve consensus on the ranking and scoring, but in all cases were able to do so within sub groups. Differences between subgroups were then discussed fully between all participants to further elucidate critical aspects of ES recognition, use and value. Respondents were also asked to identify current trends in key ES and drivers of change. Again, these were subsequently discussed by the workshop group as a whole to further explore perceived trends and livelihood impacts.

As highlighted in Table 3, provisioning services were most highly valued, with critical provisioning services widely perceived as being in decline across the Basin. Only Karagita residents indicated positive trends for drinking/domestic water, related in this case to improved supply from vendors and local water points. In all other cases this critically important service was on a downward trend, driven by pollution and soil erosion from the upper catchment, according to lakeshore residents and by deforestation, soil erosion, siltation and lack of storage according to women from the non lakeshore WRUAs. For these latter areas, deforestation was explicitly linked to population growth and land subdivision, with widely recognised linkages to decreased rainfall. Deforestation especially in the upper catchment is also linked to declining availability of construction materials and fuel. Identified trends are widely supported by secondary sources (e.g. KWS/WWF 2012), albeit being mediated somewhat by localised tree planting in Middle Malewa WRUA and some lakeshore areas according to informants.

Of the few positive trends, fish are becoming increasingly important and available to women in upper catchment WRUAs, through construction of fish ponds, providing both a food and income source. In the main lake however, fish stocks are compromised by water pollution, climate change and increased population pressures on the resource. Bees are also contributing to livelihoods in upper catchment WRUAs e.g. through sale of honey. As highlighted above, papyrus was mentioned primarily in the context of wetlands and clean water provision, with consumptive uses not identified by participants.

		Female respondents (n=12)			Male respondents (n=12)			
	<b>Ecosystem services (ES)</b>	Mariba WRUA	Middle Malewa WRUA	Upper Gilgil WRUA	Kihoto farmers	Karagita residents	Fishermen	Boat guides/operators
<b>Provisioning</b>	<i>(clean) water(d/l/i)</i>	<b>10-</b>	<b>10 --</b>	<b>10 --</b>	10 + (i); 10- (d)	10 +	<b>10 --</b>	<b>10 --</b>
	<i>Construction materials (t/o)</i>	<b>10 --</b>	<b>9 --</b>	<b>9 --</b>	<b>2 -</b>	<b>7 --</b>	3 +	
	<i>Food/crops (c/s)</i>	<b>7 -</b>	<b>10 -</b>	<b>10 --</b>	10 +	<b>10 -</b> (incl. fish)	8 ++	<b>10 -</b> (incl. fish)
	<i>Food: fish</i>	4 +	5 +	3 +			<b>10 --</b>	
	<i>Livestock/livestock products</i>	<b>6 -</b>	8 +	6 +				
	<i>Herbs/medicines</i>	<b>5 --</b>	<b>6 -</b>	3 +		5 ++		
	<i>Fuel/energy (f/c/s/o)</i>	<b>4 --</b>	<b>10 --</b>	<b>7 --</b>		<b>8 -</b>	5 ◇	
	<i>Pasture/grazing</i>	<b>10-</b>			<b>4 -</b>	4 +		
	<i>Fertiliser (hyacinth)</i>				3 +			
	<i>Bees (wax and honey)</i>	4 +	4 +	3 +				
<i>Flowers/ horticulture</i>			5 +		9+			
<b>Regulating</b>	<i>Air quality ('fresh air')</i>	10 +	10 ◇	<b>10 -</b>	5 ◇	<b>10 -</b>		
	<i>Climate regulation</i>					<b>6 -</b>	9 ◇	<b>10 -</b>
	<i>Erosion control (linked to maintenance of tree cover)</i>		10 -	10--			10 ++	
	<i>Pests</i>			2 ++				
<b>Cultural</b>	<i>Tourism/ recreation</i>			1 ◇	3 +	2 ◇	8 ◇	<b>8 -</b> Wildlife as tourist attraction
	<i>Wildlife – aesthetic values</i>	6 ++	<b>3 -</b>	2 ◇ <b>3 - birds</b>				
	<i>Flowers/ trees/ physical features- aesthetic values</i>		<b>7 -</b>	2 +				
<b>S'ting</b>	<i>Soil quality 'good soil'</i>		<b>10 -</b>	<b>9 --</b>	6 +	8 +		

**Table 3: ES: identification, trends and ranking, Naivasha, April/May 2012**

**Key:** Scale/Score: 1-10, denotes participatory scoring of ES by participants based on their analysis of value for their livelihoods

**Trends:** ◇ = no change; ++ marked trend of improvement in ES (quality/quantity/availability), + trend of improvement in ES (quality/quantity/availability), - trend of deterioration of ES (quality/quantity/availability); - - marked trend of deterioration of ES (quality/quantity/availability). **Other:** Clean water (d/l/i): domestic/livestock/irrigation; Construction materials (t/o): timber/other; Food/crops (c/s): commodity/subsistence production; Fuel/energy (f/c/s/o): fuelwood/charcoal/solar/other

Critical drivers of change were thus summarised by workshop participants as poor climate/lack of rainfall and population increase, linked to other factors such as increased pollution and sewage (urban areas); deforestation, soil erosion and land subdivision/competition. All were implicated in negative impacts on ES and livelihoods through declining soil fertility and productivity, linked to food security for example. Women in particular (Middle Malewa WRUA) highlighted links between water scarcity/ poor water quality and time poverty, with increasing time spent collecting water from distant sources. Locally identified aspects of poverty/ well being are explored below, prior to further analysis of specific ES/ livelihood contributions.

#### **4.4 Aspects of wellbeing**

Participant's definitions and understanding of wellbeing were elicited through participatory processes at the main workshops in April/ May 2012. All participants were asked to individually identify as many aspects of wellbeing as relevant to them and to write these on cards supplied, with no limit on the numbers identified (hence the number of responses in Table 4 exceeds the number of participants for both men's and women's groups). On completion of this initial exercise, cards were sorted into groups through discussion and key categories identified. These were listed, discussed and checked by the whole group, to derive Table 4, overleaf.

For both groups, multiple dimensions of well being cross cut four of the five aspects identified in the MEA: basic material needs; health; good social relations; security (Suich, 2012). The fifth, overarching dimension, freedom of choice and action, was not specifically identified by respondents, but typically derives from the earlier four. Basic material needs centred on income/ employment were the most commonly cited dimensions of wellbeing, with associated aspects of food security, livestock and farming methods for the women's group, dominated by small scale farmers in the upper catchment. For most female respondents, income was derived primarily from agricultural activities, although for two participants farming supplemented their main source of income as teachers. Overall, paid work was scarce and rates of pay low for female participants in comparison with men, reflecting wider District norms (Ministry of State for Planning, National Development and Vision 2030, 2009). Climate change linked to drought, in conjunction with poor commodity prices were identified as driving adverse effects on nutritional status and ability to access education especially for the women's group. Education and health related dimensions of wellbeing were critical for both groups. Current statistics highlight a

persistent gender gap in education in the Basin, with lower literacy rates for women (Ministry of State for Planning, National Development and Vision 2030, 2009). Female respondents at the workshop emphasised education as a critical means of accessing other dimensions of well being, notably employment and regular income, and thus as a pathway out of poverty, albeit increasingly being compromised by poor agricultural productivity and income, preventing access to schooling for children, as highlighted above.

**Table 4: Aspects of wellbeing**

	Aspects of wellbeing	Female respondents (n=12)	Male respondents (n=12)
		No. of responses =98 Frequency (%)	No. of responses =85 Frequency (%)
<i>Basic needs and health</i>	<i>Food/food security</i>	<b>8 (8)</b>	1 (1.1)
	<i>Income/employment</i>	<b>19 (19.4)</b>	<b>22 (25.8)</b>
	<i>Good quality livestock</i>	2 (2)	
	<i>Good farming methods</i>	4 (4.1)	
	<i>Shelter</i>	6 (6.1)	
	<i>Adequate clothing</i>	4 (4.1)	
	<i>Education</i>	<b>12 (12.2)</b>	<b>11 (12.9)</b>
	<i>Good health</i>	<b>11 (11.2)</b>	<b>7 (8.2)</b>
	<i>Clean water/water supply</i>	5 (5.1)	3 (3.5)
	<i>Clean environment/fresh air</i>	5 (5.1)	<b>12 (14.1)</b>
	<i>Energy/fuel</i>	1 (1)	1 (1.2)
<i>Social relations (&amp; psychological dimensions)</i>	<i>Social networks/friends</i>	5 (5.1)	<b>11 (12.9)</b>
	<i>Family</i>	4 (4.1)	7 (8.2)
	<i>Good governance</i>	1 (1)	
	<i>Religion/ belief</i>		2 (2.4)
	<i>Joy/ peace/happiness</i>	<b>9 (9.2)</b>	
<i>Security and other</i>	<i>Security/ safety</i>		3 (3.5)
	<i>Political stability</i>		<b>4 (4.7)</b>
	<i>Travel/transport networks</i>		1 (1.1)
	<i>Development</i>	2 (2)	

Key differences between men’s and women’s groups centre on the relative importance of social networks (excluding family) for the men’s group, reflecting recent in-migration for some participants and distance from close family; and the emphasis on psychological dimensions of

peace and happiness amongst the women’s group, of whom three were also recent in-migrants, following tribal clashes in 2007. Social capital however remains an important resource and aspect of well being across gender categories, and one which facilitates material benefits such as labour sharing, access to (scarce) credit through women’s groups (see Section 4.6 below), in addition to psychological benefits.

Aspects of wellbeing show clear links to ES and thus are being compromised by trends in ES quality and provision noted in Table 3:

#### 4.5 ES/wellbeing linkages

Following identification of aspects of wellbeing, men’s and women’s groups revisited the agreed lists and rankings of ES and were asked to identify how these ES contributed to particular dimensions of wellbeing.

**Table 5: Key wellbeing/ES linkages**

Aspects of well-being	Female respondents (n=12)	Male respondents (n=12)
	Linked ES	Linked ES
<i>Food/food security</i>	Food crops (c/s)	Food crops (c/s), fish
<i>Income/employment</i>	Farming; livestock; fishing; tourism; timber	Fish, pasture, livestock, water, lake/physical features; horticulture; wildlife; good soil; firewood; building materials
<i>Shelter</i>	Forest/trees	
<i>Education</i>		Forest/trees; horticulture
<i>Good health</i>	Medicinal plants	Medicinal plants; fresh air; food
<i>Clean water/water supply</i>	Clean water	Clean water
<i>Clean environment/fresh air</i>	Air quality	Trees; shelter; water; soil; climate regulation; fresh air
<i>Energy/fuel</i>	Fuel/energy (f/c/s/o)	Fuel/energy (f/c/s/o)
<i>Social networks/friends</i>	Tourism; fuel/energy; food/food security	Tourism; wildlife; Flowers/ trees/ physical features-aesthetic values
<i>Family</i>	Medicinal plants; shelter	
<i>Religion/ belief</i>		Water (baptism); trees; fresh air
<i>Joy/ peace/happiness</i>	Tourism/ recreation; wildlife-aesthetic values	

Note: ES categories from Table 3 used above as far as possible

As summarised above, there are clear overlaps between aspects of wellbeing and ES: in some instances they coincide e.g. in the case of clean water. In other instances multiple ES were identified as contributing to particular dimensions of wellbeing. Provisioning services were identified as the most significant contributors, especially to basic material needs. However,

health was also widely linked to ES such as medicinal plants, fresh air and food, thus highlighting contributions of regulating as well as provisioning services to wellbeing. Social and psychological dimensions of wellbeing were associated with adequate basic needs, in addition to cultural services, encompassing aesthetic values. In this respect results reflect findings presented in other recent work (e.g. Fisher *et al.*, undated).

As previously stated, trends in deterioration of ES are apparent across the Basin, both as reported by informants and substantiated by secondary data and statistics (Harper *et al.*, 2011; KWS/WWF 2012; Ministry of State for Planning, National Development and Vision 2030, 2009). These map onto trends of increasing poverty in the District, again as set out in secondary sources and as highlighted by informants. Further analysis of trends and livelihood implications with informants identifies some opportunities for substitution in ES, for example through livelihood diversification, e.g. growing importance of fish through fish ponds, also beekeeping in parts of the catchment, in support of food security and income-related aspects of wellbeing. These adaptations reflect responses to marginal production, linked to land subdivision, poor soil fertility and unfavourable ‘farm gate prices’. However, these adaptive responses remain limited by wider structural constraints and issues of access to opportunities for the most marginalised, for whom economic, time-related and institutional barriers may preclude constructive response, as explored further in Section 4.6 below. Elsewhere aspects of wellbeing directly linked to ES e.g. clean environment and health are effectively non substitutable, but require investment in governance and infrastructure (sewage, clean water etc); issues clearly recognised for example in District Development plans, but yet to be addressed effectively.

Spatial dimensions of tradeoffs in wellbeing between groups of stakeholders also merit further attention. In brief, land clearance/ deforestation for agriculture in the upper catchment, a short-term strategy for residents seeking to fulfil basic needs in the context of population growth, land subdivision and decreasing productivity, especially where other options are constrained as highlighted above; produces adverse impacts on livelihoods of ‘downstream’ residents. Fishermen and boat operators in particular complained of increasing water pollution and sedimentation associated with up gradient farming activities, combined in recent years with falling water levels in the Lake, again associated with upstream deforestation, but also over-abstraction and inequitable water off take. Impacts of flower farms, important employers for

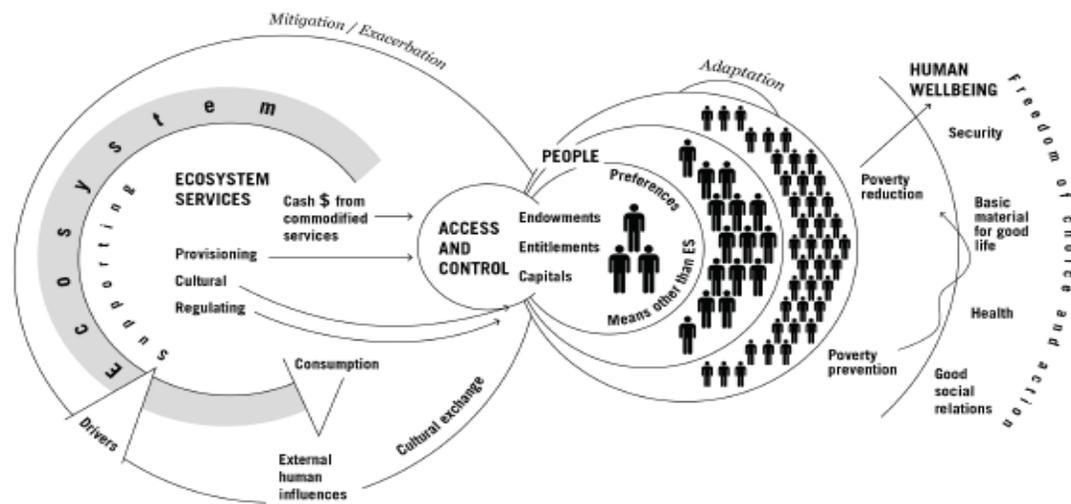
many residents of the urban settlements around Lake Naivasha, on water quality and quantity and thus on income and water-related aspects of wellbeing for other stakeholders, have been widely rehearsed (Harper et al., 2011; KWS/WWF 2012).

Key initiatives to address aspects of these tradeoffs include PES schemes e.g. as co-implemented by WWF and CARE Kenya from 2008 to link upstream farmers to downstream resource users in the Basin, whereby farmers in the upper catchment receive support in exchange for improved land use practices. These take the form of tree planting, reduced chemical fertiliser use, terracing and better management of riparian zones, and are designed to facilitate livelihood improvements for upstream participants as well as improved water quality and quantity downstream, to the benefit of Lake biodiversity and downstream water users. Pilot schemes report some success in respect of these goals and hence in shaping tradeoffs between ES dependent dimensions of wellbeing between stakeholder groups. Prospects for scaling up the approach are currently under discussion. Other key interventions with the potential ability to reshape spatial and social tradeoffs include developments around water governance, access to clean water being a key element of wellbeing. As previously highlighted, documents such as the Naivasha Basin Water Allocation Plan (WRMA, 2011) re-emphasise the need for sustainable and equitable water rights and access, while WRUAs potentially offer the opportunity for their realisation through new governance arrangements. Equitable water access remains a goal rather than a reality, but together with the PES scheme and other issues highlighted above, emphasise the importance of access in shaping ES/wellbeing linkages.

#### **4.6 New ES/PA Conceptual Framework**

The following brief discussion uses the framework developed through another ESPA project (Patenaude *et al.*), with the explicit permission of its PI and other investigators.

The framework, as reproduced overleaf, highlights issues of access, rather than aggregate availability of ES. As indicated above, and following Sen's concept of entitlements, explicit attention to differentiation and inequality, and to how these are produced, challenged and maintained, are important to more nuanced understandings of poverty/ wellbeing trajectories and their links to increasingly contested ES.



An **ecosystem** includes not only the organism-complex, but also the whole complex of physical factors forming what we call the environment (Tansley, 1930; 299).  
**Ecosystem Services** are 'the benefits people obtain from ecosystems' (MA, 2006; vi).

**Access and control** form the social and political dynamic through which people interact around ecosystem services.  
**People** are represented at different scales. They are differentiated by characteristics (endowments, entitlements, capitals, preferences and means

other than ecosystem services), influencing their ability to access and control ecosystem services.  
**Human wellbeing** incorporates material, health and security factors, good social relations and freedom of choice and action (from Narayan et al.,

1999, 2000, adopted by IEA, 2006).  
 Poverty alleviation is comprised of **poverty reduction**, a process by which people move above a national poverty line, and **poverty prevention**, the maintenance of a minimum standard of living with immediate needs met, below a

national poverty line (Angelsen and Wunder, 2003; 2).  
**Drivers** are 'natural or human-induced factors that... unequivocally influence ecosystem processes' (MA, 2006; 64).  
**External human influences** are anthropogenic

influences originating beyond the people sector.  
 Through **mitigation or exacerbation**, people (respectively) reduce, or increase drivers.  
**Adaptation** is a process of 'deliberate change in anticipation of, or in reaction to, external stimuli and stress'

(Nelson et al., 2007; 395).  
**Cash from commodified services** represents income gained from selling ecosystem-derived commodities, through conventional commodity markets, or more novel payments for ecosystem services.

**Consumption** represents the removal of ecosystem services by external human influences.  
**Cultural exchange** represents the interaction between people and external human influences, for instance through technology transfer.

According to Fisher *et al* (undated), scale is an important consideration in shaping the politics of access, for example through community, government and even international institutions and governance arrangements. Other critical innovations and contributions of the framework centre on characteristics of people (e.g. though endowments and entitlements; capitals and means of livelihood support other than ES); access as mediated and controlled through institutional and governance arrangements and the specific nature of the ES under consideration; drivers of change and response options (*ibid*). It is beyond the scope of this report to examine the application of the framework to the Naivasha case in detail – this will form the focus of a forthcoming paper. However, key elements which illuminate particular aspects of dynamic ES/PA relationships at Naivasha are highlighted below.

### *Characteristics of people*

- **Endowments and entitlements:** access to ES in Naivasha may reflect endowments e.g. through land rights, contested customary resource rights (increasingly mediated through complex, overlapping institutions associated with conservation and reserves; highly disputed politics of Lake access). However, entitlements, as highlighted by Fisher *et al* (undated) are often equally important in facilitating the effective contribution of ES to livelihoods in Naivasha, for example where ability to realise the value of entitlements requires access to labour or capital (harvesting fuelwood, building materials, access to good markets).
- **Capitals:** for example lack of physical capital/ technologies mediates the contribution of food crops/fisheries to livelihoods either through direct production or sale (access to markets with good prices; intensification of production on plots etc). Financial capital facilitates substitution, for example of locally collected fuelwood for other fuel sources, where lack of endowments/ entitlements constrain access to the former. Social capital may be critical in equitable resource allocation, especially under conditions of institutional innovation through devolved/ co management (see Access and Control, below). Human capital in conjunction with financial capital shapes ability to support livelihoods through diversification (e.g. fish ponds, honey production, cash crops in upper catchment).

- **Means other than ES:** again often related to financial capital, which may enable substitution of ES for non ES benefits, for example in the case of fuel. As noted by Fisher *et al*, (undated), biomass based variants are often time consuming to harvest and unhealthy when used in poorly ventilated areas, an issue widely noted by female participants in workshops. Ability to substitute away from ES may thus enhance wellbeing.

### ***Access and Control:***

Institutional evolution, for example in the case of Naivasha through WRUAs, Community Forestry Associations (CFAs) and multiple Community-Based Organisations (CBOs) throughout the Basin offer the prospect for mediating established regimes of access and control, although not necessarily towards more equitable forms. At present women are still under represented in leading roles in WRUAs, while experience elsewhere suggests that the poorest may be weakly integrated into community/ co management arrangements through lack of time/labour/social or financial capital or other attributes (*ibid*). In Naivasha at present there are multiple examples of overtly ‘successful’ community (including women’s groups) as part of the evolving institutional context. These provide critical functions relative to aspects of and constraints on wellbeing – for example a number of women’s CBOs operate microcredit (‘roundabout’) schemes, enabling members to access small loans and credit. However, the longer term implications for differentiated access to wellbeing and to ES supporting that wellbeing are as yet unclear, given the relatively recent appearance of many such groups. The ability to command monetary benefits from commodified ES and changing rights as ES *become* commodified are also issues highlighted under the framework with pertinence in the Naivasha context, given links to other attributes such as capitals and entitlements and potential for commodification of ES such as papyrus. These will be explored in further detail through the framework in a forthcoming paper.

At present the authors suggest that the Framework may be useful in examining the influences of policy change on endowments/ entitlements and aspects of wellbeing. Substituting the wider issues of governance/ institutional change in Naivasha, linked to policy change such as 2002 Water Act, for ‘policy change’ per se, this does indeed seem to offer a fruitful line of

enquiry. Some key aspects of this are sketched out above prior to it's in depth treatment in a forthcoming paper.

#### **4.7 EAGLO scenarios**

The EAGLO scenarios are set out in the main body of the EAGLO report and also in reports from the initial Kisumu and subsequent Nairobi workshops. They were also used as a basis for exploration and discussion of scenarios, futures and trade offs as part of the Naivasha workshops with men's and women's groups in 2012. Taking account of Sections 4.1-4.6 above, the local downscaled versions of scenarios are useful for illustrating trends and differentiated livelihood outcomes as perceived by local residents. Key aspects, focusing on best and worst case only, are summarised in Tables 6-7 below.

Table 6: Worst Case Scenarios

ISSUES NAIVASHA 2030	Worst case: Men's group	Worst case: Women's group
POVERTY/ LIVELIHOODS	<ul style="list-style-type: none"> <li>• Suffering and disease</li> <li>• Very high poverty levels</li> <li>• Poverty will lead to lower population (death/outmigration)</li> <li>• Lack of basic needs, e.g. food shelter clothing</li> <li>• Increase in insecurity due to joblessness</li> <li>• Increased theft</li> <li>• Increased deforestation driven by poverty</li> <li>• No clothes/ shoes</li> <li>• Higher death rates</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid poverty increase</li> <li>• Increase in theft and corruption</li> </ul>
LAKE ENVIRONMENT	<ul style="list-style-type: none"> <li>• Lake will become very shallow/dry up (due to deforestation)</li> <li>• Lake will become a seasonal lake- will fill and dry quickly due to siltation</li> <li>• Economy of Naivasha will collapse</li> <li>• Lake may be polluted at high rate</li> <li>• Fish will diminish due to pollution</li> <li>• Death of other marine life</li> <li>• Less vegetation</li> </ul>	<p>(Lake Environment not used: not a priority for participants, substitute by wider 'Water: Quality and Availability')</p> <ul style="list-style-type: none"> <li>• Loss of aquatic life</li> <li>• Drought</li> <li>• Unhealthy water</li> <li>• No water</li> <li>• Hunger</li> </ul>
LAND USE CHANGE	<ul style="list-style-type: none"> <li>• Land may dry up leading to lack of vegetation</li> <li>• High levels of erosion in the area</li> <li>• No bird or animal species</li> <li>• Over cultivation</li> <li>• Over grazing due to lack of pasture</li> </ul>	<ul style="list-style-type: none"> <li>• No food</li> <li>• Hunger/ starvation</li> <li>• Drought</li> <li>• Flooding</li> <li>• Soil erosion will continue</li> </ul>
FISHERIES	<ul style="list-style-type: none"> <li>• No fish in lake</li> <li>• No animals e.g. hippos in lake</li> <li>• Various species of fish will become extinct</li> <li>• Decreased income from fishing</li> </ul>	<ul style="list-style-type: none"> <li>• Poverty due to less income from fish</li> <li>• Fish will rapidly decrease</li> <li>• Fish will die</li> </ul>

**Table 7: Best Case Scenarios**

ISSUES NAIVASHA 2030	Best case: Men's group	Best case: Women's group
POVERTY/ LIVELIHOODS	<ul style="list-style-type: none"> <li>• Good education due to availability of funds</li> <li>• Good health services</li> <li>• Better pay for flower farm workers – organisation will be formed to protect employees so poverty will decrease</li> <li>• Proper education – when people are educated they will come up with a new technology to manage their business</li> <li>• NGO will intervene e.g. food supply, education, disease</li> <li>• Poverty may decrease due to employment</li> <li>• Life standard may become better</li> <li>• If poverty was less there would be less disease</li> </ul>	<ul style="list-style-type: none"> <li>• Poverty will decrease</li> <li>• Employment</li> <li>• Good life and poverty reduction due to good governance</li> </ul>
LAKE ENVIRONMENT	<ul style="list-style-type: none"> <li>• Growing of papyrus around lake and planting of trees would help filtration of lake</li> <li>• Increase of water level</li> <li>• Planting more trees around catchment area to prevent soil erosion/ siltation</li> <li>• High increase in water level</li> <li>• Farmers will use well water for irrigation (water irrigation will be available for horticulture and local farmers)</li> <li>• Due to lake conservation, there will be more income from fisheries</li> <li>• Low water pollution due to low levels of effluent flowing into lake</li> </ul>	<p>(Lake Environment not used: not a priority for participants, substitute by wider 'Water: Quality and Availability')</p> <ul style="list-style-type: none"> <li>• Increase in food production</li> <li>• Better health and sanitation</li> <li>• Clean water available</li> </ul>
LAND USE CHANGE	<ul style="list-style-type: none"> <li>• Will lead to good farming</li> <li>• Will lead to afforestation</li> <li>• Increased food production</li> <li>• Less soil erosion and siltation</li> <li>• Enough industries in the area</li> <li>• Restocking of fish</li> <li>• Pond construction</li> <li>• Monitoring, control and surveillance</li> </ul>	<ul style="list-style-type: none"> <li>• High crop yields</li> <li>• Fertile soil</li> <li>• Increased food production/ export</li> <li>• Enough food</li> <li>• Employment</li> <li>• High income</li> </ul>
FISHERIES	<ul style="list-style-type: none"> <li>• Enough fish in lake</li> <li>• Enough space for breeding for fish, birds and animals that depend on lake</li> <li>• increased income of fishermen due to increased fish population</li> <li>• more tourists visiting lake attraction sites</li> <li>• Control on fishing activities and restocking</li> <li>• Introduction of new species of fish maybe would promote local fishermen</li> <li>• Construction of ponds to regulate fishing</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in fish stocks</li> <li>• Provision of employment</li> <li>• Increased income due to good fish markets</li> <li>• Better nutrition through fish</li> </ul>

Both best and worst case scenarios echo outcomes of the main regional EAGLO scenarios. With the substitution of ‘Water Quality and Environment’ for the more specific ‘Lake Environment’ for the women’s group, the main issues identified in the regional scenarios were shown to hold true at the local scale. ‘Lake environment’ was used for the men’s group in preference to the more technical ‘Lake ecosystem functioning’ category in the main regional scenarios, as participants were unclear on its precise meaning. No further modification, substitution or addition of key issues was requested by either group following lengthy discussions.

For both groups, worst case scenarios resembled ‘business as usual’ (not presented here), reflecting perceptions of downward trends in most ES (see Table 3) and associated livelihood impacts. Pathways to best case scenarios therefore generated significant debate and were perceived as necessitating a reversal of current trends. These are summarised for both groups in Table 8, below.

In both cases, external investment is highlighted as critical in achieving best case poverty outcomes – for example through better housing, healthcare and job opportunities. However, it is notable that for the women’s group the issue of governance and (equitable) resource access emerged strongly. As members themselves of women’s CBOs in some cases, they were aware of the potential of devolved governance to deliver aspects of ES based livelihood improvement, but also currently encountering its problems and limitations. Environmental conservation measures emerged strongly in both lists, indicative of expectations for continued reliance on ES as primary sources of wellbeing into the future. Some issues, especially under ‘lake environment’, are already being targeted under government and donor programmes, for example through PES schemes, WRUA and Imarisha activities, WWF and University of Leicester programmes, the new Basin Management Plan. However, access to and inequity in, resource allocation continue to present significant challenges. Participatory ES and scenario-based analysis in conjunction with application of ESPA frameworks, as presented above, offer important tools for understanding and mapping steps to sustainable outcomes into the future.

**Table 8: Pathways to Best Case (by 2030)**

ISSUES NAIVASHA 2030	Pathway to Best case: Men's group	Pathway to Best case: Women's group
POVERTY/ LIVELIHOODS	<ul style="list-style-type: none"> <li>• NGOs intervening and government – funding research, increasing awareness, affordable housing, healthcare</li> <li>• Employment and increasing wages</li> <li>• Foreign investments</li> <li>• Application of new technologies- relevant technologies</li> <li>• Education and knowledge (transfer), skills</li> </ul>	<ul style="list-style-type: none"> <li>• Personal commitment to hard work</li> <li>• Good governance</li> <li>• Investment in good health and education</li> <li>• Good/ improved management of resources – more at community level</li> <li>• Job opportunities/ employment</li> </ul>
LAKE ENVIRONMENT	<ul style="list-style-type: none"> <li>• Environmental conservation – integrated, all stakeholders</li> <li>• Afforestation</li> <li>• Raising awareness</li> <li>• Improved waste management and recycling</li> <li>• Turning waste into resource e.g. water hyacinth into fertiliser (existing local innovation)</li> <li>• Better management</li> <li>• Promotion of constructed wetlands within flower farms and industries</li> </ul>	<p>(Lake Environment not used: not a priority for participants, substitute by wider 'Water: Quality and Availability')</p> <ul style="list-style-type: none"> <li>• Afforestation</li> <li>• Good water storage (catchment and individual – gutters, rainwater harvesting etc)</li> <li>• Protection of water sources</li> <li>• Sanitation</li> <li>• Water treatment and recycling</li> <li>• Tap water/ water infrastructure</li> <li>• Dam construction- BHs, pans</li> <li>• WRUAS need to explain role better – not familiar – governance issues</li> </ul>
LAND USE CHANGE	<ul style="list-style-type: none"> <li>• New/ improved farming techniques – e.g. reduction in soil erosion</li> <li>• Govt subsidies for farming materials/ fertiliser</li> <li>• Sustainable farming methods e.g. mixed farming</li> <li>• Control of land subdivision</li> </ul>	<ul style="list-style-type: none"> <li>• Use of organic fertilisers</li> <li>• Good farming practices- training by govt and NGOs, incl. Soil erosion control</li> <li>• Planting trees on steep slopes or napier grass- not farming</li> <li>• Population control</li> </ul>
FISHERIES	<ul style="list-style-type: none"> <li>• Invest in new appropriate species – introduction e.g. greater species diversity</li> <li>• Alternative methods e.g. fish ponds</li> <li>• Continued monitoring, control and surveillance by BMU</li> <li>• Use of suitable/ sustainable fishing methods</li> <li>• Wider conservation of environment e.g. tree planting</li> </ul>	<ul style="list-style-type: none"> <li>• Waste protection (pollution prevention, including treatment from industries)</li> <li>• Education on importance of fish- good source of food, health</li> <li>• Fish pond production increased</li> </ul>

## 5.0 Summary

In accordance with its terms of reference, this report provides an overview of key ES for the EAGLO lakes and, with reference to specific case studies, notably Lake Naivasha, Kenya, explores in more detail aspects of the nature and values of ES, key trends and drivers and livelihood contributions. It examines locally identified dimensions of wellbeing/poverty, and their gendered and spatial dimensions. Aspects of trade-offs between stakeholders for diverse aspects of wellbeing are highlighted, as are contributions of specific ES to specific dimensions of wellbeing, as determined by local stakeholders. For all the above, supporting secondary data is presented where available, in support of stakeholder claims and perceptions. Issues of access and rights, thus highlighting differentiated as opposed to aggregate scarcity/ availability of ES, are highlighted and examined in conjunction with a new ES/PA framework proposed by Patenaude and Fisher *et al* for ESPA. Finally regional EAGLO scenarios are explored with local stakeholders and implications for policy interventions to achieve ‘best case’ outcomes identified. The above work suggests that existing EAGLO indicators, as set out in workshop reports, for issues of poverty, lake ecosystem functioning, lake catchment land use and fisheries, are likely to be generally appropriate and widely applicable, as expected when formulated by key EAGLO stakeholders. However, to improve their utility in the future, wider dimensions of wellbeing could usefully be integrated into the ‘poverty’ indicator, while governance/ co-management issues, although difficult to ‘measure’, merit greater attention.

This current report sets a basis for future work, beyond EAGLO, much of which is planned or in commission. For example economic valuations to support non-economic participatory work presented here have recently begun in Naivasha under another UOL project; in-depth longitudinal work to track and quantify differentiated livelihood impacts of new governance arrangements and institutional forms at Naivasha are an important area for future study, building on established baseline; further modelling of ES including through ecohydrology approaches and tools is a priority; livelihood interventions around environmental education and water governance at Naivasha are ongoing. Papers in preparation from EAGLO work will also explore further the application of the Fisher/Patenaude *et al.* framework, to further mutual learning between ESPA projects and further illuminate critical ES/PA lessons at Naivasha, with a view to

subsequent application at other EAGLO lakes, through the new EAGLO network formed as a result of the ESPA Framework Grant.

## References.

Ago, E. 2012. *Overview: Lake Tana*. Unpublished report for EAGLO, Workshop 2, Nairobi 2012.

Atkinson, G., Bateman, I., and Murat, S. 2012. Recent advances in the valuation of ecosystem services and biodiversity. *Oxford Review of Economic Policy* 28 (1): 22-47.

Department for International Development (DFID) 2012. *Understanding poverty and wellbeing. A note with implications for research and policy*. Poverty Analysis Discussion Group, DFID, April 2012.

Fish, R. 2011. Environmental decision-making and the ecosystems approach: some challenges from the perspectives of social sciences. *Progress in Physical Geography* 35 (5): 671-680.

Fish, R., Burgess, J., Chilvers, J., Footitt, A., and Turner, K. 2011. *Participatory and deliberative techniques to support the monetary and non-monetary valuation of ecosystem services*. DEFRA Project code NR0124.

Fisher, J., Patenaude, G., Giri, K., Lewis, K., Meir, P., Pinho, P., Rounsevell, M., Williams, M. (undated). *Understanding the relationships between ecosystem services and poverty alleviation: a conceptual framework*. Unpublished paper.

Harper, D., Morrison, E., Macharia, M., Mavuti, K. and Upton C. 2011. Lake Naivasha, Kenya: ecology, society and future. *Freshwater Reviews* 4: 89-114.

Infield, M., Morse-Jones, S., and Upton, C. 2012. *Cultural services, values and wellbeing: social, conceptual and methodological insights from Indonesia and Mongolia*. Presentation at Zoological Society of London/ Valuing Nature Network workshop ‘Conservation and human wellbeing: Integrating local voices into natural resource management’, London 10<sup>th</sup> December 2012.

Kenter, J., Hyde, T., Christie, M., and Fazey, I. 2011. The importance of deliberation in valuing ecosystem services- evidence from the Solomon Islands. *Global Environmental Change* 21: 505-521.

- Kenya Wildlife Service (KWS)/WWF. 2012. *Draft Lake Naivasha Basin Integrated Management Plan 2012-2022*. KWS/WWF Kenya.
- Lamarque, P., Tappeiner, U., Turner, C., Steinbacher, M., Bardgett, R., Szukics, U., Scheremer, M. and Lavorei, S. 2011. Stakeholder perceptions of grassland ecosystem services in relation to knowledge on soil fertility and biodiversity. *Regulating Environmental Change* 11:791-804.
- Ministry of State for Planning, National Development and Vision 2030. 2009. *Naivasha District Development Plan 2008-2012*. Government Printer, Nairobi.
- Morrison, E., Upton, C., Odhiambo-K'oyoo and Harper, D. 2011. Managing the natural capital of papyrus within riparian zones of Lake Victoria, Kenya. *Hydrobiologia* 692: 5-17.
- Ngendahayo, R. 2012. Nutrient management success in Lake Kivu. EAGLO workshop presentation, Nairobi 24-27 April, 2012.
- Pacini, N. 2012. *Ecosystem services and their utilisation for livelihood improvement*. EAGLO workshop presentation, Nairobi 24-27 April, 2012.
- Schaich, H., Bieling, C. and Plieninger, T. 2010. Linking ecosystem services with cultural landscape research. *Gaia* 19 (4): 269-277.
- Suich, H. 2012. *Conceptual framework: poverty*. ESPA 2012.
- UK National Ecosystem Assessment. 2013. *Follow on phase*. Available at <http://uknea.unep-wcmc.org/NEWFollowonPhase/tabid/123/Default.aspx>. Accessed 5 January 2013.
- Upton, C. 2012. *Building community awareness of ecosystem services for poverty alleviation, Lake Naivasha, Kenya*. EAGLO workshop presentation, Nairobi 24-27 April, 2012
- Wandera, P. 2008. *Market economic survey for farm produce and natural resource based products in the Lake Naivasha Basin, Kenya*. WWF-MFS Naivasha- Malewa project report.