NILE BASIN INITIATIVE
NILE EQUATORIAL LAKES SUBSIDIARY ACTION PROGRAM

ENVIRONMENT AND SOCIAL MANAGEMENT PLAN FOR THE LAKES EDWARD AND ALBERT FISHERIES AND WATER RESOURCES PROJECT

FINAL REPORT

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Acronyms and Abbreviations

AfDB	African Development Bank
AFED	Amis de Forêt et de l'Environnement pour le Développement
BMU	Beach Management Unit
CES	Catch and Effort Survey
COOPEVI	Coopérative des pêcheurs de Virunga
DR Congo	Democratic Republic of Congo
ESA	Environmental and Social Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FIMS	Fisheries Information Management System
ICCN	Institut Congolais pour la Conservation de la Nature
ILMP	Integrated Lakes Management Plan
IWRM	Integrated Water Resources Management
LEA	Lakes Edward and Albert
LEAF	Lakes Edward and Albert Fisheries (Project)
MCS	Monitoring, Control and Surveillance
MFNP	Murchison Falls National Park
MIS	Management Information System
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NELSAP-CU	Nile Equatorial Lakes Subsidiary Action Program – Coordination Unit
NEMA	National Environment Management Authority
NTEAP	National Transboundary Environmental Action Project
PNV	Parc National des Virunga
RMNP	Ruwenzori Mountains National Park
QENP	Queen Elizabeth National Park
SENADEP	Service National pour le Développement des Pêches
UGREP	Unité de Gestion des Ressources en Eau et Pêche
WCS	World Conservation Society
WWF	World Wide Fund for Nature

1 INTRODUCTION

1.1 STUDY BACKGROUND

The sector goal of the Lakes Edward and Albert Fisheries and Water Resources Management Project (also referred to as the LEAF Project) is poverty reduction and sustainable livelihoods for local fishing communities through effective control and management of Lakes Edward and Albert (LEA) Basin water and fisheries resources and the protection of its environment.

The LEAF Pilot Project was initiated in August 2003, and was designed to generate replicable experiences in co-management of fisheries and water resources in a transboundary context, as both lakes straddle the borders of the Democratic Republic of Congo and Uganda. Full-scale project implementation at the early stage would have been risky given the differences in administrative structures in the two countries. As a Pilot Project, LEAF enabled various methodologies to be tried and tested as well as institutional arrangements for project implementation to be identified and improved.

The Pilot Project was implemented over a two year period, and was completed in December 2008. The main output from the LEAF Pilot Project was an Integrated Lakes Management Plan (ILMP), and an Investment Plan.

These plans, together with other reports produced during the Pilot Project, were subsequently synthesized and prioritized into a Programme for Sustainable Development and Management of Lakes Edward and Albert Basin Resources, complete with their respective budgets and according to standard donor formats. Following consultations between NELSAP and NELTAC Members from Uganda and DR Congo, a Working Group (WG), facilitated by the NELSAP, was formed to develop bankable project profiles based on the synthesized LEAF Pilot Project Reports, specifically the Integrated Lakes Management Plan. Detailed profiles were developed for three potential components identified by the WG, namely:

i. Fisheries Resources Development and Management;
ii. Integrated Water Resources Management; and
iii. Project Management and Coordination.

Thus the LEAF Project's development objective is to sustainably develop, manage and utilize the LEA Basin water and fisheries resources through its three components. The Project aims to:

- Address the issue of poverty in the region, especially the core Project area around Lakes Edward and Albert through sustainable use of natural resources and development of investment projects;
- Foster bilateral cooperation of the two riparian countries at the community and national level through periodic meetings and development of joint institutional frameworks;
- Improve incomes and increase productivity of the fishing industry by providing information, education, and training in sustainable fish harvesting and on fisheries and water resources;
- Facilitate the adoption of joint fishing regulations with the aim of harmonizing the fishing activities, which should minimize current conflicts on the lakes;
- Contribute towards conservation of biodiversity in the two lakes; and
- Develop an integrated approach to natural resources development and management in the region.

1.2 OBJECTIVES OF THIS ASSIGNMENT

On the basis of the nature and characteristics of the proposed components and respective activities of the LEAF Project, this has been classified as a Category 2 project as defined by the African Development Bank's Environmental and Social Assessment (ESA) Procedures for Public Sector Operations, since some activities under the LEAF Project may have some detrimental or site specific impacts of a significant nature, but their consequences can be mitigated, and are deemed not to be so serious as to be categorised as a Category 1 project.

The AfDB's ESAP stipulate the need for an Environmental and Social Management Plan (ESMP) to be prepared for Category 2 projects. Hence the objective of this assignment is to prepare an ESMP which will describe impacts on the physical, biological and socio-cultural environment of the LEAF Project, and propose appropriate mitigation measures. The ESMP presented here follows on from the LEAF Pilot Project process and the Integrated Lakes Management Plan that was the primary output of that process.

During contract negotiations, it was agreed that the specific objectives of this assignment were to:

i. Determine and evaluate the potential impacts of the LEAF Project, and their significance;
ii. Identify and describe measures required to prevent, minimize, mitigate or compensate for adverse impacts and for social and environmental enhancement;
iii. Prepare an Environmental and Social Management Plan (ESMP).

1.3 METHODOLOGY

This ESMP has been prepared primarily on the basis of documentation prepared during the pilot phase of the LEAF Project, documents obtained during the field visit, and internet research. A list of references is presented in Annex A.

During contract negotiations it was also agreed that a detailed evaluation of the social and socio-economic aspects of Lake Edward and Albert Basins and the development of strategies for participatory implementation would not be undertaken as part of this assignment. Rather, the ESMP is to assume that the data and outcomes from consultations undertaken during the Pilot Phase are still valid.

The field visit was conducted from 13th to 19th March 2011. The Consultant, together with the Study Coordinator, met with the Nord Kivu Provincial Administration, stakeholders and fishers from the DR Congo side of Lake Edward; representatives from the Central Government in Kampala as well as from Bushenyi, Rubirizi, Kasese and Hoima Districts in Uganda; and stakeholders and fishers from the Ugandan side of both Lake Edward and Lake Albert. A full list of persons consulted is presented in Annex B.

The conduct of this study has been guided by the African Development Bank's Environmental and Social Assessment Procedures as well as environmental laws of Uganda and DR Congo and the existing NBI strategy for addressing environmental and social safeguards. The assignment has also taken due note of the "NELSAP Environmental and Social Management Framework for Project Preparation and Implementation", which provides appropriate guidance to NELSAP in addressing and managing environment and social safeguards, public consultations, and disclosure.

1.4 LIMITATIONS TO THE STUDY

The main limitation to the study was the availability of and accessibility to information, particularly with regard to socio-economic and environmental information specific to the DR Congo. There also appeared to be a general reluctance among some organisations to provide documentation to NELSAP and the Consultant. In order to implement the LEAF Project (and other NBI/NELSAP projects) it is important that all government and non-government organisations who are carrying out activities in the LEA Basin share information that they have in order that resources are not wasted in duplicating efforts, and so that effective conservation and protection of the valuable ecosystems with the LEA Basin can be undertaken.

Another difficulty in obtaining data was due to the recent creation of new districts in Uganda. Most of the district documents (such as the District State of the Environment Reports and District Development Plans), and other documents referred to during this study, refer to the pre-2010 district boundaries. It was not always possible to obtain information specifically applicable to newly-formed districts. Descriptions in this report therefore refer to pre-2010 district boundaries.

In addition, it was not possible to visit the DR Congo side of Lake Albert due to security reasons, and therefore the data used for DR Congo has largely been drawn from documents prepared during the LEAF Pilot Project.

2 PROJECT COMPONENTS

In order to be able to assess the potential environmental, social and socio-economic impacts of the LEAF Project, it is necessary to understand the various components and sub-components that the LEAF Project will comprise, and the activities that will be undertaken within for each component.

As mentioned in Section 1.1, the LEAF Project has three components, namely:

i. Fisheries Resources Development and Management;
ii. Integrated Water Resources Management; and
iii. Project Management and Coordination.

Details of each of these components are provided in the respective project profiles that were developed on the basis of the reports prepared during the LEAF Pilot Project, while an outline of each component is provided below. The activities of the three components is as provided in the table 2.1 below.

Table 2.1: Project components, sub-Components and Activities

No.	Components	Cost (UA Million)	Sub-components and activties
1	Fisheries Resources Devpt. and Mgt	9,37	• *Regional Monitoring, Control Surveillance & Maritime Safety*: i) 5 Well equipped Patrol Boats with radar & communication equipment, and 4 surveillance stations, ii) Conducting joint surveillance operations; iii) Design of sub regional funds for MCS Operations maintenance and training of staff; iv) Harmonization of Policy Legislation against the use of illegal gears; v) Maritime security survey. • *Fishery management* : i) Fish frame Survey every two year; ii) Permanent Catch Assessment Survey with standard methodology for both countries; ii) 1 research vessel for Lake Albert; iii) ICT equipment (shared data bases for each lake); iv) Construction of two fisheries research stations; v) Identification and demarcation of the main fish breeding areas; vi) Design and implementation of fisheries management plans for each lake; vii) Removal and control of aquatic weeds by mechanical and manual harvesters. • *Fish Conservation and value addition*: i) Construction of 14 Standard Fish handling facilities in the major landing sites; ii) Construction/rehabilitation of 150 km of feeder roads; iii) Capacity Building/Training of Beach Mgt Units and women associations in fish handling; iv) Sensitization program for the use of mukene and ragori stocks. Promotion of alternative livelihoods; v) Survey to evaluate aquaculture potential (carrying capacity for tilapia cage farming) for each lake; vi) 10 Demonstration sites for cage fish farming (5 each in each country; vii) Support to fish farmers to access existing credit schemes; viii) Tree planting & Woodlots development; ix) Boat construction and repairs; x) Apiculture and poultry development; xi) Training of the BMUs in the use of appropriate fish capture technology.
2	Integrated Water Resources Management	4,29	• *Catchment and wetland Management*: i) Soil erosion and lake water/siltation sedimentation reduced); ii) Improved basin vegetation cover (4,000,000 agro forestry and fruit trees with 500,000 local trees to be

			planted); iii) 1000 ha in each country wetland and riverbank buffer areas restored, iv) 2000 producers / fishers trained. • *Water quality and quantity assessments: i)* 2 well equipped water laboratories; ii) 2 Construction of hydro-meteorological stations and infrastructure; ii) Development of basin hydrological and natural resources database. iii) Provide on-site- sanitation facilities (40 toilets and 100 boreholes will be provided). • *Development of Lake Edward and Albert Basin Water resources model*: i) Establishment community based wetland management organization, ii) development and implementation trans-boundary management frameworks, iii) facilitate establishment of lake management funds, iv) support resources mobilization for LEA projects and v) building capacity on IWRM. • *Maritime safety:* Establishment and operationalization of a maritime safety system for each.
3	Project Management & Coordination	3.10	• *Strengthening the existing Regional Project Coordination Unit in NELSAP: i)* Recruitment of the RPCU, Project Accountant & Fisheries Expert; ii) Coordinate the establishment of the LEABO; iii) Coordinate the Procurement activities of the Project; iv) Coordination & Supervision of the Work plan & Budget; v) M & E; vi) Audit of Project activities • *Support to the National Focal Institutions:* i) Identification and deployment of the Staff of Ministries of Fisheries & Water Resources to work on the Project; ii) Support to National Focal Offices in Port Fortal (Uganda) and Bunia and Besmobo (DRC); iii) Capacity Building of the RCU and National Focal Institutions; Provision of 5 vehicles (2 for each country and 1 for NESAP); IT and Office equipmentTraining for the Field staff.

3 ENVIRONMENTAL AND SOCIO-ECONOMIC PROFILES

During the LEAF Pilot Project, extensive baseline information was gathered for a number of environmental and social aspects, including fisheries biology, water resources and water quality, hydrology, and the socio-economic characteristics of the fishing communities along the Lake Albert and Edward lakeshores. In this chapter, a summary of baseline information is provided for the purposes of establishing the project setting. Full details can be found in the following documents:

- NELSAP/NBI (November 2008); Lakes Edward and Albert Fisheries Pilot Project, Integrated Lakes Management Plan, Volume 1, Final Report.
- NELSAP/NBI (March 2008); Lakes Edward and Albert Fisheries Pilot Project, Feasibility Report.
- NELSAP/NBI (September 2007); Lakes Edward and Albert Fisheries Pilot Project, Mid-Term Diagnostic Report.

The information in the above documentation has been supplemented here by data from other documentation listed in the References in Annex A. In particular, the reader is referred to the *Environmental Sensitivity Atlas for the Albertine Graben* (NEMA, 2010) and the *Biodiversity of the Albertine Rift* (Pumptre et al, 2003), both of which provide much relevant baseline information. It must be noted that only limited specific information was available for the DR Congo.

3.1 ENVIRONMENTAL SETTING

3.1.1 Project Location

Lakes Edward and Albert and their catchment areas form an integral part of the Nile Basin. Both lakes straddle the international boundary between DR Congo and Uganda. Lake Edward is located in Nord Kivu Province of D R Congo, and in Uganda the lake is bordered by the districts of Kanungu, Bushenyi, Rubirizi and Kasese. Lake Albert lies in Orientale Province of DR Congo, while in Uganda, six districts, namely Ntoroko, Kibaale, Hoima, Buliisa, Nyowa and Nebbi, share its lakeshore[1].

3.1.2 Topography

Lakes Edward and Albert lie within the Albertine Rift, in what is referred to as the Albertine Graben, or the floor of the Rift. The Albertine Rift is part of the East African Rift Valley System and stretches from the northern tip of Lake Albert to southern tip of Lake Tanganyika.

Lake Edward is situated at an altitude of 916 m asl. It is bordered to the west by the Mitumba - Kyavirimu Mountain Range (its highest point being 3,117 m asl) which is part of the Parc National des Virunga (PNV). The Nyiragongo and the Nyamulagira Volcanoes are also located within the PNV to the south of Lake Edward. To the north of Katwe town the land rises to around 1,390 m asl. The lake is 90 km long and 40km wide. Its average depth near the Ugandan shoreline is estimated at 34m, but its maximum depth is 117 m on the Congolese side.

Lake Albert lies at an altitude of 618 m asl. The Blue Mountains (peaking at 2,417 m asl) form its western border. Lake Albert is 160 km long and 35 km wide. It is relatively shallow with an average depth of 25 m and a maximum depth of 58m (near the Congolese border).

[1] During the recent creation of new districts in Uganda, Rubirizi District was carved out of Bushenyi District and Ntoroko District was carved out of Bundibugyo District. Several reference documents used to prepare this report refer to the old district boundaries (pre-2010), and therefore descriptions in the text of this report refer to Bushenyi and Bundibugyo Districts.

Located between Lakes Edward and Albert are the Ruwenzori Mountains, which rise to 5,110 m asl at Margherita Peak.

3.1.3 Climate and Rainfall

The climate in the Project area can be described as hot and humid in the graben, temperate in the highlands, and tropical alpine in the mountain areas. As noted in the preceding section, the topography of the project area varies greatly (from around 600 m to 5,000 m asl), and this dramatically influences its climate and rainfall patterns. The floor of the Rift Valley is in a rain shadow, and mean annual rainfall is low, between 650 mm to about 900 mm. The areas on the escarpment to the east of the graben receive an annual rainfall of around 1,400 mm, while the mountain ranges to the west of the lakes may receive in excess of 2,000 mm of rainfall per year. Rain falls throughout the year, but peaks twice in the year between April and May, and between August and October. January and June are generally drier.

In the Albertine Graben temperatures range from a minimum of 18 ^{o}C to a maximum of 30 ^{o}C, while temperatures in the mountain ranges can fall below freezing.

3.1.4 Geology and Soils

The Environmental Sensitivity Atlas of the Albertine Graben (NEMA, 2010) describes it as being a "Cenozoic rift basin formed and developed on the Pre-cambrian orogenic belts of the African Craton". It is thought that the process of rifting began during the late Oligocene or early Miocene period. Characteristic features of the Albertine Rift are steep border faults and uplifted escarpments which are mainly metamorphic rocks such as gneisses, quartzites, schists and phyllites derived from Pre-cambrian basement. Sediments in the Rift floor are mainly fluvial and lacustrine deposits which generally comprise sandstones, claystones and shales.

The soils are predominantly yellowish-red clay loams on sedimentary beds. On the plateau towards Masindi and Hoima, the soils are highly leached, reddish brown clay loams, while along the axis of warp, dark brown, black loams can be found. Along the escarpment, the soils are of recent origin, predominantly shallow sandy soils that are prone to erosion and landslides, soil slips and rock falls (NBI/NELSAP, 2007).

3.1.5 Hydrology and Drainage

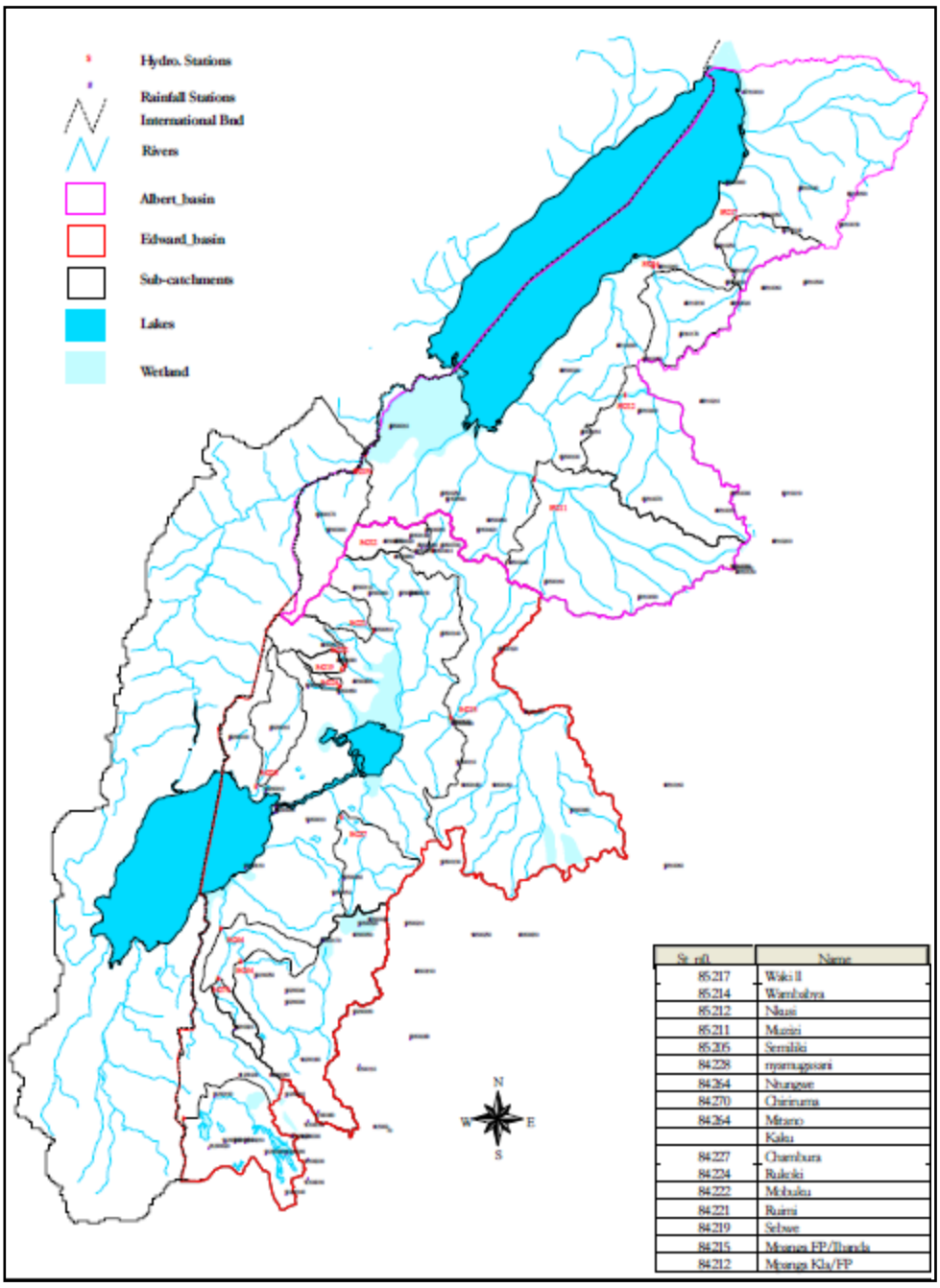
The Lake Edward basin has an area of approximately 12,000 sq km. Water from Lake George flows into Lake Edward through the Kazinga Channel. The main rivers flowing into Lake Edward are the Rwindi and Rutshuru, Nyamugasani, Ishasha, Taliha and Lubila Rivers. The Semiliki River to the north is the only outlet for Lake Edward, and flows into Lake Albert, for which it is the primary source. Lake Albert also receives water from the Victoria Nile which flows into the lake immediately below its outlet at the mouth of the Albert Nile. However, the Victoria Nile has no significant influence on the lake ecology, other than to maintain water levels. There are numerous other smaller rivers which feed into Lake Albert on both the DR Congo and the Ugandan side, eg the Waki, Muzizi, Nkuzi, Wambabya, and Chambura.

Figure 3.1 depicts the extensive hydrological systems feeding the two lakes.

Studies undertaken during the LEAF Pilot Project attempted to establish a water balance for Lakes George, Edward and Albert. The water balance of the lakes is affected by activities in the catchment areas. The results show a slightly negative balance for Lake Edward, and a slightly positive balance

for Lake Albert. However, due to the lack of data covering the two basins, and inconsistency of available data, no substantive conclusion could be reached.

Figure 3.1: Hydrological Catchment of LEA Basin



Source: NBI/NELSAP, 2008

3.1.6 Surface Water and Groundwater Sources

As implied above, there are plenty of surface water sources in the LEA Basin. The Lake Edward / Lake George area is supplied by the Rutshuru, Rwindi, Nyamugasani, Ishasha, Taliha, Lubila, Mubuku and Nyamwamba Rivers, while the Sambiya, Victoria Nile, Semiliki, Hohwa, Wambabya,

Waki, and Muzizi are some of the rivers found in the Lake Albert area. Both areas are supplied by numerous seasonal rivers.

However, groundwater sources are scarce due to the geological basement rock that underlies the area. Some groundwater is found in rock fissures and localised aquifers.

3.1.7 Wetlands

Three Ramsar sites are located within the LEA Basin in Uganda: Lake George, Murchison Falls-Albert Delta Wetlands System and Ruwenzori Mountains. Negotiations are underway to extend the classification of the Murchison Falls – Albert Delta Wetlands System to the Semiliki Flats. In the DR Congo, the Parc National des Virunga – within which the entire DR Congo part of Lake Edward is located – has been designated a World Heritage Site (WHS). These areas therefore have significant global importance because of the biological and geological diversity of their habitats. Of these, the PNV has been categorised as a "WHS in Danger" (http://whc.unesco.org/en/list/63) due to the threats it faces as a result of the civil unrest in eastern DR Congo.

Large areas of swamp are found around Lake George, in the Semiliki River at its inflow into Lake Albert and at the Albert Delta in the north of Lake Albert, as well as in the catchment areas of both lakes. It was observed that wetlands and swamps in the Project area are being drained and cleared for agricultural purposes, which is likely to have impacts on the water levels as well as water quality of the lakes[2]. In Uganda, wetlands that lie outside protected areas are not gazetted. In 2001 the National Wetlands Programme drew up a wetlands inventory, but this did not indicate which wetlands were managed sustainably. Moreover, over the past decade, a number of wetlands have been drained, destroyed or have dried up, and therefore the inventory needs to be updated.

Plate 3.1: Burning and Clearing of Wetlands in the Project Area

3.1.8 Water Quality in the Lakes

During the LEAF Pilot Project, a baseline was obtained for the water quality in both Lake Edward and Lake Albert. Annex C contains the findings of the water quality assessment undertaken during the LEAF Pilot Project, while further details can be found in the Lakes Edward and Albert Fisheries

[2] Apunyo (2006) reports that there is some evidence that wetland destruction, in addition to other factors such as climate change, has contributed to a 2 m drop in water levels in the Nile River and Lake Victoria.

Pilot Project, Feasibility Report (NBI/NELSAP, 2008). This section summarises the findings of that study.

In general, measurements of dissolved oxygen (DO), temperature, conductivity, pH, Chlorophyll a levels, turbidity, and Total and Faecal Coliform counts indicate low levels of pollution in the two lakes, although there are a number of localised pollution "hot spots". For example, very low values of DO were found in the bottom waters at the confluence of Kazinga Channel and Lake Edward and near Vitschumbi in DR Congo where Chlorophyll 'a' counts were high and shallow Secchi Depth measurements were shallow. This reflects an accelerated nutrient loading from expanding human activities in the upper catchments and immediate vicinity of Lake George and Kazinga Channel, which then drain into Lake Edward. Localised eutrophication was also noted in some areas on Lake Edward, for example around Katwe, attributed to high algal concentrations. The Total and Faecal Coliform counts at these locations were also very high at 4000 and 2000 per 100 mls respectively, and are attributed to the high volumes of sewage being discharged directly into the lake at these points. Faecal contamination was also evident at the Inshore Station near Katwe Fish Landing. The bottom offshore waters of Lake Albert were found to be devoid of oxygen. High algal concentrations (11 – 18 µg/l) were noted in the shallow areas where the Semiliki River enters Lake Albert and entrance of Victoria Nile near Wanseko Fish Landing, but these may be due to the swampy environment at these locations in addition to nutrients being washed down from the upper catchments of the two rivers.

3.1.9 Land Use

Land use in the Project area is predominantly agricultural, mainly small scale farming, which together with mining and settlements comprises nearly 80% of the total land use. Table 3.1 gives a breakdown of land use in the Albertine Graben in Uganda, which also reflects land use in the LEA Basin.

Table 3.1: Land Use in the Albertine Graben

Type of Land Use	Area Covered (ha)	% of Albertine Graben Area
Agriculture, settlement and other miscellaneous land uses	5,369,164	79.1
Forest Reserves	462,129	6.8
Wildlife Conservation Areas	957,194	14.0
	6,788,616	100%

Source: NEMA, 2010

Forest reserves comprise Central Forest Reserves, Jointly Managed Forests by UWA and NFA and Local Forest Reserves, while wildlife conservation areas are the national parks and wildlife reserves. These make up some 20% of the total land area in this area. With a rapidly growing population in the LEA Basin, it is not surprising then that there is substantial pressure to convert forest areas into agricultural land, or to encroach onto other protected areas.

The Mapping and Inventory Centre of the National Forestry Authority in Uganda has created land cover /land use maps for 1990 and 2005, indicating the changes that have taken place over those 15 years (NFA, created 11 January 2010). Forest reserves in the Project area include Bugoma and Budongo Forest Reserves, and Maramagambo Forest. The map shows forest degradation and deforestation in the catchment immediately to the north of Lake George, while to its northeast and south, much of the land has been converted from grassland to agriculture. Land immediately to the north and south of the Kazinga Channel where it flows into Lake Edward is now agricultural. Although some forestation is also evident within QENP, forest degradation was also noted – in the 1990s all of QENP is shown as being bushland, woodland or grassland. The map also shows substantial degradation of forest within the catchment areas of Lake Albert, particularly in the

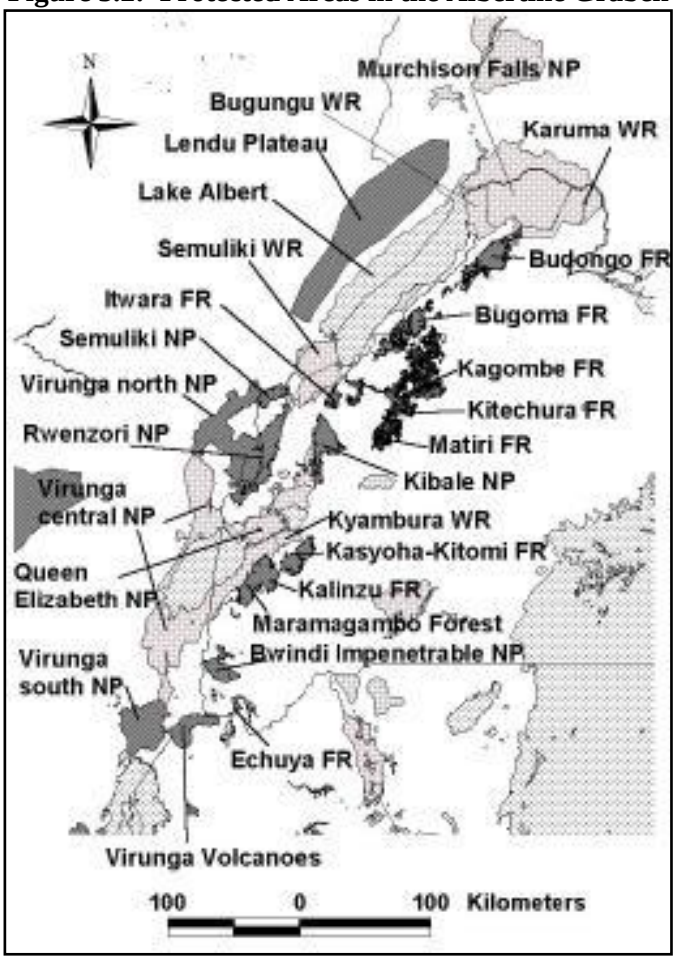
districts of Amuru (some 1800 sq km), Buliisa (roughly 800 sq km), Hoima and Bundibugyo. Deforestation in Kyenjojo and Kibaale Districts is apparent, and during the field visit conducted for this study in March 2011, it was observed that large areas of land in the Lake Albert catchment were being cleared for agriculture, particularly in Hoima District.

Plate 3.2: Forest Cleared for Agriculture in Hoima District

3.1.10 Protected Areas

There are many national parks, wildlife reserves, forests and forest reserves in the LEA Basin, and as noted above, these make up some 20% of the land use in the Albertine Graben. These areas are illustrated in Figure 3.2 below. Of the 22 national parks and wildlife reserves in Uganda, 10 are located in the Albertine region. Lake Edward is entirely enclosed by two national parks: the Queen Elizabeth National Park (QENP) in Uganda to its east and the Parc National des Virunga in the Democratic Republic of the Congo along its western shores. Murchison Falls National Park (MFNP) and Bugungu Wildlife Reserve stretch right up to the shores of Lake Albert, while the Semiliki National Park, Tooro-Semiliki Wildlife Reserve and the Ruwenzori Mountains National Park (RMNP) are located between the two lakes. Other wildlife reserves in the LEA Basin are Karuma Wildlife Reserve in Masindi District, Kabwoya and Kyambura Wildlife Reserves in Hoima and Bushenyi Districts respectively, and Kigezi Wildlife Reserve in Rukungiri and Kanungu Districts (NEMA, 2010). Forests have been discussed in Section 3.1.9 above.

Figure 3.2: Protected Areas in the Albertine Graben



Source: Plumtre et al, 2003

3.1.11 Fauna and Flora

Albertine Rift harbours has a great diversity and a great number of mammals, birds, snakes and amphibians, many of which are endemic. Indeed the Ruwenzori Mountains are said to contain the highest species richness of mammals on the African continent (Plumtre et al, 2003), they host 241 species of birds of which 19 are endemic, but are most noted for their spectacular array of plants including bamboo, *Mimulopsis* spp, *Erica* spp, *Lobelia* spp, *Senecio* spp and *Carex* spp (www.uwa.org). UWA also reports that Queen Elizabeth National Park has 95 mammal species (it is famous for its hippo population), 612 species of birds and 57 types of vegetation. Table 3.2 below illustrates the biological importance of the Parc National des Virunga.

Table 3.2: Species Richness in the Parc National des Virunga

Taxon	Species Richness	Endemic Species	Threatened Species
Mammals	278	30	22
Birds	871	31	16
Reptiles	134	12	1
Amphibians	84	21	10
Fish	81	56	?
Plants	3,180	246	27

Source: Plumtre et al, 2003

Plumtre et al (2003) give an extensive account of faunal and floral species found in the Albertine Rift. Within the LEAF Project area, endangered mammal species[3] which are endemic to the LEAF Project Area include the Mountain Gorilla (*Gorilla beringei beringei*), Schaller's Mouse Shrew (*Myosorex schalleri*) and the Golden Monkey (*Cercopithecus mitis kandti*).

The aquatic species found in the lakes are also important, particularly in terms of fisheries. During the LEAF Pilot Project, a detailed survey of aquatic flora and fauna was undertaken. The survey showed that Lake Albert has a much richer diversity of algal species, both the blue greens and green algae, than Lake Edward. These are dominated by *Microcystis* which is the most abundant alga, but other groups include *Planktolyngbya*, *Anabaena*, *Cylindrospermum*, *Merismopedia*, *Chrococcus* and others. *Microcystis* is a phyto-toxin producer and could be one of the factors causing fish kills in Lake Albert. The green algae include types such as *Chlorococcum, Ulothrix, Ankistrodesmus, Scenedesmus, Pediastrum, Synecocystis* and *Tetraedon.* Diatoms are least abundant of the three types of algae and include *Nitzchia, Diatoma* and *Navicula*. Diatoms, the preferred fish food, are more abundant in Lake Edward than in Lake Albert.

Zooplankton is widely found in both lakes. Cyclops and *Nauplii* are the commonest Copepods. *Diaphanosoma* and *Moina* are the most abundant Cladocerans. *Keratella* and *Brachionus* are the most common Rotifers. The shallow lagoons and the shallow inshore stations had more zooplankton than the deep off-shore stations. Lake Edward was found to be richer in zooplankton than Lake Albert.

Mollusks are the most common of the benthos fauna in the two lakes, and particularly in the inshore stations. The mollusks are composed mainly of gastropods such as *Bullinus, Biomphalaria, Mellanoidae* and *Bellamya*. Several species of insects and worms are also found in the benthos.

The bottom of the shallow inshore waters of Lake Albert is clogged with submerged aquatic weeds identified as *Najas pectinata* (Najadacea) and *Vallisneria spiralis* (Hydrocharitacea).
Littoral microphytes include Water Hyacinth, sedges, Papyrus, Typha, and Ambatch.

On Lake Albert, 24 fish species were identified during the LEAF Pilot Project survey, including *Lates macrophtalmus* (Nile perch) *Hydrocynus forskahlii, Oreochromis niloticus, Barbus bynni, Auchenoglanis occidentalis* and *Brycinus nurse*. Among the 16 fish species identified during the Pilot Project survey on Lake Edward were *Bagrus docmac, Barbus altianalis, Oreochromis leucostictus, Oreochromis niloticus, Protopterus aethiopicus,* and *Clarias gariepinus*. Lake George is reportedly very productive. Lakes Edward and Albert are said to have more than 60 endemic cichlid species. Interestingly, Lake Albert has a diverse fish fauna that is markedly different from other East African Great Lakes in that it has very few cichlid species, of which even fewer are endemic; Lakes Edward and George have more than 60 endemic cichlid species. McClanahan and Young (1996) reported that while some species in Lakes Edward and George are also found in Lake Albert (for example *Bagrus docmac*, and *Oreochromis niloticus*), other species (eg *Polypterus senegalus* and *Hydrocynus* spp) and families (Mastacemebelidae, Characidae, Schilbeidae) are absent. The differences in faunal species are attributed to very dynamic historical geological activity in the Great Lakes Region.

3.1.12 Minerals

The project area has several mineral reserves that are currently being exploited, or that could potentially be exploited in the near future.

[3] IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 28 May 2011.

Copper is found around Lake George and Lake Edward, and was mined in the past at Kilembe in the Nyamwamba River Valley in Kasese District. The Kilembe Mines have not been operating for the past 30 years, although substantial reserves of copper reportedly still remain there. There have long been concerns that tailings from the mines were contaminating Lake George. Currently the Kasese Cobalt Company Ltd (KCCL) is extracting cobalt from copper tailings. KCCL has put in measures to address the leaching of copper and cobalt tailings, and appears to have made great progress with regard to rehabilitation of some of the affected areas (pers. comm., Arnold Waiswa, Director, Environmental Monitoring & Compliance, NEMA). In addition, the company has a strong corporate social responsibility programme.

Also located in Kasese District are limestone deposits that are being exploited for cement and lime at Hima, Dura and Muhokya. Gypsum is mined at Kibuku in the Semiliki area of Bundibugyo District.

Gold can be found in Maramagambo Forest to the south of Lake Edward in Bushenyi District, and deposits of iron-ore, gold and wolframite are found along the rift escarpment in Kabale, Kanungu and Rukungiri Districts.

Salt mining has been done both commercially and locally for several decades at Lake Katwe, and for domestic purposes along the shores Lake Albert north of Kaiso-Tonya.

The oil and gas finds in Lake Albert and Lake Edward have raised several concerns with regard to the environmental and social impacts that exploration, drilling, storage and transportation activities associated with the oil and gas will have, particularly given the location of the wells in areas containing some of the richest biodiversity in Africa. In Uganda, the most productive well is located in Murchison Falls National Park. Apparently oil drilling has not yet begun in the lake waters, but it will do so in the near future. EIAs were done for exploration and drilling activities, which have been reviewed by NEMA, and an SEA for the oil and gas sector has just commenced.[4] In addition, several donors are focusing on capacity development in order for the respective authorities to be able to deal with any adverse eventualities (see Chapter 8). In the DR Congo, however, ICCN will not allow exploration and drilling for oil in the PNV, including Lake Edward.

DR Congo is immensely rich in other minerals. Nord Kivu Province has viable deposits of columbite-tantalite (coltan), cassiterite (tin), and wolframite (tungsten), while gold and diamonds are found in Orientale Province. But the continued civil unrest and political instability in eastern DR Congo hampers the development of the mining sector in these areas (Yager, 2007).

3.2 SOCIO-ECONOMIC SETTING

3.2.1 Land Tenure

The existing arrangement under which land is owned and used in the project area in Uganda consists of customary, leasehold, freehold and public land. Customary tenure of land is the most widespread and the oldest form of tenure, where land rights are regulated by the local customs. Customary land is inherited. As land has been sub-divided over and over again from generation to generation, fragmentation of land has occurred. Pressure on land resources from an expanding population, coupled with reduced land productivity as holdings get smaller and soils get exhausted, have contributed to increased poverty levels in the Project area. Land under leasehold tenure is granted by the Land Commission or an urban authority for a specified period in return for payment of rent conferred by the state or a private individual. In the project area, this type of land tenure occurs

[4] Namara, Justine; Oil Exploration in Sensitive Ecosystems; Presentation at the IAIA Conference, Puebla, Mexico, May-June 2011.

primarily in the urban centres. Freehold land is privately owned, and is free of any obligations to the state other than payment of taxes (and other land use controls imposed on it in the interest of the public). All protected forests and wildlife conservation areas, and land accommodating government institutions and infrastructure are public lands.

3.2.2 Population and Demographic Characteristics

Table 3.3 below shows the estimated population in the project provinces and districts. Again, demographic information on DR Congo, particularly Orientale Province was lacking. It was therefore not possible to get population figures for lower administrative units for the two lakes.

While the table below does not realistically indicate the number of people within the LEA catchments, it does give an idea of the vastness of the two project provinces in the DR Congo. It also illustrates how sparsely populated Orientale Province is, compared with the other districts covered by the LEAF Project. The average household size in the Ugandan Project districts is around 5 persons per household.

Table 3.3: Population of the Project Provinces and Districts

Country	District/ Province	Population 2002	Population 2005	Growth Rate (%)	Population Projection 2011	Area (sq km)	Density (persons / sq km)	Av HH Size
	Lake Edward							
DRC	Nord Kivu		7,460,642	3.24	9,033,669	59,483	151.9	n/a
Uganda	Bushenyi	731,398		2.00	874,088	3,823	228.6	5.1
	Kanungu	204,732		2.10	246,841	1,254	196.9	4.7
	Kasese	523,033		3.60	719,063	2,911	247.1	5.3
	Rukungiri	275,162		1.50	314,617	1,434	219.4	4.9
Lake Edward Total					11,188,279			
	Lake Albert							
DRC	Orientale		9,870,578	3.24	11,951,724	503,239	23.7	n/a
Uganda	Bundibugyo	209,978		5.00	325,745	1,979	164.6	4.6
	Hoima	343,618		4.70	519,513	3,602	144.2	4.6
	Kibaale	405,882		5.20	640,533	4,142	154.7	4.8
	Masindi	459,490		4.90	706,733	8,447	83.7	5.0
	Nebbi	435,360		5.00	675,386	2,802	241.1	4.8
Lake Albert Total					14,819,633.77			

Sources: DR Congo http://www.statoids.com/ucd.html and http://www.state.gov/r/pa/ei/bgn/2823.htm
Uganda http://www.ubos.org/index.php?st=pagerelations2&id=16&p=related%20pages%202:2002Census%20Results (UBOS, 2002 Population and Housing Census)

The Uganda 2002 Census report also shows that 50% of the population all the Project districts is under the age of 15 years.

The population in the fishing villages fluctuates according to the fishing seasons. In the DR Congo it is estimated that about 50,000 people who are dependent on fishing live in the Parc National des Virunga. It is estimated that some 5,000 people live in the five gazette landing sites/fishing villages along the shores of Lake Edward. In the Kaiso/Tonya area along Lake Albert, there are about 3,000 people.

Table 3.4 below gives figures for access to various social services based on Uganda's 2002 census data. It shows that on average around 15% of the households in the districts around Lake Edward and Albert have access to a health facility within 5 km, while nearly 20% of households have access to a primary school within 5 km. Less than 1% of households have water supplied on their premises, while 16% have water within 1 km. With regard to health, malaria, respiratory infections and

diarrhea are the prevalent causes of morbidity. HIV/AIDS prevalence in the project districts is around 6 %, but reportedly very high in the fishing villages.

Table 3.4: Access to Basic Social Services in the Project Districts in Uganda

Project District (Uganda)	Health Facility		Primary School		Water Source		
	Upto 5 km	> 5 km	Upto 5 km	> 5 km	On premises	Upto 1 km	> 1 km
Lake Edward							
Bushenyi	15.0%	4.6%	18.8%	0.8%	0.7%	16.7%	2.2%
Kanungu	15.4%	5.8%	19.6%	1.6%	0.7%	17.0%	3.5%
Kasese	15.5%	3.4%	17.6%	1.3%	1.4%	12.5%	5.0%
Rukungiri	15.9%	4.5%	19.7%	0.7%	0.9%	17.6%	2.0%
Lake Albert							
Bundibugyo	17.3%	4.1%	20.0%	1.5%	1.3%	15.5%	4.7%
Hoima	14.9%	5.6%	18.7%	1.8%	0.7%	15.7%	4.0%
Kibaale	12.1%	8.9%	18.9%	2.1%	0.6%	16.5%	3.9%
Masindi	13.5%	6.5%	17.9%	2.1%	0.8%	14.4%	4.8%
Nebbi	17.0%	3.7%	19.8%	0.8%	0.7%	16.7%	3.3%

Source : http://www.ubos.org/onlinefiles/uploads/ubos/census_tabulations/centableB31.pdf
UBOS, Uganda 2002 Population and Housing Census

In Nord-Kivu Province, only 17% of the population has access to potable water (and still fewer to electricity). 45.5% of the population suffer from chronic malnutrition, and life expectancy is 43.7 years. The HIV/AIDS prevalence rate in the province is 5.4%.

3.2.3 Settlements

The main urban centres in the Project districts and LEA Basin are Kasese, Rukingiri, Fort Portal, Hoima and Masindi and Hoima in Uganda, and Rutshuru, Lubero, Beni, Bunia Djugu and Mahagi in DR Congo. The main settlements along the lakeshore on Lake Albert are Nyakasenyi, Ntoroko, Kalondo, Mirembe, Kiabahamba, Kaiso-Kabanda, Tonya, Kibiro, Ruga, Butiaba, Walykubya, Bugoigo, Wanseko and Kiyonga and Dei on the Ugandan shores, and Mahagi Port, Pigwa, Tshoma and Kasenyi on the DR Congo shores. On Lake Edward, some of the main settlements along the lakeshore on the Ugandan side are Kayanja, Fort George, Katwe, Mweya, Kisenyi. Rwenshama, while on the DR Congo side they are Chavinionga, Isango-Isoro, Katanda, Kamande and Bwera-Vitschumbi, and Buheri.

In the Uganda, the fish landing sites/fishing villages in the Project area were demarcated and gazetted in the 1950s. On Lake Edward, these villages are enclaves, entirely surrounded either by Queen Elizabeth National Park in Uganda or in the DR Congo, by the Parc National des Virunga. There was concern that as a result of oil exploration, some of the villages would be relocated. However, it seems unlikely that that will be allowed to happen.

As mentioned above, the fisher population of the fishing villages varies, depending on the fishing season. In addition, due to the civil unrest in the DR Congo, many fishermen from the DR Congo have settled in the Ugandan fishing villages, or go back and forth from Uganda to DR Congo.

3.2.4 Socio-Economic Activities

The main economic activities in the project area are fishing and subsistence small holder farming. Nearly 73% of the population is dependent on fishing as a livelihood. Fishing is mainly done using dormant gill nets, beach seines, hooks and traps. Plank canoes and traditional dugout canoes are used. Less than 25% of the boats are motorised. Activities associated with fishing include fish processing (selection, smoking or sun-drying, which is usually done by women), boat building and repair. People in the fishing villages area also involved in other activities such as trading/retail business, food vending, restaurants and hotels (boarding and lodging).

The main crops grown are beans, maize and bananas for subsistence but sometimes for cash. Along the Mubuku River in Kasese District, some irrigated agriculture also takes place. In some parts of Kasese District, tobacco and cotton are grown as cash crops. Coffee is grown at the foot of the Ruwenzori Mountains, while tea is grown in Hoima and Kanungu Districts. There is a sugar cane plantation in Masindi District. In the drier areas of the project districts, for example the Semiliki Flats, Kasese District and around Lake Albert, there are several pastoral tribes whose livelihoods depend on livestock. Most fishermen and/or their families also have farms outside the fishing villages, and grow food crops. Where the fishing villages are located outside protected areas (eg. those along Lake Albert), livestock (cattle, sheep and goats) is also reared.

Tourism is becoming an increasingly important activity in the Project area, on account of its unique wildlife and scenery. Tourism is being strongly promoted by both the Ugandan and DR Congo governments. In the Ugandan parks in the project area (QENP, MFNP, and RMNP), there are a number of tourist accommodation facilities.

3.3 STATUS OF CRITICAL ECOSYSTEMS

The Environmental Sensitivity Atlas of the Albertine Rift (NEMA, 2010) lists the most sensitive land use forms that would be affected by oil exploration activities and oil spills. The document also describes all the various types of ecosystems that occur within the Albertine Rift, and suggests that high forests, wetlands and open water are the most sensitive ecosystem types on account of the difficulty in restoring them to their original state, once they have been affected or destroyed in any way. This is true whether the damage to these ecosystems is caused by oil spills or other anthropogenic and non-anthropogenic activities (eg volcanic eruptions or earthquakes), since the ecological dynamics of these systems take years to establish.

The LEA Basin ecosystems specifically face a number of threats. The expanding population in the LEA catchment area, particularly at the fishing villages and landing sites, has resulted in a demand for land, leading to deforestation and clearing of wetlands, in turn causing loss of ecosystem habitats. Deforestation is also occurring due to growing requirements for fuelwood. These have resulted in increased levels of suspended solids in water courses which ultimately end up in the lakes. Poaching of wild animals is on the rise as the need for food (protein) rises. Pollution from domestic sewage (both in the immediate vicinity of the lake, but also further up in the catchment), agricultural inputs and mining is also contributing to deteriorating water quality in the lakes. Oil drilling activities could lead to contamination of lake waters by oil, although there is no evidence that this has happened to date. In Uganda, parties involved in the development of oil and gas resources are currently working together with the National Environment Management Authority to prepare an oil spill contingency plan.

In addition, fish stocks in the two lakes, in terms of species diversity and yield, are reported to be declining. This is also attributed to overfishing by the population expansion in the fishing villages resulting from natural growth and an influx of people from the DR Congo and other parts of the

Project districts, as well as to fishing malpractices, such as harvesting immature fish, and use of illegal nets (ie. those with mesh sizes of less than 4 ½ cm).

These concerns were re-iterated during the consultations held with representatives of the various government institutions, fisher folk and other stakeholders consulted during this study.

3.4 LEGAL AND INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT

3.4.1 Legislation and Regulatory Framework

There are a number of pieces of legislation in both the DR Congo and Uganda that regulate fisheries, covering the registration of vessels, licensing of activities, fishing gears, prohibited methods of fishing, fish quality standards and their enforcement. However, much of the legislation was drawn up more than 20 years ago, and does not address transboundary aspects of fisheries management that arise from shared water resources – for example, the two countries have different standards of compliance and quality. The existing legislation is based on the premise that fisheries resources are to be exploited as a food resource and for income generation. Moreover, the fisheries laws often overlap and conflict with other sector legislation, such as wildlife, environment, water, forests, mining, public health and local government.

Democratic Republic of Congo

The Fisheries Policy is based on the need to increase fish production to provide protein for the local populations and thereby to ensure food security. There is no central environmental law although there are many isolated legal texts relating to environmental matters. DR Congo now has a decentralized system of governance, and local governments (provinces) have been granted legislative powers. The main legislation governing fisheries in DR Congo includes the following:

- 1932 Decree on Exclusive Fishing Rights;
- 1937 Decree on Fishing and Hunting as amended for its fisheries provisions by a decree of 17 January 1957, a legislative ordinance No. 52/273 of 24 June 1958 and a decree of 27 June 1960);
- The Ordinance No. 432/Agri. of 26 December 1947 (as amended in 1952 and 1954) provides for the status and powers of fish controllers;
- A 1979 ordinance (as amended by a regulation of 1983) provides for fishing permits, fees and determines the various issuing authorities;
- A regulation of 1981 prohibits fishing by means of electrical devices, explosives or toxic substances and provides for the seizure by the authorities of any such articles and any catch caught by such means;
- In 1985, a draft law providing a general legal framework for both marine and inland fisheries was devised with the assistance of FAO. It comprises 70 articles primarily directed at regulating inland fisheries.

Uganda

The Fisheries Policy in Uganda has been shaped by a number of policy initiatives at national level, including the Constitution of Uganda, 1995, the National Environment Management Policy (1994), the National Policy for the Conservation and Management of Wetland Resources (1995) the National Water Policy (1999) and the decentralization and privatization policies. The Fisheries Policy recognizes the need for sectoral development to proceed according to principles of 'rational

exploitation' and 'sustainability,' and to achieve a balance of benefits between domestic food and employment provision requirements, and generation of foreign exchange through export sales. The main fisheries and other related legal instruments include the following:

- Fish Act, Cap. 228, Rev. 1964;
- Trout Protection Act, Cap. 229, Rev. 1964;
- Fishing Rules, 1964;
- Fish and Crocodiles (Amendment) Act , 1967;
- Fish and Crocodiles (Immature Fish) Statutory Instrument No.15 of 1981;
- Fish and Crocodiles (Limitation on Number of Licenses) Statutory Instrument No.29 of 1981;
- National Environment Act, 1995, and its regulations as follows:
    - Environmental Impact Assessment Regulations, 1998;
    - National Environment (Standards for Discharge of Effluents into Water or on Land) Regulations, 1999;
    - National Environment (Waste Management) Regulations, 1999;
    - National Environment (Wetlands, River Banks And Lake Shores Management) Regulations, 2000;
    - National Environment (Hilly And Mountainous Areas Management) Regulations, 2000;
    - National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001;
- Local Government Act, 1997;
- Water Act, 1995 and the Water Resources Regulations and Water (waste discharge) Regulations, 1998;
- Mining Act, 2003;
- Public Health Act, 1964;
- Fishing (Quality Assurance) Rules, 1998;
- Uganda Wildlife Act, 1996;
- Fish (Beach Management) Rules, 2003;
- Fish (Aquaculture) Rules, 2003.

At the international level, DR Congo and Uganda have a number of international conventions/ protocols relevant to the LEAF Project including:

- Phyto-sanitary Convention for Africa;
- African Convention on Natural Resources and Nature Conservation;
- Ramsar Convention on Wetlands of International Importance;
- World Heritage Convention;
- Bonn Convention on Migratory Species of Wild Animals;
- Convention on Biological Diversity ;
- Bamako Convention on the Ban of the Import Into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes Within Africa.
- Basel Convention on Transboundary Movement of Hazardous Wastes.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- UN Framework Convention on Climate Change (1992), and its protocols (Montreal, Kyoto).

3.4.2 Institutional Arrangements for Fisheries and Environmental Management

In both DR Congo and Uganda, fisheries fall under the Ministry responsible for agriculture.

In DR Congo, the Fisheries Department deals with law enforcement, while the Service National pour le Développement des Pêches (SENADEP) deals with fisheries management. Other government ministries and departments in DR Congo with a stake in fisheries management include:

- Ministry of Environment, Nature Conservation and Tourism;
- Ministry of Planning (National Water & Sanitation Action Committee);
- Ministry of Energy (Water Supply Corporation);
- Ministry of Transport;
- Ministry of Public Health ;
- Institut Congolais pour la Conservation de la Nature (ICCN).

The DR Congo has two local institutions that are also currently involved in fisheries: COOPEVI and Unité de Gestion des Ressources en Pêche (UGREP) and Cooperative des Pêcheurs des Virunga (COOPEVI), both of which are involved in the management of fisheries at the local level.

In Uganda, the Department of Fisheries Resources is responsible for regulation, law enforcement and fisheries management services. The following governmental institutions in also have a stake in fisheries management:

- Ministry of Water and Environment;
- National Environment Management Authority;
- Wetlands Inspection Division;
- Fisheries Resources Research Institute;
- Department of Environmental Health in Ministry of Health;
- National Water and Sewerage Corporation;
- Government Analytical Laboratory;
- Uganda National Bureau of Standards ;
- Uganda Wildlife Authority;
- Makerere University.

In Uganda, Beach Management Units (BMUs) have been set up (in place of fisheries guards) with a view to involve the community in the management of lake fisheries. The BMUs are responsible for mobilizing and sensitizing local people for participation in managing fisheries activities, the intention being to supplement the Fisheries Department's efforts to provide advisory and extension services.

In both countries, fisheries offices have inadequate budgets, and are poorly staffed and equipped, and this hinders the provision of technical services, build capacity at the local community level and to monitor fisheries activities in the lakes.

At the political level, the Joint Permanent Commission was established in 1986 as an institutional mechanism for cooperation between DR Congo and Uganda. The Commission last met in 1997 due to strained relations and armed conflicts between the two countries in the nineties. Subsequently at the end of 2007, the Joint Permanent Commission was revived, and a decision was taken relating to updating the 1990 Protocol on Fisheries which needs to reflect the current issues in order to be able to regulate transboundary fisheries. However at present there is no formal dispute resolution mechanism between the two countries to resolve disputes/conflicts relating to access to fisheries resources – this is done on an ad hoc basis during cross-border meetings.

With regard to the petroleum sector, there are existing frameworks for regional cooperation in petroleum matters through the Committee on Energy of the East African Community of which Burundi, Kenya, Rwanda, Tanzania and Uganda are members. The cooperation between Uganda and the Democratic Republic of Congo (DR Congo) is governed by the 1990 Agreement of Cooperation as amended in January 2008.

4 STAKEHOLDER CONSULTATIONS

4.1 CONSULTATIONS DURING THE LEAF PILOT PROJECT

During the LEAF Pilot Project, extensive stakeholder consultations were carried out with fisher communities along Lakes Edward and Albert in order to establish a socio-economic profile of these communities. This has been summarised in Section 3.2 above. In addition, consultations were held with both fisher communities and representatives from relevant government institutions in order to establish the most important issues affecting, or likely to affect, the lacustrine communities. Critical issues and problems in the Lakes Edward and Albert Basin as perceived by the stakeholders were consolidated as being:

- Poverty, especially among the fisher communities;
- Declining fish stocks due to overfishing;
- Civil wars causing population displacement;
- Land degradation in the lake catchment areas, leading to siltation and chemical and physical pollution of the waters;
- Shortage of sources of energy, leading to deforestation, and therefore loss of biodiversity;
- Wetland destruction;
- Degradation of river banks and lake shores, resulting from clearing of vegetation;
- Water quality deterioration, due to poor agricultural practices in the catchment and use of agricultural inputs as well as solid and liquid waste being disposed of into the lakes;
- Lake water level fluctuations, probably due to climate change but also upstream abstraction;
- Poor mining and quarrying practices resulting in sediment loading and heavy metal pollution of the rivers and lakes;
- Conflicts in resource use, for example oil exploration and drilling;
- Inadequacies in policy, laws and institutions;
- Prevalence of diseases and pests, due in part to poor sanitation in the fishing villages;
- Poor public and stakeholder participation;
- Poor information generation, dissemination and management.

The above issues have direct adverse implications on the livelihoods of the lacustrine communities, and it was felt that if no action is taken the consequences would be serious. There was also apprehension with regard to how to mitigate these problems, and who would bear the costs of doing this. In addition, stakeholders understood the geological extent, and the transboundary nature, of these issues (refer LEAF ILMP 2008).

4.2 STAKEHOLDER PARTICIPATION IN LAKE MANAGEMENT

In the DR Congo there have been various agreements between the Government, ICCN and the Lake Edward and Albert communities, but these have only partly worked. For Lake Edward, apart from the ICCN, two local institutions are currently involved in fisheries: COOPEVI and UGREP. In 1949, a 30-year concession agreement was signed between the Government (ICCN) and COOPEVI, which was renewed in 1979, but expired in 2009. At the moment therefore, COOPEVI has no legal standing to manage the fisheries on the lake. ICCN is now in the process of renewing this agreement but only for a limited period, after which ICCN will assess progress and will decide if a further 30 year agreement should be signed.

In Uganda, management of Lakes Edward and Albert falls under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Previously there were fish guards who were government employees at every landing site. In a bid to increase stakeholder participation in lake management,

MAAIF helped to set up a Beach Management Unit (BMU) at each landing site. MAAIF supervises the BMUs, and the BMUs are supposed to patrol, inspect fishing gear, and collect data on fish catches, length and weight of fish. The BMUs are required to report back to MAAIF on a monthly basis. However, while some BMUs are effective, the majority are not. Constraints faced by the BMUs include lack of capacity, lack of financial resources for patrolling and monitoring, and poor office facilities. Apparently criteria for forming committees are flawed as they are based on the popular vote (and as the majority of fishers support illegal fishing they will vote for a person that will condone illegal activities). Consequently data collected is inconsistent, and management of the lake is generally poor.

4.3 CONSULTATIONS DURING THIS ASSIGNMENT

Consultations were also held with various stakeholders both in the DR Congo and Uganda, during this assignment. A list of persons consulted is provided in Annex B. A summary of the outcome of the consultations during this assignment is presented below.

4.3.1 DR Congo

Discussions were held with the Provincial Government of Nord Kivu Province (It was not possible to visit Orientale Province during this assignment due to logistical and security reasons). At this level the link between environment and agriculture, and the importance of the LEAF Project was appreciated. In addition, the need for integrating projects and opportunities was stressed. For example, with regard to Lake Edward and the Parc National des Virunga (PNV), the need to coordinate tourism, security, wildlife (including fish) and environment was acknowledged. The Provincial Government indicated their willingness to support a mechanism for coordination between NELSAP and themselves. One of the main issues in the country is energy supply. Charcoal and fuelwood are the primary energy sources, and this is having a serious impact on the forests, leading to large scale soil erosion, and consequently affecting the quality of water in the rivers that feed Lake Edward (and Lake Albert).

Lake Edward constitutes a very important ecosystem within the PNV. As mentioned in Section 3.1.10, the entire lake area lying within the DR Congo falls within the park, and is under the management of the ICCN. According to the park's Director, the main threats to the lake are due to:

- Illegal settlements on the west coast of the lake;
- Substantial movement of people into the park to exploit the lake resources;
- Agricultural development in the lake's catchment area;
- Deforestation resulting from an increased demand for charcoal and fuelwood;
- Illegal fishing;
- Oil exploration and drilling currently being done on the Ugandan side of the lake;
- Presence of armed groups (some of whom are benefitting from illegal fishing).

The ICCN is implementing various measures to address some of these problems, for example through protecting breeding sites (most of the fry areas in the southern and northern parts of the DR Congo side of the lake are protected), controlling net size, regulating the number of boats on the lake, and regulating the number of fisheries on the lake. ICCN patrols the lake (it has three fast boats for this purpose), and they also conduct aerial surveillance. Although there are number of statutes and regulations in place, these have proved unpopular with the local fisher communities.

A meeting was held with members of fisher communities along Lake Edward (a list of participants is provided in Annex B). They listed their major concerns as follows:

- Fish stocks are declining;
- There are too many fisheries – only 400 boats are legally allowed, but they believe there are in excess of 2,800 boats operating on the DR Congo side of the lake;
- The fishermen find it difficult to identify areas set aside for breeding, so there needs to be clear demarcation of breeding sites;
- Road infrastructure to the fish landing sites is very poor, which makes it difficult for them to take their catch to the market;
- Illegal fishing has displaced fish stocks and needs to be stopped;
- Illegal fishermen are also threatening registered fishermen (security risk);
- Agriculture around the lake is causing pollution of the lake, which is affecting fish stocks;
- Fishermen need training in fishing techniques;
- The nets that are available in the market are packaged and sold as 4 ½ cm mesh size, but when the fishermen use these nets they are caught for having illegal nets. So while they are trying to respect the law, they are being cheated by the shopkeepers;
- Not many women participate in fishing, but they are involved in fish processing, especially smoking. Conditions for fish processing are very poor;
- The solid and liquid waste situation at the fish landing sites is very bad, and needs urgent management.

The participants felt that since ICCN, together with local fishing cooperatives COOPEVI (Coopérative des Pêcheurs de Virunga) and UGREP (Unité de Gestion des Ressources en Eau et Pêche), have become actively involved in the management of the lake, and in preventing illegal fishing, there has been some recovery in fish stocks.

4.3.2 Uganda

Discussions were held with officers from the District Offices in Bushenyi, Rubirizi, Kasese and Hoima Districts, and from the Uganda Wildlife Authority in Queen Elizabeth National Park (QENP). In addition, meetings were held with officers from NEMA, UWA, the Department of Fisheries Resources in the Ministry of Agriculture, Animal Industry and Fisheries, and the Directorate of Water Resources Management in the Ministry of Water and Environment.

There are a number of landing sites and fishing villages located within QENP and MFNP which were gazetted in the 1960s and therefore legally do not fall within the jurisdiction of the park. The settlements were gazetted in order to facilitate fishing and trading, but these have now become towns. This makes it problematic for the park authorities to control activities in the landing sites. The increasing populations in the fishing villages have had several serious consequences on the lake ecosystems:

- Effluents (foulwater) from the villages/landing sites are being discharged directly into the lake;
- There is increased pressure on fisheries resources, due to overfishing and poaching, while fish stocks are also affected by diminishing water quality;
- The villagers keep domestic animals which encroach into the national parks;
- The villagers also go into the parks to collect wood and catch wild animals for food, leading to human/wildlife conflict.

Other issues of concern include:

- Oil exploration and drilling activities on Lakes Edward and Albert could potentially lead to pollution of the lakes;

- Environmental degradation in the lake catchment areas, resulting from deforestation, clearing of wetlands and poor agricultural practices, is also leading to sediment loading of rivers and streams which flow into the lakes, subsequently affecting the lake water quality.

Discussions were also held with members of the fisher communities and BMUs at Rwemshema on Lake Edward, and Kaiso on Lake Albert. They raised the following issues:

- The number of fishermen is increasing, and immature fish are being caught. Fish stocks are therefore declining;
- The influx of refugees from the DR Congo is contributing to the increase in the number of fishermen;
- Access (roads) to markets from the fish landing sites are in very poor condition, so while market prices at the fish landing site are low, by the time the fish is sold in the markets, the price is very high;
- Because of the poor road conditions, some sites are not served by public transport;
- The price of fishing nets is very high so fishermen buy cheaper fishing gear which does not always comply with regulations;
- Water supply, sanitation and solid waste disposal facilities are poor – at some sites there are no public latrines;
- Health care facilities are located very far from the fishing villages;
- Fish processing sites are also far from the landing sites – there is a need for improved facilities so that fish for export can be handled/processed at the landing sites;
- The landing sites are surrounded by national parks, and in addition there are crocodiles and hippos in the lakes: people are often attacked by wild animals;
- Regulations between DR Congo and Uganda differ – the former are more lax than the latter. Also if a Congolese is caught breaking the law in Uganda he/she is deported, while if a Ugandan is caught in DR Congo, they are put into prison;
- There is a need for identifying and pursuing alternative livelihoods outside the fishing villages and national park areas;
- There is concern among the fishermen that oil drilling activities could affect fish stocks;
- There is a big demand for wood for charcoal as well as for smoking fish – this has led to deforestation around the landing sites and villages and therefore people are now going into the parks to find wood.

Most of these concerns have been highlighted in earlier consultations undertaken during the preparation of the Baseline Survey Report for Quality Assurance for Fish Marketing (DFR, October 2009).

4.4 CONCLUSIONS

The issues of concern expressed by stakeholders representing government institutions as well as fisher communities during the LEAF Pilot Project are still valid today. In essence, the erosion of the natural resource base due to growing population in the fishing villages, over-fishing, and point- and non-point pollution, have caused ecological imbalances which are impacting on the ecosystems of the lakes, consequently posing a threat to lake fisheries, and therefore to the livelihoods of the fisher communities, as well as to other potential sources of income, such as tourism.

Recognising the above, there is undoubtedly great support for the project from the majority of government institutions in the DR Congo and Uganda, from civil society and, importantly, from the fisher folk themselves who would be the primary beneficiaries of the project.

The current Priority Action Plan (Plan d'Actions Prioritaire PAP 2010) for Nord Kivu Province highlights reduction of pressure from human activities on protected areas, promotion of good agricultural practices, re-establishment of forest cover, and soil conservation as actions for conservation. For fisheries, the Plan prioritises sensitisation of fisher communities on best fishing practices; rehabilitation of fish processing facilities, infrastructure and equipment; and enhancement of technical capacity at the fisheries stations.

The Government of Uganda's commitment to managing the lake ecosystems is reflected in various district documents. For example, the Bushenyi District Environmental Action Plan (2005) identified soil degradation, deforestation, wetland degradation and cultivation along lakeshores and river banks as being key areas for intervention. However, since subsequent action plans were not prepared, it is not clear whether the proposed interventions were implemented. The Hoima District Development Plan 2009-2012 states its natural resources objectives as being: to improve on the rational use of our natural resources for sustainable development and poverty eradication; to empower community to sustainably harness/use natural resources; to attain and maintain a clean, healthy and productive environment; and to increase productivity of natural resources base. The district hopes to achieve these through, among other activities: enforcing environmental policies and laws; restoration of degraded ecosystems; mainstreaming environmental concerns into the District policies, plans and programmes; sensitization and capacity building among the public and government institutions; and environmental monitoring of natural resources. The Kasese District Development Plan (2010/2011) lists soil erosion and loss of soil fertility, poor health and sanitation, reduced tree cover, conflict within protected areas, pollution and poor waste disposal, reduced fish stocks, and degraded wetlands, riverbanks and lake shores as being the major environmental problems in the district. Proposed strategies for addressing these issues include environmental sensitization; implementing soil conservation measures; improving agricultural practices; providing public access to clean drinking water, sanitation and solid waste disposal facilities; formulating and enforcing bylaws and laws on sanitation, effluent discharge and wetland conservation; implementing reafforestation programmes and regulating tree harvesting; and providing alternative income sources for the local communities (for example fish farming as opposed to lake-based fishing).

However, there is need for more tangible participation from the Uganda Wildlife Authority since a substantial portion of the catchments for Lakes Edward and Albert lie within UWA's jurisdiction and the very resources that UWA is mandated to protect stand to be threatened by any deterioration in the environment in and directly around the lakes.

Coordination between the various government institutions will be crucial for the proper implementation of the ESMP. This is perhaps one of the greatest weaknesses, and although commitment to facilitate the LEAF Project has been expressed by both the Nord Kivu Provincial Government in the DR Congo and the Fisheries and Water Resources Departments in Uganda, there will have to be a determined effort to form some sort of mechanism for coordination between the two member countries and between the various institutions within the countries.

Finally, there is clearly a need for enhancing the capacity of the BMUs and UGREPs through training and provision of additional resources.

5 ENVIRONMENTAL SCOPING

At this stage, the exact nature, and specific locations, of activities to be implemented under the LEAF Project have not been determined. Consequently the analysis of environmental and social issues that may arise as a result of the Project has been carried out at a generic level. This will be based on the critical issues experienced in the LEAF Project area, and through determining what effects the proposed project components and activities will have as a whole, rather than at the project-specific level. Activities to rehabilitate or build new infrastructure will require specific EIAs to be carried out in accordance with the respective environmental laws and regulations of Uganda and DR Congo.

Based on a review of documentation and stakeholder consultations, the critical environmental and social issues within the LEAF Project area can be summarised as:

i. Increasing populations in the fishing villages due to natural growth. In the case of the Ugandan settlements, this is also attributed to the influx of migrants, from more densely populated districts such as Kabale and West Nile, and also from refugees from the DR Congo;
ii. Wildlife/human conflicts due to the fishing villages being located within protected areas;
iii. Deforestation in protected areas due to the demand for charcoal and fuelwood in the settlements;
iv. Overfishing and poaching of wildlife to feed the growing populations in fishing settlements, and militia;
v. HIV/AIDS, which is a significant problem in the fishing villages;
vi. Poor water supply, sanitation and solid waste disposal at fishing villages and landing sites;
vii. Declining fish stocks threatening the livelihoods of fisher communities;
viii. Limited opportunities for alternative sources of income;
ix. Deforestation in the lake catchment areas and destruction of wetlands, leading to high levels of suspended solids in lake water quality and sedimentation;
x. Potential pollution from oil drilling and exploration activities in both Lake Edward and Lake Albert;
xi. Poor agricultural practices causing chemical pollution, as well as sediment loading of the lake waters;
xii. Lack of capacity and/or financial/human resources among fisheries institutions, BMUs and fishing cooperatives to manage lake resources effectively;
xiii. Spread of water hyacinth (*Eichhornia crassipes*) which forms mats that prevent sunlight and oxygen from reaching the water columns and submerged plants, while its shading and crowding of indigenous aquatic plants reduces biological diversity in aquatic ecosystems.

For the most part, the LEAF Project activities will focus on:

- Studies, research, surveys and analyses;
- Training, capacity building and sensitisation programmes;
- Setting up documentation centres, databases and information management systems;
- Supplying equipment for data gathering (eg hydro-meteorological stations and stations for monitoring lake levels and river flows), patrolling, laboratories, etc.
- Developing plans and strategies for management of the lake resources and their catchments; and
- Reviewing/harmonising legislation and regulations for managing fisheries and lake resources for both member countries.

The activities listed above per se are not likely to cause adverse environmental impacts, but they may have indirect, cumulative or synergistic effects in the medium to long term. These are discussed in the following chapter.

Proposed LEAF Project activities (listed in Tables 2.1 above) that may require specific environmental assessments, depending on their location and scale, are:

- The construction of fish handling facilities;
- The construction of ice plants;
- Construction of fish artisanal processing facilities (eg. fish smoking and salting sheds, fish drying areas);
- Provision of clean and potable water supply at landing sites and fishing villages;
- Rehabilitation of access roads and road network from landing sites to markets;
- Establishment of weevil rearing stations for biological control;
- Mechanical removal of aquatic weeds;
- Construction of social infrastructure eg. educational facilities, electrification, social halls, health facilities, etc;
- Establishment of aquaculture parks;
- Promotion of ecotourism;
- Construction of urban solid waste management systems (composting, storage, etc) at demonstration sites;
- Construction of storm water drainage infrastructure and sanitation systems at four demonstration sites;
- Rehabilitate fisheries, water and environment research facilities and structures.

The potential impacts of these facilities are discussed in generic and strategic terms in the following chapter.

6 ANALYSIS OF POTENTIAL ENVIRONMENTAL AND SOCIAL ISSUES

6.1 INTRODUCTION

As mentioned in Section 1.3 on the methodology adopted for this assignment, the analysis of impacts has been made on a generic level. Therefore specific impacts of each of the proposed interventions are left to the project specific EIAs to examine. At the strategic level, the impacts of the proposed Project have implications on human and ecosystem well-being.

6.2 OVERVIEW OF BENEFICIAL IMPACTS OF THE LEAF PROJECT

The overall objective of the LEAF Project is to ensure the sustainability of fisheries of Lakes Edward and Albert, and the ecosystems within the lake basins. This is to be done by developing strategies and projects that would reduce poverty levels among the fisher communities, ensure food security, provide alternative means of livelihoods and protect the environment.

Proposed studies, research and surveys will result in the collection of data and setting up a database which will allow fish spawning areas to be identified and then protected, and will also enable a fisheries management system to be established so that the lake fisheries can be effectively and sustainably managed. The review and harmonisation of laws and training of relevant personnel in enforcement will also contribute towards enhancing sustainable fisheries. Support will be provided for alternative income generating activities through training and capacity building, and through the facilitation of access to credit. Fishermen will also be trained in means to reduce post-harvest losses, so that they will be able to sell more fish, while setting up fish processing facilities will add value to fish products. In the process it is likely that additional skills will be developed among the fisher communities that would result in improving their livelihoods and thereby alleviating poverty. Improving hygiene at the fish landing sites and providing an ice plant will ensure that the fish is not contaminated and that it remains fresh, and therefore more acceptable for marketing abroad. Marketing will be made even easier through improvements in road infrastructure. Provision of sanitation facilities, water, and urban waste disposal systems will elevate the health standards of the fisher communities, which will increase their productivity and hopefully their ability to generate more income. The construction of social amenities will contribute to strengthening the social fabric of the community and improve their health and education levels.

The project will also help to address the prevailing issues of land degradation and pollution of water sources in the LEA Basin by instituting soil and water conservation measures, and again through training, capacity building and sensitisation. In addition, it is anticipated that by strengthening the capacity of the relevant government institutions responsible for environmental management in the lakes and their catchments, they will be able to properly monitor the condition of land and water resources for the purposes of sustainably developing these resources.

Finally, the project will provide for strengthening the collaborative management of the transboundary natural resources of the lakes, and in this way it will contribute to the sustainable utilization and development of lake resources towards improvement of community livelihoods.

6.3 GENERIC PROJECT-SPECIFIC IMPACTS

6.3.1 Hydrology

Road improvement/construction will cause some temporary (but overall minor) changes in hydrology during the construction phase, particularly where access roads and bridges/culverts will be newly constructed or rebuilt. In the case of existing access roads, subterranean and surface drainage will already have been altered. But where new access roads are to be constructed, then there will be a small overall change in surface hydrology, caused by altering the natural flow of runoff across the land. As for bridges and culverts, these tend to concentrate flow, and may result in eddying and ponding, and on occasion erosion of the riverbank on the downstream side of the river or stream if provision has not been made for sufficient through flow.

Climate change could also affect hydrological flow and drainage in the LEA catchments. This is discussed in Section 6.4.6.

Mitigation:

- During the construction / improvement of access roads and rehabilitation of culverts and bridges, the design must ensure that the flow of water in the river (or any streams encountered en route) is not impeded.

6.3.2 Soil Erosion

During the construction of the fish landing sites, fish processing facilities and ice plants, and road construction/improvement, earthworks may cause soil erosion, which could continue after construction. Improper drainage (for example from road runoff) could also lead to erosion, and subsequent increases in sediment loads in watercourses.

Mitigation:

General

- Proper management of excavation activities and organisation of spoil, eg by covering it, will reduce the amount of soil washing away. The spoil can then be reused (for backfilling or landscaping).
- Compaction of cut surfaces of the excavation will reduce the amount of percolation.
- Earthworks should be controlled during the construction phase, so that land that is not required for the works is left undisturbed.
- Revegetation of disturbed areas should be undertaken as soon construction is complete. Planting with grass for stabilising any steep slopes/embankments should be considered.
- Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain.

Access Roads

- Along access roads, provision should be made for directing road runoff away from the road, by installing side drains and mitre drains. These structures must be well designed, properly constructed and regularly maintained so that runoff does not accumulate by the side of the road, water that is drained off the road does not create gullies, and siltation of the structures does not occur. Steeper sections along the access roads (those having gradients greater than 4%) should have cascades and/or scour checks along the side drains.
- All drainage structures must ensure safe final disposal of water and must also be self-cleaning.

- All embankments should be planted with shrubs and grasses to stabilise them as well as to reduce the chances of erosion.

6.3.3 Pollution

Air Quality

The main pollutants during construction will be dust (from excavators and earth moving vehicles, as well as materials delivery), particulate matter from dry materials (sand, cement, gravel, murram, etc), and emissions (smoke, hydrocarbons and nitrogenous gases among others from machinery exhausts). This will, however, have a localized effect confined to the immediate surroundings of the site.

During and after construction, dust will result from vehicles travelling along the access roads to the fishing sites.

Mitigation:

- The speed of vehicles on unsurfaced (gravel or earth) roads should be limited to reduce dust levels. This can be achieved by supervising drivers of construction vehicles, and also through sensitising all drivers.
- Proper maintenance of construction plant and equipment (including trucks) will reduce emissions of noxious fumes (carbon dioxide, carbon monoxide, nitrogen oxides, and sulphur oxides).
- Water should be sprayed on working areas to reduce dust.
- Any stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to minimise dust emissions.

Noise Pollution and Vibration

Noise and vibration are associated with all construction works and will result from activities such as trenching and earthworks, as well as from construction equipment and vehicles. These will be temporary impacts.

After construction works, noise is not expected to be an issue.

Mitigation:

- Machine operators and truck drivers should be sensitized to keep noise levels down at all times. No construction works should be carried out at night.
- The tender documents should stipulate that the Contractor is to keep noise levels to levels as specified in the national environmental laws.
- PPE should be provided to workforce where noise levels exceed permissible limits.

Water Quality

Water quality in the lakes has been discussed in Section 3.1.8.

The project components that involve construction activities may contribute to siltation in the lakes and the wetlands along their shores, from building debris and soil erosion. Soil from the earthworks may be washed into the lakes, consequently reducing the water quality.

Sewage from latrines at the fishing site is another possible contaminant of lake water sources.

Sediment loading due to soil erosion could continue after construction, and will be dependent on the effectiveness of soil protection and conservation measures employed.

There is some risk to water quality in the lakes from spillage of oil products, for example, from generators which may be installed for the weevil rearing stations or the laboratories, or due to leakage from construction vehicles.

There may also be some chemical contaminants from laboratory wastewater (weevil stations and water quality laboratories). It is likely that the concentrations of these chemicals will be small, and could well be diluted in normal wastewater streams. However, an EIA will need to be conducted for the laboratories in order to assess the true amounts and therefore impacts of chemicals that may be used and disposed of.

Mitigation:

Sediment Loading

- Proper management of spoil and diligence on the part of the Contractor during earthworks will reduce the risk of contamination by sediment loading of the river. If possible, earthworks should be done during the dry season.
- The incorporation of erosion protection measures (see above) would reduce the amount of soil reaching water bodies.
- The Contractor must ensure that construction debris is disposed of in a sensible manner and not thrown into the river. This should be stipulated in the tender documents.

Foulwater Contaminants

- The location of sanitation facilities to be provided, and their design, should be such that they do not allow contamination of water bodies. This will depend on the topography and soils of the specific area where the facilities are to be located. Wastewater discharges should conform to national standards for discharge into aquatic environments.

Pollution from Oil and Chemicals

- During the construction of infrastructure facilities, a specially designated area should be allocated on site for maintenance of construction vehicles, and plant vehicles so that oil spills can be controlled and localised.
- All oil products should be stored in a specified area, and all oil containers/drums should be stored on sump pallets.
- Procedures for the storage, handling and disposal of oil products and oil wastes, as well as other flammable liquids, should be drawn up for use by personnel handling these products.
- Spill kits should be provided.
- Drip trays should be used when oil is being drained from vehicles and equipment/machinery, and waste oil should be properly stored until it can be disposed of in an acceptable manner.
- Proper maintenance of plant and equipment, and vehicles will minimise oil leaks and therefore contamination by oil.
- An EIA will need to be carried out to address the impacts of the weevil rearing stations and water quality laboratories, including the impact of wastewater from these facilities.

Solid Waste and Construction Debris

Solid waste is a major issue at the fishing villages and landing sites. It consists mainly of papers, plastics, packaging, etc, disposed of by the local populations.

When the new infrastructure facilities are being constructed, construction debris, plastics, steel and metal residuals, wrappers and papers, glass, wood, etc, will also need to be disposed of.

Apart from visual impacts, solid can affect water quality and poses a health risk.

Mitigation:

- The tender documents should specify the proper disposal of all solid and construction waste during construction.
- Diligence on the part of the Contractor during construction activities will minimise the amount of construction debris generated, and also will ensure that debris is disposed of in a sensible manner, at a specified and approved dump.
- The LEAF Project will initiate an urban solid waste management system which will look into and provide means of disposal for solid waste generated at the fishing villages and landing sites.

6.3.4 Materials Sources

With regard to the construction of infrastructure facilities, the Contractor may need to identify gravel sites for the construction of access roads. Once the sites have been identified, the Contractor will be required to undertake environmental impact assessment studies on the sites. Alternatively he may choose to purchase gravel from an existing source – this latter option would be simpler in terms of adhering to environmental regulations and managing environmental and social impacts.

The soils in the project area are prone to erosion, and have a history of instability. Should the Contractor undertake to open up gravel sites, excavation activities as well as the gradient of excavated slopes of the gravel sites may affect erodibility of the soils. When gravel sites are being excavated, that land cannot be used for cultivation or grazing. After excavation it may still not be possible to cultivate that land because the topsoil will have been removed. A substantial portion of the cropping or grazing land therefore becomes unproductive. Furthermore, excavation often leaves an uneven land surface, which makes it difficult to cultivate later.

Drainage is another major issue associated with the excavation of gravel sites, as water tends to accumulate their lowest point. When the pits become saturated with water, it is difficult to remove material. Pits that are left open after excavation also tend to collect water. Accumulated water provides a breeding habitat for mosquitoes, thus propagating malaria. Other concerns relating to the winning of gravel include dust, disturbance during excavation, access (including destruction of structures), and hazards posed to children and livestock. Often trucks collecting material from such sites will use several routes to access one gravel site. This has severe implications on environmental degradation outside the immediate boundary of the excavated area. Homesteads that are located close to gravel sites will be affected by dust and noise during excavation. Provision of access and traffic to the gravel sites may also pose a nuisance to people living around them.

The sources of construction materials are yet to be established. However, the Contractor should be instructed in the use of all materials that may have negative environmental (including health) effects. As far as possible, environmentally friendly and sustainable materials should be used.

Mitigation:

In the event that the Contractor undertakes to excavate gravel himself, rather than source it from an existing site, the following will need to be carried out:

- In Uganda, an environmental impact assessment will have to be carried out for the materials site(s) for submission to NEMA. In DR Congo, EIAs will have to be submitted to ICCN for approval.
- People living at, or near, the materials sites must be informed of the environmental implications of excavation at the time of selection of the sites. The owners of the sites should be told at the earliest opportunity whether or not testing has revealed that material from their plot is acceptable for use by the project; the owners of material from the sites found to be acceptable, and which the Contractor selects for excavation, must be compensated. Gravel site owners must also be told of the options available to them after excavation, for example rehabilitation/landscaping, or fencing. The tender documents should instruct the Contractor to maintain fences and "make good" afterwards, in accordance with the written agreement with the landowner.
- All access routes to gravel sites should be planned ahead of construction and described in the tender documents. This will stop several routes being created to one materials site which would have severe implications on environmental degradation around the excavated area.
- Gravel pits must be excavated such that drainage is controlled, and water is not allowed to accumulate. Any water that does collect has to be pumped out and disposed off sensibly.
- The area to be excavated should be cordoned/fenced off, to keep livestock and children away.
- Gravel pits must be landscaped, and then reinstated or backfilled with overburden/topsoil. For this to be done, separate stockpiles of material should be put aside at the time of opening up the pits for topsoil, overburden, gravel, etc. Terracing and replacement of fencing is part of the rehabilitation process. The tender documents should instruct the Contractor to plant trees to replace those that have been removed during excavation.
- Dust emissions can be controlled by wetting the working surfaces.
- No garbage, spoil or oil wastes should be disposed of in the gravel site.

6.3.5 Vegetation / Flora

It is anticipated that any infrastructure facilities to be constructed will be within the fishing villages and landing sites, or on sites that have already been substantially altered from its original state. No infrastructure facilities are planned to be built in the protected areas or forests.

Before the construction process begins and also during the construction activities, clearing of some of the existing vegetation may have to be done. It is not clear whether any aquatic vegetation will be cleared.

Clearing activities could encourage soil erosion.

The project proposes setting up weevil rearing stations, where weevils will be used to control aquatic weeds. Details of this activity have not been established as yet. However, since it will support biological control, and given that the individual lake ecosystems are different, a detailed EIA will need to be done for this activity. In addition, precautions will have to be taken in the design of the station in order to avoid weevils escaping, and also to prevent contamination of the laboratories where they are kept.

Mitigation:

- Clearing of vegetation and trees should be limited to what is absolutely necessary, and should not be carried out indiscriminately.
- After road improvement/construction and powerline construction is complete, disturbed areas should be rehabilitated by planting grass and trees.
- A detailed EIA for the weevil rearing stations should be carried out for each lake.

6.3.6 Forests and Woodlands

Forests within the Project area have been described in Section 3.1.9. While the LEAF Project focuses on the protection of the forests and woodlands through its catchment conservation activities, the Project may encourage more settlement in the fishing villages as a result of the social amenities that it intends to provide. This will then put pressure on forest and woodland as demand for firewood and charcoal will increase. People may also have to go into the forest to collect timber for building materials, and non-timber products such as honey and plants (for food and medicinal purposes). Honey collection has been associated with forest destruction because fires are lit to smoke the bees out of their hives, and these fires are then left to burn in an uncontrolled manner.

Mitigation:

- Buffer zones around the forests and woodlands (and protected areas) in the Project area should be maintained (where they exist) or created.
- The local communities should be encouraged to plant woodlots for fuel. Most fishing villages do not have enough land to establish woodlots, but it may be possible to plant woodlots as part of the buffer zones.
- The local communities should be supported to use fuel efficient stoves, which use nearly 50% less charcoal. Amis de Forêt et de l'Environnement pour le Développement (AFED) in the DR Congo has done exactly this with initial support from NBI (see Chapter 8).
- Members of the local communities could be trained in apiculture. Bee hives can then be placed in the buffer zones along the forests, so that beekeepers do not have to go into the forests and woodlands or protected areas to get honey, nor do they have to smoke out the bees from the hives.

6.3.7 Wildlife / Fauna

The growing populations in the fishing villages (encouraged by the provision of social services) will need a source of protein. Fish stocks will still take time to recover, so there may not be enough fish for both the local market as well as for sale in markets outside the fishing villages. Besides all members of the communities at the fishing villages are fishermen, so they must look for other sources of protein. Poaching of wildlife will therefore continue, and probably on a greater scale than as at present.

Mitigation:

- In order to be able to protect wildlife, the local communities will have to benefit from wildlife, so that they understand the value of preserving it. This can be done, in collaboration with the wildlife authorities, by involving members of the local communities in wildlife management activities, such as patrolling, monitoring, etc, where they would be paid for these services.
- Alternatively, the LEAF Project could explore the possibility of starting up eco-tourism initiatives, where, for instance, villagers could be trained as guides to take visitors into the

protected areas. (This has been done in Mida Creek on the Kenyan coast, where the community has built a walkway above the mangrove forest to a hide from which visitors can watch waterfowl. Visitors can go for guided walks along the tidal flats at low tide, take boat rides into the creek with local fishermen, or eat local food at a restaurant which is also run by the community).

- Another option would be to set up community-managed tourist accommodation facilities of acceptable (international) standards in locations away from the fishing villages and outside the protected areas. If this is an area that the communities are interested in, then the first step would be to provide them with basic training in hospitality.

6.3.8 Settlement and Immigration

As indicated above, the LEAF Project activities may indirectly encourage an influx of people into the fishing villages, as a result of improved social and well-being conditions. The fishing villages are already overpopulated and cannot accommodate more people. Resources, such as fish stocks, water supply and fuelwood are already stressed, and would be further stressed. Other existing problems such as sanitation, solid waste, etc, will be exacerbated.

Physical relocation of people in the fishing villages is not an option as it will have political and social repercussions. Therefore, people – particularly the youth – must be enticed to move out of the villages, and this can only be done if they are employment opportunities or other livelihood options available at the new location.

It must be noted also that fishing is a seasonal activity, so many people in the fishing villages leave the villages and go to their other homes at certain times of the year (eg from January to March). This means that most of the fishermen have links to other locations outside the fishing villages.

Mitigation:

- Recommendations have been made above for alternative livelihood opportunities in the tourism and other sectors which could be away from the fishing villages and outside protected areas. These ventures may stimulate other supply activities (knock on activities) that would also be located outside the fishing villages. For example, women could be encouraged to grow vegetables and keep poultry to supply the tourist restaurants or hotels, or to make uniforms for the accommodation staff.
- Social services such health centres or education facilities, should be located away from the fishing villages in protected areas.

6.3.9 Loss of Land/Property and Crops

It is not envisaged at this point that loss of land will be an issue, since no relocation is anticipated. Nor will any crops be destroyed as a result of any of the Project activities.

6.3.10 Employment Opportunities

Alternative livelihood options mentioned above would result in increased incomes, and therefore, it is assumed, better health.

For the construction of infrastructure proposed under the LEAF Project, labour based methods for construction should be considered, so that more employment opportunities will be available, albeit for a short time. This could contribute to increasing income levels in the area to a small extent.

The labour for construction of infrastructure should be sourced from the fishing villages, to the extent possible. Various types of skilled and unskilled labour may be required, for example, masons, carpenters, joiners, electricians and plumbers, and manual labourers. However, it is likely that some labour will be hired from outside the fishing communities.

Mitigation:

- The construction methodology should, as much as possible, adopt labour based works.
- The Contractor must take care to ensure that the maximum possible number of employees hired is sourced from the fishing villages.
- The Project could support vocational training for specific types of labour, so that those skills can be used during construction and also after construction.
- Women must also be given opportunities within the project, and a specific quota (eg 20%) should be reserved for women.
- Women should also be provided with appropriate, separate and adequate facilities such as lavatories and dormitories.

6.3.11 Agricultural Activities

The Project activities will not directly affect agricultural production in the Project area. However, the construction of access roads, depending on their location, may facilitate the movement of agricultural produce and inputs to and from markets. This is judged to be a positive impact overall.

6.3.12 Public Health

During construction of the proposed infrastructure, a number of aspects may impact on public health. There will be increased dust, noise and air pollution levels, which are considered to be negative impacts, although for the general public this would be minor to minimal. The workforce would be more exposed to these hazards. Oil wastes can also impact on public health if they find their way into water sources. These have been discussed earlier in Section 6.3.3.

Transient workforces are associated with the spread of STDs and HIV/AIDS. The Fisheries Development Component includes sensitisation of fishing communities, but this must be extended to the workforce that will be involved in construction of the various infrastructures.

Sanitation and hygiene is an existing problem, but will also be a concern at the Contractor's Yard. If these issues are not properly addressed, they may lead to outbreaks of illnesses such as hepatitis, typhoid, intestinal worms, etc.

Mitigation:

- STD/HIV/AIDS awareness campaigns should be conducted prior to construction of infrastructure, and condoms distributed, to the workforce as well as in the fishing villages.
- Domestic sewage generated in the fishing villages and landing sites must be treated in a satisfactory manner, eg through well designed conventional septic tanks and soakaway pits, and located appropriately.
- Arrangements should be made for the proper disposal of solid and liquid waste, including sanitary waste.

6.3.13 Occupational Health and Safety

Construction sites always present an element of danger. Occupational health and safety of the workforce will have to be monitored by the Contractor's supervisors and foremen. As long as proper procedures are followed and personal protective equipment (PPE) is provided and its use enforced, risks of accidents and incidents can be substantially reduced.

Mitigation:

- All workers should be provided with suitable protective gear (such as nose masks, ear muffs, helmets, overalls, industrial boots, etc) as required. All workers must be forced to wear PPE.
- There must be a fully equipped first aid kit available to the construction workers.
- The Contractor must have workmen's compensation cover.
- Potable water should be available to the construction workforce at all times.

6.3.14 Contractor's Yard

It may be necessary for the Contractor to temporarily acquire or rent land for his yard. The Contractor may approach the LCI or LC II Chairmen, or Chiefs, or any other authorized person for assistance in this matter.

The Contractor's Yard will require a potable water supply, proper sanitation and washing facilities, and a garbage disposal system.

Mitigation:

- Solid waste should be disposed of in a sensible manner. Non-degradable wastes should be taken to approved dumps.
- The tender documents should specify conditions for hygiene standards, sanitation, solid waste disposal and health services for the workforce.
- An awareness campaign should be initiated to sensitise the workforce and local communities on the risks of STDs and AIDS.

6.3.15 Disturbance to the Public

Disturbance to the public may occur due to various construction activities, such as noise, vibration, traffic movement and disruption of routine activities may result.

Mitigation:

- Levels of pollution should be minimised, as discussed above in Section 6.3.3.
- The communities should be sensitised about any potential disruption to their normal activities caused by construction works. This can be done with the assistance of the local administration (such as chiefs and LCI and LCII Chairmen).
- To minimise disturbance to villagers, construction activities should not be carried out at night.

6.3.16 Archaeological or Cultural Sites

No sites of archaeological or cultural importance are likely to be affected by the LEAF Project. However, these may become apparent during project activities.

Mitigation:

- In the event that any archaeological or cultural find is discovered, then the relevant national authorities in the participating countries must be noted immediately.

6.3.17 Visual Impact

The visual impact of the Project will be small in terms of infrastructure to be built. However, the visual impact after the water catchment programme is likely to be positive, as green areas will be restored, and scenic value enhanced.

6.4 OVERVIEW OF STRATEGIC IMPACTS OF LEAF PROJECT ACTIVITIES

6.4.1 Poverty

The overall goal of the project is to ultimately alleviate poverty in the project area. This is to be done through various activities proposed in the Fisheries Resources Development and the Integrated Water Resources Management Components, which will: improve fish stocks through promoting sustainable fishing techniques; promote more efficient ways of processing, storing and transporting fish; and improve water quality in the lakes thus providing favourable conditions for fish to breed).

However, there is the possibility that with improved facilities (for processing as well as hygiene and sanitation) at the fish landing sites and fishing villages, more people will be encouraged to settle in these areas. Remembering that 50% of the population in the Project area is under the age of 15 years, and that health initiatives proposed as part of the LEAF Project will improve longevity and reduce mortality rates, the population in the fishing villages is set to increase quite considerably. As noted above, this would have negative repercussions on natural resources – particularly fisheries, forests and woodlands, and water resources – with the result that poverty would be perpetuated. To address this situation, the local administrations will have to be strict about allowing fishing settlements to expand, especially those surrounded by protected areas. The local councils will have to develop and implement physical development plans in order to regulate settlement.

In addition, the Fisheries Resources Development Component includes an activity to identify and assess the feasibility of alternative means of livelihoods which the fisher communities can pursue. These for example could include aquaculture, ecotourism, beekeeping, butterfly pupae[5], craft making from water hyacinth, poultry keeping and kitchen gardening to supply tourist hotels. These are all activities that have been successful in other similar locations in Uganda and other East African countries, and therefore could be introduced in the Project area. However, care must be taken to locate these activities away from the fishing villages located within protected areas, so that people are encouraged to move out of these villages. In addition, the local communities themselves must show interest in pursuing these alternative livelihoods, for which they would require appropriate training.

Recommendation:

[5] This has been done in Watamu, Kenya, where forest edge communities have an opportunity to get an income directly from the forest by live breeding the unique butterflies of the Arabuko-Sokoke forest, and sending them to live butterfly display centres around the world. See www.kipepeo.org

One of the primary objectives of the LEAF Project will be to alleviate poverty. A detailed socio-economic study was undertaken during the LEAF Pilot Project in 2007; it is now necessary to update that study in order to establish current poverty levels and socio-economic characteristics in the fishing communities, including accurate demographic data, income and expenditure, employment characteristics, health status, education levels, etc. Therefore as an initial activity of the Project, a baseline study should be conducted to assess the current socio-economic status of the fishing villages covered by the LEAF Project both in Uganda and DR Congo. The study should also investigate suitable options for alternative livelihoods for the fisher communities, and where these can be located so that they are still accessible to the fisher communities. This would best fit under the Fisheries Development Component, since this component includes a sub-component for supporting sustainable alternative livelihoods.

6.4.2 Fisheries

Fisheries are an important commercial activity in the Project area, and indeed is the main focus of this Project. It is expected that the proposed Fisheries Development Component under the LEAF Project will result in improved fish stocks and sustainable fisheries. This will to a degree provide food security, provided the populations in the fishing villages remains stable, and provided the demand for fish in markets outside the project area does not overtake supply[6].

The LEAF Pilot Project Final Report (NBI/NELSAP, 2008) indicates that no data is available on fish catches on Lakes Edward and Albert since 2004. The fisheries biology and stock assessment exercise undertaken during the LEAF Pilot Project shows that the size of fish being caught is smaller (indicating that immature fish are now being caught). In the DR Congo, data on fish catches is available for only 17 years from 1950 to the present. While available data for Lake Albert shows that fish catches are stable, those for Lake Edward are on the decline. However, it is difficult to establish trends without having consistent data.

Wetlands are important in terms of fisheries as they provide breeding grounds for fish, as well as habitats. However, there is not much data available on the species and population structure of fish, and the importance of fisheries, in wetlands. A study to establish the extent of wetlands in the LEA Basin, and the status of the flora and fauna in those wetlands, is recommended under Section 6.4.4 below.

Recommendation:

There is therefore a need to conduct a lake wide assessment in both lakes on the population structure in terms of species and number of fish in the lakes and the dynamics of commercially exploited fish stocks, in order that the success of the Fisheries Resources Development Component can be measured.

6.4.3 Water Resources

The Integrated Water Resources Management (IWRM) component of the LEAF Project proposes several interventions including conservation of wetlands and forests. One of the major outputs will be improved water and water sources, in terms of both quantity and quality.

Wetlands and forests play a critical role in climate regulation, retention of water resources and regulation of hydrological flows. As noted above, wetlands are also important in terms of fisheries.

[6] Connected with the issue of food security, is the threat posed by militia who are also operating on both the lakes, and continue to fish illegally.

Activities focussing on conservation of wetlands and forests will help to protect soils in the upper catchment, as well as reduce sediment loading in the rivers, wetlands and lakes. The success of the IWRM Component will therefore contribute towards both improved water quantity and quality in the lakes and therefore to the sustainability of fisheries.

The Mid-Term Diagnostic Study for the LEAF Pilot Project (NBI/NELSAP, 2007) was not able to establish a water balance for Lakes George, Edward and Albert due to the lack of and inconsistent data. The IWRM Component proposes that detailed hydro-meteorological studies be undertaken in the catchment areas in order to develop a database on water resources in the LEA catchment areas.

Mining is an important activity within the LEA Basin (see Section 3.1.12), and leachates from the mines are thought to pollute the lakes. Similarly, agricultural activity is on the increase in the Project area, and runoff from agricultural land also has implications on the water quality, in terms of nitrates, phosphates and heavy metals. One of the problems with exploration and drilling activities, apart from spills and leakage, is the disposal of drilled material for which a suitable solution has yet to be developed (pers. comm. Josephine Nyangoma, District Environment Officer, Hoima District). The IWRM Component includes a study to identify 'hot spots' of point and non-point source pollution in the LEA Basin under Source and Urban Liquid and Solid Wastes Management of the Catchment and Wetland Management Sub-component. This will then enable the LEAF Project, together with the respective authorities and organisations, to assess how to deal with specific pollution problems.

Recommendations:

One of the initial activities of the IWRM Component should be to establish what programmes other NGOs such as the WWF (see Section 8.2) are undertaking within the LEA catchments and adjacent catchments so that there is no duplication of efforts, but rather IWRM activities complement and support other catchment conservation activities and vice versa.

Information gathered from the hydro-meteorological and pollution hot spots studies should be periodically analysed to assess the impacts on water quality and quantity in the lakes and their catchment areas, whether induced by climate change or other anthropogenic activities.

6.4.4 Biodiversity

The catchment forests and wetland conservation initiatives of the IWRM Component will protect critical ecosystems that provide several ecosystem services. In addition to the functions they serve (mentioned above), wetlands and forests are crucial in supporting fundamental processes such as nutrient recycling and soil/substrate formation which support biodiversity and primary production. A number of forests and wetland areas in the Project area have global significance in terms of diversity (see Sections 3.1.7 and 3.1.11), and provide enormous potential for tourism. Their preservation is therefore of great importance locally, nationally and internationally. In the context of the Project area, biodiversity together with tourism provide a number of options for alternative livelihoods.

However the greatest threat to biodiversity is presented by oil exploration, drilling, storage and transportation activities that are taking place in the catchments of both Lakes Edward and Albert in Uganda. Although there are several initiatives being undertaken to assist the relevant authorities in addressing any potential environmental and social impacts, it is probable that exploration and drilling will continue to expand, and in the long term this will be at the expense of protected areas and sensitive ecosystems, as this is influenced by the revenues received from oil and gas production against those from tourism and livelihoods that these ecosystems support. In the DR Congo, if the Government decides to allow exploration and drilling activities in the PNV, the park would first

have to be degazetted. This will then jeopardise the future of the internationally recognised biodiversity hotspot that comprises the Parc National des Virunga.

Recommendations:

In order to be able to determine the effects of the LEAF Project on biodiversity, it will be necessary to carry out a number of surveys in order to establish:

i) the status of aquatic flora and fauna in the lakes,
ii) the extent of wetlands in the LEAF Project area and the status of wetland flora and fauna, and
iii) forest cover in the catchment.

While proposals for alternative livelihoods on biodiversity-based activities will benefit the local fishing communities in the near to medium term, other options for livelihood strategies that are not biodiversity-based should also be proposed which would have long term benefits for these communities.

6.4.5 Health

The Fisheries Resources Development Component includes the provision of sanitation and potable water facilities at the fishing villages and landing sites. This will directly benefit the health status of the fishing communities. Improved health is also associated with increased productivity resulting in reduced poverty levels. However, improved health also means increased longevity, and lower mortality rates among mothers, infants and children. This has implications on the population growth in the fishing villages, the impacts of which are discussed under poverty in Section 6.4.1.

This underlines the importance of finding alternative livelihoods for members of the fishing communities.

Because of the mining activities around lakes (particularly Lake Edward), there is some concern regarding heavy metal pollution of water sources (the lakes and the rivers that flow into them). A study done in 2005 concluded that copper levels in Lake George did not pose a risk to the populations living around the lake (Hartwig et al, 2005). However, the concentration of copper and other heavy metals in the river and lake waters must be continually monitored.

Recommendations:

To establish the impacts of the LEAF Project on health, a detailed baseline survey is needed on the health status of the fishing communities. This can be done as part of the socio-economic survey proposed under Section 6.4.1.

In addition, as part of the water quality element under the IWRM Component of the LEAF Project, heavy metal concentrations (particularly copper, cadmium, nickel and mercury) should be measured in the lakes, wetlands and rivers that flow into them, as well as in fish.

6.4.6 Impacts of Climate Change

The World Conservation Society has undertaken an assessment of the impacts of climate change on the biodiversity of the Albertine Rift between 1990 and 2090. Three of the seven landscapes covered by the assessment lie within the LEAF Project area, namely the Albertine Rift, the Murchison-Semiliki and the Greater Virunga landscapes. A summary is presented in Annex D,

while details can be found on: http://programs.wcs.org/albertineclimate/ClimateChange/tabid/2804/Default.aspx.

The findings are similar for all landscapes. The impacts are gradual between 1990 and 2030, but increase rapidly thereafter. Temperatures will rise, rainfall will increase, as will runoff. This implies that the lake levels will rise, and it is likely then that the water table will also rise. Net primary production as well as heterotrophic respiration will increase, implying that there will be higher levels of CO_2 in the atmosphere. Beans and maize yields will both decrease, which will impact on food security. Brachiaria yield will increase.

Adaptation Measures:

It is assumed that some of the infrastructure proposals under the LEAF Project will be built to last for at least 20 years. Other activities, such as training and monitoring, would take place in the shorter term, so the effects of climate change would not necessarily be noticed within the immediate Project period. Some recommendations for adaptation are as follows:

- The location of the proposed fish handling facilities, ice plants, and fish processing facilities, would have to be such that in 20 years' time they will not be inundated by the lake waters.
- Similarly, in designing water supplies, and depending on whether these will be sourced from the lakes or from shallow wells, consideration would have to be given to the location of the intake or the wells, as well as to the distribution network (for example the location of standpipes), so that in the future they would still be accessible.
- Water may seep into foulwater systems (septic tanks and pit latrines), causing them to overtop, and pollute the immediate surroundings. They should therefore be designed and located to avoid this situation.
- Access roads will have to be designed such that they avoid low lying areas, while precautionary signs should be erected where the roads pass places susceptible to rockfalls and landslides. Road drainage design will also have to take higher runoff into account.
- Stormwater drainage will need to be designed to account for higher flows.
- The design of the proposed aquaculture parks will have to take into consideration the location of these parks, so that they will not be inundated.
- The Project's training component should include sensitisation of the local communities on the effects of climate change in the LEA Basin, and together with these communities develop strategies for implementing adaptive measures. For example, the Project could include sensitisation of catchment communities on how runoff in the lakes' catchment areas can be harvested, not only to enhance water supplies in those areas, but also to protect the catchments against soil erosion, landslides and rock falls which could result from excessive rainfall.
- In the development of alternative livelihoods for the fisher communities, and enhancing their skills, the Project must consider how and whether proposed alternatives will be affected by higher temperatures. This is particularly important if alternative livelihoods entail agricultural activities.
- Brachiaria is a species of grass (native to East Africa) which has various uses, for example in erosion control and for livestock feed. Its viability in livestock keeping activities and other potential uses in the LEAF Project area could be investigated.

Recommendation:

There is a need to collect relevant climate information in order to be able to assess the impacts of climate change, whether in the near or distant future. As part of the IWRM Component, hydro-

meteorological data will be collected. However this data will have to be periodically analysed in terms of changes in climatic factors.

6.5 SUMMARY OF MAIN MITIGATION MEASURES

Activities	**Significant negative impacts**	**Mitigation measures**
Project activities	Pressure on forest and woodland as demand for firewood and charcoal will increase resulting from more settlement in the fishing villages as a result of the social services that it intends to provide. Conflicts between local communities and resettled people to access to the projects resources.	**Measure 1:** Create buffer zones around the forests and woodlands in the Project or maintain where they exist. **Measure 2:** Plant woodlots for wood fuel for the fishing villages as part of the buffer zones. **Measure 3:** Define and disseminate transparent and equitable eligible criteria to project financing. **Measure 4:** Regional workshop on the trans-boundary lakes management and the LEAF activities.
Construction of infrastructure Fisheries research stations Landing sites and rehabilitating of existing jetties Rehabilitation of 150 km of feeder roads Water laboratories Water and on-site- sanitation facilities	Erosion caused by earthworks Water pollution by wastewater from latrines and oil products Clearing of the existing vegetation on the sites of infrastructure and on the material sites. Conflicts with fishermen villages if they are not enough involve in the construction in term of employment opportunities. Spread of STDs and HIV/AIDS related to the presence of transient workforces.	**Measure 5:** Undertake environmental impact assessment for each infrastructure and include mitigation measures in the contracts of the contractors. **Measure 6:** No infrastructure facilities are planned to be built in the protected areas or forests **Measure 7:** The construction methodology should, as much as possible, adopt labour based works. **Measure 8:** The Contractor must take care to ensure that the maximum possible number of employees hired is sourced from the fishing villages. **Measure 9:** STD/HIV/AIDS awareness campaigns should be conducted prior to construction of infrastructure, and condoms distributed, to the workforce as well as in the fishing villages.
Promotion of alternative livelihoods	Conflicts with communities with the criteria are not transparent and equitable. Clearing of existing vegetation and establishing of resettled people in the protected areas.	**Measure 10:** Define and disseminate transparent and equitable eligible criteria to alternative livelihoods. **Measure 11:** Finance livelihoods subprojects outside the protected areas or forests.

Harmonization of Policy Legislation against the use of illegal gears	Conflicts between stakeholders having different interests in fisheries management.	**Measure 12:** Undertake sensitization and information campaigns to mobilize stakeholders to the project approach. **Measure 13:** Adopt a participative and steps approach during the studies and implementation of the harmonized rules.

7 ENVIRONMENTAL & SOCIAL MONITORING AND MANAGEMENT

7.1 MONITORING PROCESS

Monitoring is a long-term process, which should begin during project formulation and continue throughout the life of the project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. Monitoring involves the continuous or periodic review of construction and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental and social deterioration or improvement can be established, and previously unforeseen impacts can be identified or pre-empted. Monitoring allows measures to be implemented in order to prevent or avert negative impacts.

Monitoring focuses on specific parameters that can be measured to determine environmental or social change (ie. improvement or deterioration) during and after the construction or implementation of the project. On the other hand, environmental and social management plans provide a complete overview of the considerations to be taken during planning, design, construction, defects liability, operation and maintenance. That is, it covers the entire project life. Environmental and social monitoring must therefore be incorporated into the environmental and social management plan.

The overall objective of environmental and social monitoring is to ensure that activities carried out during the LEAF Project are environmentally and socially acceptable, and therefore sustainable.

The environmental and social monitoring plan in Table 7.1 below covers the phases of the Project for the infrastructure that will be constructed during the LEAF Project, as well as other Project activities. Table 7.2 provides a plan for strategic monitoring of the LEAF Project. Both plans describe indicators that can be monitored, and suggest how monitoring should be done, how frequently, and who should be responsible for monitoring and action.

Aspects to be monitored have been selected so that they can realistically be monitored, and monitoring need not require great additional expenditure.

In terms of infrastructure proposals which will have project-specific impacts, it is recommended that the following be monitored:

- Impeded flow in streams and rivers;
- Soil erosion;
- Foulwater;
- Solid waste;
- New gravel sites opened by the Contractor;
- Clearing activities;
- Recruitment of local people on infrastructure construction projects; and
- Site safety and workers safety.

Monitoring of strategic impacts will reflect the overall success of the LEAF Project. Aspects to be monitored in this case include:

- Poverty status in the Project area;
- Flora and fauna in the Project area;
- Fish species and population structure, and dynamics of commercial fishing;

- Characteristics of water resources in the LEA catchment area;
- Wetland degradation or recovery;
- Forest degradation or recovery;
- Land use in the LEAF catchment area;
- STD/HIV/AIDS rates of infection;
- Heavy metal levels in lake waters and fish tissue; and
- Climatic factors (temperature, rainfall).

In most cases baseline studies will be required in order that comparisons can be made at later stages over the Project period. With regard to biodiversity, wetlands and catchment management, data can be obtained from various organizations that are currently working in the Albertine Region, for example WWF, World Conservation Society, the National Wetlands Programme, and the National Forest Authority; but this data would have to be collected, collated and analysed in order to assess impacts. Water quality analysis and hydro-meteorological measurements will be done as part of the IWRM Component anyway, so additional resources will not be required for this.

Table 7.1: Infrastructure Proposals – Project-Level Environmental and Social Monitoring Plan

Environmental /Social Aspects / Impacts	Proposed Aspects for Monitoring	Performance Indicator	Baseline data	Responsibility for intervention and/or monitoring during design, construction or development	Responsibility for mitigation, monitoring and/or maintenance during operation and implementation of LEAF activities	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring
ENVIRONMENTAL MONITORING							
Impeded flow	Culverts and bridges allow unimpeded flow through structure.	- No. of culverts silted up / blocked - No. of bridges/culverts causing ponding	- Zero culverts silted / blocked - Zero bridges /culverts causing ponding	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) inspection (i) inspection	(c) continuous (i) continuous
Soil Erosion	Efficiency of soil erosion measures	- Erosion observed at specified locations	- Zero erosion	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) (i) Inspection	(c) (i) continuous
Foulwater	Functioning of septic tanks and sewage systems	- No. of overflowing septic tanks and pit latrines	- Zero septic tanks and pit latrines overflowing	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) (i) Inspection	(c) (i) continuous
Solid waste	Functioning of solid waste management system	- No. of waste collection points used - Amount of waste collected (eg by number of containers per day or week)	- Zero waste collection points used - Zero waste collected	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) (i) Inspection	(c) (i) daily
New gravel sites opened by Contractor	Rehabilitation of gravel site(s)	- No. of site(s) rehabilitated	- Zero sites rehabilitated	Interim Coordination Unit / Contractor	n/a	(c) inspection.	(c) continuous
Clearing activities	Rehabilitation of cleared areas	- Area of vegetation re-established	- Zero areas of vegetation re-established	Interim Coordination Unit / Contractor	n/a	(c) Inspection	(c) Daily
SOCIAL MONITORING							
Recruitment of local people on infrastructure construction projects	Recruitment of people from local communities. Recruitment of women.	- % of workforce from local communities - % of women in workforce	- 0% workforce from local community - 0% women in workforce	Interim Coordination Unit / Contractor	n/a	(c) Certificate of employment.	(c) monthly

Environmental /Social Aspects / Impacts	Proposed Aspects for Monitoring	Performance Indicator	Baseline data	Responsibility for intervention and/or monitoring during design, construction or development	Responsibility for mitigation, monitoring and/or maintenance during operation and implementation of LEAF activities	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring
Site Safety	Security and safety level of site infrastructure	- No. of accidents and incidents	- Zero accidents and incidents	Interim Coordination Unit / Contractor	n/a	(c) records of accidents and incidents	(c) continuous
Site / workers safety	Use of PPE	- No. of workers NOT using PPE	- All workers using PPE	Interim Coordination Unit / Contractor	n/a	(c) PPE & first aid kit - inspection / observation; workmen's insurance cover details	(c) continuous

Table 7.2: Strategic Environmental and Social Monitoring Plan

Environmental /Social Aspects / Impacts	Proposed Aspects for Monitoring	Performance Indicator	Baseline data	Responsibility for mitigation, monitoring and/or maintenance during operation and implementation of LEAF activities	Monitoring means	Recommended frequency of monitoring
Poverty	Poverty status in Project area	- Changes in key socio-economic characteristics of fisher communities	- Current income and expenditure levels; - Employment status - Health status - Education status	Initially, Interim Coordination Unit; later LEABO Project Manager, supported by Community Development Specialist and M&E Specialist	Socio economic study	Baseline immediately, follow up study in 5 yrs
		- No. of people employed in alternative livelihood activities	- Zero people employed in alternative livelihood activities			
Fisheries	Fish species and population structure, and dynamics of commercial fishing	- Changes in fish stocks, species composition	- Current fish stocks and species composition	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Fisheries Expert and M&E Specialist	Lake wide assessment of fish species and population structure and dynamics of commercial fishing	Baseline immediately, follow up study in 5 yrs
Water resources management	Characteristics of water resources in the catchment area	- Changes in flow of selected rivers - Changes in rainfall patterns - Changes in lake water levels - Changes in water quality	- Current flow measurements in selected rivers - Current rainfall measurements - Current lake levels - Water quality measurements from LEAF Pilot Project data - Additional baseline data on concentrations of heavy metals in lake waters	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Stud y to analyse changes hydro-meteorological conditions - this data will be collected as part of the IWRM Component; Study on water quality in lakes.	Baseline immediately, analysis to be done annually.
Biodiversity	Flora and fauna in Project area	- Changes in flora and fauna composition in key Project ecosystems (lakes, wetlands, forests, catchments areas)	- No. and occurrence of animal and plant species currently in each ecosystem	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Study reports (data can be obtained from other agencies)	Baseline immediately, follow up study in 5 yrs
		- Changes in invasive aquatic weed species, composition and cover	- No. and extent of invasive species			

Environmental /Social Aspects / Impacts	Proposed Aspects for Monitoring	Performance Indicator	Baseline data	Responsibility for mitigation, monitoring and/or maintenance during operation and implementation of LEAF activities	Monitoring means	Recommended frequency of monitoring
Wetlands management	Wetland degradation or recovery	- Changes in wetland cover	- Current area of wetlands in Project area	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Survey of wetland cover (data can obtained from other agencies)	Baseline immediately, follow up study in 5 yrs
Catchment management	Forest degradation or recovery Land use in the LEAF catchment area.	- Changes in forest cover - Changes in land use in catchment area	- Current area of forest cover in Project area - Current area of major land uses in Project area	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Survey of forest cover and recovery (data can be obtained from other agencies); Survey of land use	Forest and land use status surveys immediately; follow up study in 5 years.
Health	STD/HIV/AIDS rates of infection	- No. of reported cases in Project area	- Base year data from Ministry of Health	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Community Development Specialist and M&E Specialist	Medical records	Annually
	Heavy metal levels in lakes and fish tissue	- Concentrations of Cu, Ni, Co, Ca, Hg in lake waters and fish tissue	- Current concentrations of heavy metals in lake waters and fish tissue	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Water quality analysis; For fish, biometric assays. Part of IWRM Component	Water quality analysis for heavy metals to be done twice a year. Concentrations in fish tissues to be done at project start up, then follow up every 2 years.
Climate change	Climatic factors: temperature, rainfall	- Changes in temperature, rainfall	- Current temperature and rainfall measurements	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Measurements - this data will be collected as part of the IWRM Component	Baseline immediately, analysis to be done annually

7.2 ENVIRONMENTAL MANAGEMENT

Tables 7.3 and 7.4 present the environmental and social management plan for project infrastructure impacts as well as strategic level impacts. They describe how each of the main mitigation measures proposed in Chapter 6 should be implemented, how frequently, and who should be responsible during and after construction. Monitoring indicators and means of monitoring have also been included the table.

With regard to interventions that necessitate construction of facilities, project specific EIAs will be required. In this case, generic impacts have been listed, since details of the various projects are not available at this stage. During contract tendering process for infrastructure interventions, the EIA reports must be provided to the bidders so that they can appreciate what is involved in implementing proposed mitigation measures and will be able to include mitigation measures in their bills of quantities.

The responsibility for supervision of the implementation and monitoring of all the proposed mitigation measures for the construction of infrastructure facilities will lie with the Interim Coordination Unit, while the Contractor will be responsible for day to day operational matters of construction, which will include implementation of mitigation measures that he is responsible for. After construction, responsibility for the operation and maintenance of the various infrastructure facilities, as well as monitoring, will rest with the LEABO Project Manager and Purchasing Officer.

As for strategic level impacts, the responsibility for their management and monitoring will lie with LEABO Project Manager who will be supported by various experts specialising in Water and Environment, Fisheries, Community Development and Monitoring and Evaluation.

Tables 7.3 and 7.4 also give an estimate of the costs of environmental and social management and mitigation. It must be noted that some costs have already been included in the individual component budgets, for example hydro-meteorological monitoring, water quality analysis, assessment of alternative livelihoods, etc.

Table 7.3: Management of Project Specific Impacts

Environmental/ Social Aspects / Impacts		Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and/or monitoring during design, construction and start up	Responsibility for mitigation, monitoring and/or maintenance during Project implementation	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring	Estimated Cost (US$)
ENVIRONMENTAL MANAGEMENT PLAN							
Changes in Hydrology	Impeded flow	- Culverts and bridges allow unimpeded flow through them	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) inspection (i) inspection	(c) continuous (i) continuous	(c) Included in construction cost (i) routine operational costs
Soil Erosion	Earth works	- Controlled clearing of vegetation and re-vegetation of disturbed areas as required. - Management of excavation activities, and reuse/ storage / disposal of spoil. - Undertaking of earthworks during dry season.	Interim Coordination Unit / Contractor	n/a	(c) Inspection	(c) continuous	(c) Included in construction cost
	Access roads	- Incorporation of properly designed drainage structures along access roads. - Revegetation of road embankments.	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) Inspection (i) inspection	(c) (i) continuous	(c) Included in construction cost (i) routine operational costs
Air Quality	Air and dust emissions	- Control speed of construction and other vehicles on site. - Equipment/machinery operators and drivers of construction vehicles to be sensitised. - Maintenance of construction plant and equipment. - Watering to keep dust levels down - Stockpiles to be enclosed / covered.	Interim Coordination Unit / Contractor	n/a	(c) inspection / observation	(c) Daily/random	(c) Included in construction cost
Noise Quality	Noise pollution	- Construction workers and drivers sensitised. No movement of heavy vehicles after dark. - Noise levels to comply with national standards - Maintenance of plant and equipment. - PPE (ear plugs/muffs) to be provided and use enforced.	Interim Coordination Unit / Contractor	n/a	(c) Inspection / observation	(c) continuous	(c) Noise meter US$500. PPE and maintenance of plant & equipment will be included in construction costs

Environmental/ Social Aspects / Impacts		Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and/or monitoring during design, construction and start up	Responsibility for mitigation, monitoring and/or maintenance during Project implementation	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring	Estimated Cost (US$)
Water Quality	Sediment loading	- Management of earthworks and spoil. - Incorporation and maintenance of erosion control measures	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) inspection (i) Inspection of erosion control measures; water quality analysis	(c) continuous (i) monthly or as needed; annual maintenance.	(c) construction cost (i) routine operational costs; water quality analysis done inhouse
	Foulwater contamination	- Provision of sanitation facilities that are designed properly and located appropriately, so as to ensure compliance with national standards.	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) Inspection (i) Inspection	(c) continuous (i) continuous	(c) construction cost (i) routine operational costs
Contamination by Oil	Oil pollution	- Specified area allocated for maintenance of construction plant and equipment. - Provision of proper contained facility constructed for storage of oil and oil products or use of sump pallets. - Training and procedures for proper storage, handling and disposal of oil products, and spill response - Provision of spill kit	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) Inspection (i) inspection; training records	(c) oil storage facility – on completion of works; other aspects monitored continuously (i) continuously; maintenance as required.	(c) Storage facility: include in construction cost. Spill kit US$200 (i) Spill kit US$200; Training done in house
Chemicals	Laboratory chemicals	- EIA to assess how laboratory chemicals will be managed and disposed of	Interim Coordination Unit / EIA Consultant	LEABO Project Manager, supported by Water & Environment Expert	(c) EIA Report, ESMP (i) inspection, quality of effluents discharged from laboratory	(c) on completion of EIA study (i) daily inspections; effluent quality to be assessed weekly for 3 months during normal operation, then decide how often and which contaminants need to be measured and how to dispose of them	(c) EIA Study: US$10,000 per lab (i) routine operational costs

Environmental/ Social Aspects / Impacts		Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and/or monitoring during design, construction and start up	Responsibility for mitigation, monitoring and/or maintenance during Project implementation	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring	Estimated Cost (US$)
Solid waste and Construction Debris	Solid waste	- Contractor's practices to minimise amount of debris and waste generated. - All waste to be properly disposed of. - Functioning of LEAF urban solid waste management system	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) Inspection (i) inspection	(c) Daily. (i) Daily	(c) Construction cost. (i) routine operational costs. LEAF waste management system cost included in IWRM proposal. Monitoring done inhouse
Materials Sources	New gravel sites opened by Contractor	- EIA of gravel sites to be carried out. - Properly planned excavation activities, including proper drainage, fencing, access and egress to the site, and rehabilitation of gravel site as agreed with gravel site owner. - Prohibition of dumping of oil, garbage and spoil in the gravel site area. - Dust reduction through water sprinkling.	Interim Coordination Unit / EIA Consultant / Contractor	n/a	(c) EIA report; inspection of rehabilitation of gravel sites.	(c) on completion of EIA study, when sites are identified and before excavation begins. Other aspects to be monitored continuously.	(c) EIA Study: should be part of Project-specific EIA study; other costs to included in construction costs
Vegetation / flora	Clearing activities	- Controlled clearing of vegetation and trees. - All disturbed areas to be rehabilitated and revegetated.	Interim Coordination Unit / Contractor	n/a	(c) Inspection	(c) Daily	(c) Construction cost.
	Invasion by aquatic weeds	- EIA to be carried out on weevil rearing stations and operations	Interim Coordination Unit / EIA Consultant	LEABO Project Manager, supported by Water & Environment Expert	(c) EIA report, inspection (i) monitoring reports on ESMP for weevil rearing station. (i) Study on effectiveness of weevil control of aquatic weeds	(c) on completion of EIA study (i) baseline on aquatic weeds to be done at start up, follow up study each year	(c) Cost of EIA study: US$20,000 per station (i) Baseline study on aquatic weeds US$20,000. Follow up studies each $10,000

Environmental/ Social Aspects / Impacts		Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and/or monitoring during design, construction and start up	Responsibility for mitigation, monitoring and/or maintenance during Project implementation	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring	Estimated Cost (US$)
Forests/ woodlands	Destruction of forests and woodlands	- Establish buffer zones around forests /woodlands/protected areas - Establish woodlots with local communities - Support use of fuel efficient stoves among local communities - Support apiculture in fishing villages adjacent to forests and woodlands	n/a	LEABO Project Manager, supported by Water & Environment Expert, Community Development Specialist	(i) survey of forest cover and recovery; records of daily hydrological flow	(i) forest status study at start up; follow up study once in 5 years.	(i) Baseline study on forest cover US$30,000. Follow up study US$20,000.
Wildlife / fauna	Human / wildlife conflicts	- Involve local communities in wildlife conservation activities (patrolling, monitoring, research) - Train and involve local communities in eco-tourism activities so that they earn an income from wildlife resources	n/a	LEABO Project Manager, supported by Community Development Specialist	(i) records of meetings held with communities involved in wildlife conservation activities; no. of communities involved; No. of communities trained	(i) continuous	(i) included in alternative livelihoods sub-component in Fisheries Resources Development Component
SOCIAL MANAGEMENT PLAN							
Settlement and	Expanding populations in fishing villages	- Provide alternative livelihoods for local communities - Locate new social services such as schools, hospitals, social centres, outside fishing villages in protected areas	n/a	LEABO Project Manager, supported by Community Development Specialist	(i) minutes of meetings with people employed in alternative livelihoods; no. of people in alternative livelihoods	(i) every 6 months	(i) none
Employment opportunities	Recruitment	- The Contractor should be instructed to use labour based methods where possible. - Preferential recruitment of people from local communities. - Provide vocational training to local community members in skills that can be used during construction of infrastructure and afterwards. - Recruitment of women.	Interim Coordination Unit / Contractor/	LEABO Project Manager, supported by Community Development Specialist	(c) Certificate of employment. (i) no. people trained given vocational training	(c) monthly (i) 3 months after start up	(c) Construction cost.
Public Health	Risk of STD / HIV/ AIDS	- STD/HIV/AIDS awareness campaign to be conducted as part of LEAF Fisheries Development Component to target workforce as well as local communities	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Community Development Specialist	(c) (i) minutes of awareness raising meetings	(c) every month (i) every 6 months	(c) HIV/AIDS awareness US$4000 (i) included in Fisheries Resources Development Component

Environmental/ Social Aspects / Impacts		Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and/or monitoring during design, construction and start up	Responsibility for mitigation, monitoring and/or maintenance during Project implementation	Monitoring means (c) = construction (i) = implementation	Recommended frequency of monitoring	Estimated Cost (US$)
	Waste and Wastewater disposal	- Proper treatment and disposal of sewage generated at fishing villages and landing sites to comply with national regulations - Proper arrangements for disposal of solid waste to comply with national regulations	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) inspection (i) inspection	(c) (i) sanitation facilities: completion of works certificate; other aspects monitored daily	As above (c) construction cost (i) routine operational costs
Occupational Health and Safety	Site / workers safety	- All workmen / visitors to be provided with suitable protective gear where necessary - A fully equipped first aid kit should be available on construction sites - Workmen's compensation cover required as per regulations.	Interim Coordination Unit / Contractor	LEABO Project Manager	(c) (i) PPE & first aid kit - inspection / observation; cover details for workmen's insurance. Records of accidents and incidents.	(c) continuous (i) continuous	(c) PPE – included in construction cost (i) PPE: US$ 1,000. First aid kit – US$500
	Potable water	- Workers to be provided with drinking water	Interim Coordination Unit / Contractor	LEABO Project Manager, supported by Water & Environment Expert	(c) inspection (i) inspection	(c) continuous (i) continuous	(c) Construction cost (i) routine operational costs s
Contractor' s Yard	Contractors Yard Site	- Liaison with local administration for identification of possible sites for Contractor's Yard.	Interim Coordination Unit / Contractor	n/a	(c) minutes of meetings, Letter of approval from authorities	(c) upon mobilization before Yard is set up	(c) construction cost
	Waste and Wastewater disposal	- Proper treatment and disposal of sewage generated by construction activities to comply with national regulations - Proper arrangements for disposal of solid waste to comply with national regulations	Interim Coordination Unit / Contractor	n/a	(c) inspection	(c) daily	(c) see above
	Risk of STD / HIV/ AIDS	- STD/HIV/AIDS awareness campaign to be conducted for workforce	Interim Coordination Unit / Contractor	n/a	(c) minutes of awareness raising meetings	(c) every month	(c) see above
Disturbance to the public	Pollution	- Minimise pollution as above	Interim Coordination Unit / Contractor	n/a	(c) inspection	(c) continuous	(c) construction cost.
	Sensitisation of community	- Notify community leaders of possible disturbances during construction.	Interim Coordination Unit / Contractor	n/a	(c) minutes of meetings	(c) Community sensitization – before mobilization.	(c) construction cost
	Nuisance	- Prohibit construction activities at night.	Interim Coordination Unit / Contractor	n/a	(c) Observation/ inspection.	(c) continuous.	(c) construction cost.

Table 7.4: Management of Strategic Environmental and Social Impacts

Strategic Aspect	Recommendations	Responsibility during Project implementation	Monitoring means	Recommended frequency of monitoring	Estimated Cost (US$)
Poverty	- Conduct a baseline study to assess the current socio-economic status of the fishing villages covered by the LEAF Project.	LEABO Project Manager, supported by Community Development Specialist and M&E Specialist	Socio economic study	Baseline up on start up, follow up study in 5 yrs	Each study US$30,000
Fisheries	- Conduct a lake wide assessment in both lakes on the population structure and the dynamics of commercially exploited fish stocks	LEABO Project Manager supported by Fisheries Expert and M&E Specialist	Study Report	Baseline up on start up, follow up study in 5 yrs	Each study US$30,000
Water Resources	- Carry out periodic analysis of impacts on water resources (both in terms of quantity and quality) in the catchment areas, whether induced by climate change or other anthropogenic activities, based on hydrometeorological data collected during IWRM Component.	LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Stud y to analyse changes in hydro-meteorological conditions, and water quality. This data will be collected as part of the IWRM Component	Baseline up on start up, analysis to be done annually.	Included in IWRM Component.
Biodiversity	- Carry out surveys to establish: i) the status of aquatic flora and fauna in the lakes, ii) the extent of wetlands in the LEAF Project area, and status of aquatic wetland flora and fauna and iii) forest cover in the catchment.	LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Study reports (data can be obtained from other agencies)	Baseline up on start up, follow up study in 5 yrs	Forest cover – included in Table 7.3 above. Wetlands and biodiversity studies, US$20,000 each
	- Identify alternative livelihood options for fisher communities that are based on biodiversity and those that are not.	LEABO Project Manager, supported by Community Development Specialist and M&E Specialist	Report on alternative livelihoods	Baseline up on start up, follow up study in 3 and 5 yrs	Included in Fisheries Resources Development Component.
Health	- Conduct a detailed baseline survey on the health status of the fishing communities.	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Community Development Specialist and M&E Specialist	Medical records	Annually	Included in costs for socio-economic study above
	- Assess levels of heavy metal concentrations (particularly copper, cadmium, nickel and mercury) in the lakes, wetlands and rivers that flow into them.	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Water quality analysis Biometric assays for fish (both the above as part of identification of pollution hot spot activity under IWRM Component	Water quality analysis for heavy metals to be done twice a year. Concentrations in fish tissues to be done at project start up, then follow up every 2 years.	Water quality analysis done in house at no cost. Testing for heavy metals in fish tissue US$1000 each time
Climate change	- Carry out periodic analysis of changes in climatic factors, and their effects on proposals for alternative livelihoods.	Initially, Interim Coordination Unit; later LEABO Project Manager supported by Water & Environment Expert and M&E Specialist	Measurements - this data will be collected as part of the IWRM Component	Baseline up on start up, analysis to be done annually	Included in IWRM Component. Analysis can be done in house at no cost.

7.3 RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS

In both DR Congo and Uganda, fisheries fall under the Ministry responsible for agriculture. In DR Congo, the Fisheries Department deals with law enforcement, while the Service National pour le Développement des Pêches (SENADEP) deals with fisheries management. Other government ministries and departments in DR Congo with a stake in fisheries management include the Ministries of Environment, Nature Conservation and Tourism, Energy, Transport, Public Health and the Institut Congolais pour la Conservation de la Nature (ICCN). Two local institutions are currently involved in fisheries: COOPEVI and Unité de Gestion des Ressources en Pêche (UGREP) and Cooperative des Pêcheurs des Virunga (COOPEVI), both of which are involved in the management of fisheries at the local level.

In Uganda, the Department of Fisheries Resources is responsible for regulation, law enforcement and fisheries management services. Various other governmental institutions are also involved in fisheries management, including the Ministry of Water and Environment, National Environment Management Authority, Wetlands Inspection Division, Fisheries Resources Research Institute, and Uganda Wildlife Authority. At the local level, Beach Management Units (BMUs) are responsible for mobilizing and sensitizing local people for participation in managing fisheries activities, the intention being to supplement the Fisheries Department's efforts to provide advisory and extension services.

In both countries, fisheries offices have inadequate budgets, and are poorly staffed and equipped, which hinder the provision of technical services, build capacity at the local community level and to monitor fisheries activities in the lakes.

LEAF Institutional Arrangements

At the regional level, the Project will be coordinated by utilising the existing structure at NELSAP and its constituent staff. The structure comprises experts in (i) Water Resources management and development (ii) water resources data base, GIS and remote sensing (iii) environmental management (iv) social development vi) development communication (v) economics and strategic planning (vi) Monitoring and Evaluation (vii) procurement and (vii) finance and administration. This structure will be complemented by three positions to be financed by the project which include the *Regional Project Manager (RPM), Fisheries Expert, and Financial Management Expert* who will be regionally recruited and funded by the Project. NELSAP will (i) provide technical assistance, and expertise in project supervision (ii) implement regionally significant activities (iii) share information on good practices, and organize training related to strengthening project implementation capacity in the two countries (iv) coordinate the harmonization (convergence) of procedures and (v) Monitor and report on progress and maintain relations with national implementing institutions and the Bank.

At National level, the National Focal Point Ministries in the member States, will serve as the main NELSAP hub in the respective countries, with respect to project implementation have been designated as follows: (i) DR Congo - Ministry of Agriculture and (ii) Uganda - Ministry of Water and Environment. With respect to Uganda, the National Project Management Team (NPMT) will be located in Fort Portal. The Project activities will be mainstreamed into the existing structures of the Ministry of Water and Environment. The NPMT will have *fully deployed* staff from the concerned agencies including: a) Fisheries Expert who doubles as the Lead; b) Water Resources Expert; and c) Project Accountant. Specifically for DRC, the National Project Management Team (NPMT) will be located in Bunia with a satellite office located in Butembo. Each of these offices will include three experts: a) Fisheries Expert who doubles as the Lead; b) Water Resources Expert;

and c) Project Accountant. This office will however be reporting to the Office in Bunia. Two NGOs will be recruited in DRC (one per Lake) as Local Executing Agency for the implementation of the field activities.

The environmental expert in NELSAP will coordinate the implementation of the ESMP at the regional by undertaking by-annual missions in the project area. A launching workshop will also be organized with the stake holders of the two countries to familiarize with ESMP measures and to agree on the action plan for the implementation. Water resources expert in national coordination unit will coordinate the implementation of the ESMP in DRC and Uganda. Environmental monitoring will be covered by the 'Direction des établissements humains et protection de l'environnement (DEH/PE)' in DRC and by the National environmental management agency (NEMA) which will also undertake by-annual missions. The environmental expert in NELSAP will keep abreast PIU and relevant stakeholders on the progress of implementation of ESMP. This will be through the ESMP progress report.

Capacity building

Trainings and capacity building on the ESMP and health safety plan will be undertaken by an environmental consultant /safe guard expert/social expert and Health Safety Expert respectively. This will be mandatory for all project staff/workers and will occur before site work kicks off and during project implementation. The target participants for the training are: NELSAP, RCU, NCUs, Relevant Government Institutions, Contractors and workers and specific project beneficiaries/community. The expected outcome of this training will be to raise awareness about environmental, social, health and safety safe guards amongst stuff/workers so as to minimize risk and enhance benefits from implementation of LEAF project activities. The expected output of the training will be to ensure that trainees understand and implement the proposed ESMP to the latter throughout the project period.

The ESMP training will revolve around environmental and social mitigation guidelines, general environmental and social awareness, and legislative aspects of environmental and social safeguards compliance during the construction as well as operation of activities, in order to minimize the adverse environmental and social impacts of the project. Project Staff and workers will also be trained on Health and Safety Monitoring Plan. This will cover health and safety management during construction and project implementation. In addition, workers will be trained on the effective use of protective clothing, emergency kits and first aid measures.

7.4 COST ESTIMATES FOR ENVIRONMENTAL AND SOCIAL MONITORING AND MANAGEMENT

Table 7.5 below summarises the costs of environmental and social monitoring and management. Some items are included in the cost estimates for the different elements, and are therefore not included here. The costs associated with construction of proposed infrastructure will be included in the Contractor's estimate, such as provision of drainage along access roads, soil conservation measures along roads, and provision of PPE for his workforce. Costs for project-specific EIAs for all infrastructure are included the technical studies costs. Thus the total costs for environmental and social monitoring and management for the Project activities currently proposed are estimated at US$471,000.

Table 7.5: Cost Estimate for the ESMP (US$)

Measures	Quantity	Schedule for Delivery	Cost in USD	Responsibility
Measure 1: Create buffer zones around the forests and woodlands in the Project or maintain where they exist.	500 ha in DRC 500 ha in Uganda	40% completed by Q4 of 2017. 100% completed at the end of the project.	DRC = 14,000 Uganda = 10,000	NGOs District environment services NCU
Measure 2: Plant woodlots for wood fuel for the fishing villages as part of the buffer zones.	250 ha in DRDC 250 ha in Uganda	40% completed by Q4 of 2017. 100% completed at the end of the project.	DRC = 5*5000= 25,000 Uganda = 5*5000= 25,000	NGOs District environnent services NCU
Measure 3: Define and disseminate transparent and equitable eligible criteria to project financing access.		Criteria defined by Q2 of 2016.	DRC = 10,000 Uganda = 6,000	NGOs NCU
Measure 4: Regional workshop on the trans-boundary lakes management and the LEAF activities.		100% Completed by Q2 of 2016	NELSAP = 50,000	NELSAP NCUs
Measure 5: Undertake environmental impact assessment for each infrastructure and include mitigation measures in the contracts of the contractors.			Included in the project cost, technical studies of infrastructure.	NCU Consultants
Measure 6: No infrastructure facilities have to be built in the protected areas or forests.			PM	RCU NCU
Measure 7: The construction methodology should, as much as possible, adopt labour based works.			PM	RCU NCU
Measure 8: The Contractor must take care to ensure that the maximum possible number of employees hired is sourced from the fishing villages.			PM	NCU Engineers supervising works

Measure 9: STD/HIV/AIDS and malaria prevention awareness campaigns should be conducted prior to construction of infrastructure, and condoms distributed, to the workforce as well as in the fishing villages.	2 campaigns for years 2, 3 and 4 for each lake and each country = 24 campaigns.	33% completed by Q4 of 2017. 100% completed at the end of 2019.	DRC = 2*6*4000 = 48,000 Uganda = 2*6*3500 = 42,000	NGOs NCU
Measure 10: Define and disseminate transparent and equitable eligible criteria to alternative livelihoods.		Criteria defined by Q2 of 2016.	See measure 3	NGOs NCU
Measure 11: Finance livelihoods subprojects outside the protected areas or forests.	400 livelihoods subprojects (200 in DRC, 200 in Uganda)	40% completed by Q4 of 2017. 100% completed at the end of 2020.	-	NCU RCU
Measure 12: Undertake sensitization and information campaigns to mobilize stakeholders to the project approach.	2 campaigns for years 1 et 2 for each lake and each country = 16 campaigns.	100% Completed by Q4 of 2017	-	NCU RCU
Measure 13: Adopt a participative and steps approach during the studies and implementation of the harmonized rules.			-	Consultants NCU RCU
Measure 14: Training on environmental impacts assessment, ESMP implementation and monitoring.	1 session in DRC 1 session in Uganda	100% Completed by Q4 of 2016	DRC = 20,000 Uganda = 20,000	Consultants NCU RCU
Measure 15: Training on health and safety management during construction.	1 session in DRC 1 session in Uganda	100% Completed by Q4 of 2016	DRC = 20,000 Uganda = 20,000	Consultants NCU RCU
Measure 16: Regional ESMP launching workshop.		100% Completed by Q2 of 2016	Regional component RC = 30,000	NELSAP
Measure 17: By-annual ESMP supervision missions.	10 missions	50% completed by Q4 of 2017. 100% completed at the end of the project.	RC = 10*4000 = 40,000	NELSAP

Measure 18: Environmental monitoring in DRC and Uganda.	Baseline, Mid-term and end of project.	50% completed by Q2 of 2018. 100% completed at the end of the project.	DRC = 30,000 Uganda = 20,000	Provincial environnent' service District' environnent' service
Measure 19: By-annual ESMP control missions in DRC and Uganda	12 missions in DRC 12 missions in Uganda	50% completed by Q4 of 2017. 100% completed at the end of the project.	DRC = 8*6,000= 48,000 Uganda = 8*4000= 32,000	DEH/PE NEMA
Total			**DRC = 215,000 USD** **Uganda= 175,000 USD** **RC/NELSAP = 120,000 USD** **LEAF = 510,000 USD**	

8 COMPLEMENTARY INITIATIVES

There are a number of complementary initiatives that will enhance various aspects of the ESMP. However, in order to successfully implement the LEAF Project it is important that all government and non-government organisations who are carrying out activities in the LEA Basin freely share information that they have in order that resources are not wasted in duplicating efforts, so that the valuable ecosystems with the LEA Basin can be effectively conserved and protected.

8.1 NILE TRANSBOUNDARY ENVIRONMENTAL ACTION PROJECT

Between 2006 and 2010, the Nile Transboundary Environmental Action Project (NTEAP) undertook various activities, in both DR Congo and Uganda, focusing on: institutional strengthening through training, including training using the Nile River Awareness Kit (which covers river science, people and the river, governance and environmental management); environmental education and public awareness primarily targeting primary and secondary school children; community-level land, forest and water conservation (through tree planting, introducing fuel efficient stoves, and initiatives to improve hygiene and sanitation); wetland and biodiversity through, among others, establishing wetland working groups; and water quality monitoring by providing laboratory equipment, manuals and simple water quality testing kits for use by schools and communities.

8.2 CATCHMENT PROTECTION AND REAFFORESTATION

In the DR Congo for example, Amis de Forêt et de l'Environnement pour le Développement (AFED) is involved in reafforestation efforts in the Ruturu area of the Lake Edward catchment. With initial support from NBI, it is also promoting fuel efficient stoves and believes that households are now using half as much charcoal as before, which not only means that fewer trees are felled, but these households are also halving the amount of money they spend on buying charcoal.

In Uganda, the Farm Income Enhancement Programme is a 5-year initiative under the District Forest Office in Rubirizi District. Its activities include reafforestation of bare areas with recommended tree species, constructing soil and water conservation structures on farmland, and sensitizing farmers to discourage them from bush burning.

The World Wildlife Fund has also embarked the second phase of the Semiliki River Catchment and Water Resources Management Project. The project will carry forward the interventions initiated during the inception and build further capacity for the implementation of the catchment management plans, including the establishment of transboundary mechanisms for catchment and water resources management. As part of the project baseline studies have been carried out on the water resources of the Mubuko-Nyamwamba river catchments (draining into Lake George) and the Lamia and Lower Semiliki river catchments (which drain into Lake Albert). A socio-economic baseline study was also compiled for these catchments.[7] The project is carrying out awareness raising on integrated water resources management. At present all the information gathered so far is being compiled in order to prepare sub-catchment plans which will be developed through a participatory approach and are expected to be complete by June 2011 (pers comm. Ebong Ivan, Project Manager, Semiliki River Catchment and Water Resources Management Project).

[7] NELSAP-CU contacted the WWF Uganda Country office in an attempt to obtain these documents but no response was received.

8.3 ALTERNATIVE LIVELIHOODS

The National Agricultural Advisory Services (NAADS) in Uganda is supporting alternative income generating activities for fisher communities. For example, in Bushenyi District, NAADS is encouraging women and youth to breed poultry. There has been some success here, where the groups have managed to produce broilers to supply the hotels. NAADS was also trying to promote goat rearing and beekeeping, but UWA did not allow them to keep goats as these would have to graze within the (QENP) park, while hives would have to be placed in the park, which would mean that beekeepers would be going into the park to harvest the honey.

8.4 ENVIRONMENTAL MANAGEMENT OF THE OIL AND GAS SECTOR IN UGANDA

The Ministry of Energy and Minerals has, with support from the Government of Norway, embarked on a 5-year programme to strengthen the management of the oil and gas sector in Uganda (MWEM, February 2010). The programme comprises three pillars: i) Resource Management, ii) Revenue Management and iii) Environmental Management. NEMA, UWA, the Department of Fisheries Resources and the Directorate of Water Resources Management were involved in drawing up the Environmental Management Pillar.

Under the Resources Pillar, the programme will support the following activities which are relevant to the LEAF Project:

- Periodical review of the policies, legal and regulatory framework to keep it in line with national requirements;
- Developing a supervisory strategy and plan for HSE matters in petroleum operations;
- Developing tools for undertaking of HSE audits;
- Developing health, safety and environmental standards and monitoring mechanisms.

As part of the Resource Management, training and other capacity building activities will be undertaken in order to enable the various institutions involved in the programme to effectively carry out their assigned responsibilities.

The expected outputs of the Environment Pillar are expected to be as follows:

i. Strategic Environmental Assessment (SEA) for the Albertine Graben conducted and results widely disseminated;
ii. Capacity development programs developed and implemented in all relevant institutions under the pillar, for areas identified as relevant/critical to the oil and gas sector with particular emphasis on managerial skills;
iii. Environmental and biodiversity related policies reviewed with respect to oil and gas including biodiversity off-sets, and presented for approval;
iv. Existing Acts reviewed, recommendations drafted and presented for approval;
v. Management plans for protected areas, and relevant sector plans for the Albertine Graben (AG), reviewed and updated taking the oil and gas issues into consideration[8];

[8] The Norwegian Directorate for Nature Management is currently working with UWA to update the management plans for Queen Elizabeth National Park (pers. Comm. Mari Lise Sjong, Norwegian Directorate for Nature Management, May 2011)

vi. An environmental monitoring system for the AG, with clear and agreed indicators, is established;
vii. Environmental regulations and standards relevant to the oil and gas sector developed;
viii. Hazardous waste management system strengthened;
ix. Framework for compliance monitoring and enforcement of the oil and gas industry strengthened;
x. National oil spill contingency plan developed and operationalised.

The total budget allocated for the Environment Pillar over the 5 year period is NOK 23,778,591 (approximately US$ 4,260,000).

The School of Environment and Development at the University of Manchester is currently undertaking a study which aims to assess how and under what conditions petroleum development can co-exist with biodiversity conservation in the protected areas and sensitive ecosystems in the Albertine Graben.

The World Bank is currently supporting the Second Environmental Management Capacity Building Project (EMCBP II) for Uganda, which will strengthen the management of environmental and natural resources at the national, district, and community levels. Activities included in this project that are relevant to the LEAF are the enhancement of enforcement capacity within NEMA to address priority environmental issues and investment in priority environmental regulations, monitoring equipment and training relating to the rapidly expanding petroleum and gas sector in Uganda (Ref. http://web.worldbank.org).

9 ESMP IMPLEMENTATION SCHEDULE

No.	ESMP ACTIVITIES	REPORTING DEADLINES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5		
1	ESMP Launching	• Annually at end 4th quarter																			
2	Development of Site-specific ESMPs	End Year 1, 1st quarter																			
3	Implementation of Mitigation measures	Annually with each planting session																			
4	Monitoring the progress of the implementation of the mitigation measures	Annually at end 4th quarter																			
5	Staff Training in Participatory Environmental Monitoring	By end of 2nd quarter year one																			
6	Sanitation and health training	In the 2nd year of the project																			
7	Health and HIV/AIDS mainstreaming	Annually by end of 2nd quarter																			
8	Environmental monitoring	Annually by end of 2nd quarter																			

10 CONCLUSIONS

The Lakes Edward and Albert Basins are no doubt facing some serious threats. One of the most critical is the increasing populations in the fishing villages due to natural growth, as well as the influx of migrants from more densely populated districts and refugees. Human pressure in the fishing villages, especially those that are enclosed by protected areas, have led to wildlife/human conflicts, deforestation in response to the demand for charcoal and fuelwood in the settlements, and overfishing. Deforestation in the lakes' catchment areas and destruction of wetlands are affecting the quality of lake water. There is a persistent problem with aquatic weeds. Overfishing and poaching of wildlife is on the rise. Fish stocks are therefore on the decline, and this is threatening the livelihoods of fisher communities, but there are limited opportunities for alternative sources of income. Poverty levels are therefore high. A significant development which threatens the unique biodiversity in the Project areas is the exploration and drilling of oil. Other issues are the high incidence of HIV/AIDS, poor sanitation and waste disposal facilities at the fishing villages.

The LEAF Project aims to address many of these issues through its three components. It proposes various studies, research, surveys and analyses. The Project includes training, capacity building and sensitisation programmes, as well as the identification of alternative livelihoods. It will set up documentation centres, databases and information management systems and supply equipment for data gathering, patrolling, laboratories, etc. In addition it will develop plans and strategies for the management of the lake resources and their catchments, as well as harmonise legislation and regulations for managing fisheries and lake resources for both member countries.

One of the weaknesses in establishing baselines has been the lack of recent and reliable data. Proposals have been made for the collection of relevant data and its analysis, which will enable the successes and failures of the LEAF Project to be assessed.

As part of the Project, infrastructure will be constructed. These are aimed at improving fish land sites and processing facilities, road access to and from the fish landing sites, as well as hygiene and sanitation. The scale of these facilities will be small, so their direct impacts are not expected to be significant. Indeed, all the anticipated impacts associated with construction of infrastructure can be managed.

A major concern however, is that improved infrastructure and social facilities may encourage more people to move into the fishing villages that are located within protected areas, which would perpetuate poverty or at least negate any decrease in poverty levels. It has therefore been proposed that social infrastructure as well as alternative livelihoods be located away from these villages. However, it will be necessary to facilitate access to these facilities through the provision of transportation means, and members of the local communities could be encouraged to provide means of transport as an income generating activity.

The threats posed to the ecosystems within the Project area by oil exploration and drilling activities are a nationwide concern, and several organisations are working with the oil companies and government institutions to enhance their capacity in the event of an oil spill or other accident.

It is expected that as a result of the LEAF Project, fish stocks will increase to sustainable levels; health, hygiene and sanitation conditions at the fish landing sites and fishing villages will greatly improve; water quality in the lakes and other water sources will improve; the LEA catchments and wetlands, and the biodiversity within these areas, will be conserved. Ultimately therefore, the Project should contribute to alleviating poverty in the LEA Basin.

In summary, provided recommendations for environmental mitigation, monitoring and management are implemented, it is unlikely that any of the proposed activities under the LEAF Project will have adverse environmental or social impacts, but rather it could provide tangible benefits to the fisher communities in both DR Congo and Uganda.

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Annex C
WATER QUALITY ASSESSMENT

The following has been extracted directly from the Lakes Edward and Albert Fisheries Pilot Project, Feasibility Report (NBI/NELSAP, 2008).

A total of 1161 profiles were taken from Lake Albert and 268 profiles from Lake Edward for Dissolved Oxygen (DO) Temperature (T), Electrical Conductivity (EC) and pH. Table C.1 gives a summary of the results of in-lake measurements for Lake Edward and Table C.2 gives results for Lake Albert for Dissolved Oxygen (DO) in mg/L, Temperature (Temp) in ^{o}C, pH in units, Conductivity in µS/cm, Chlorophyll a in µg/L, Secchi Depth in cm, Faecal Coliform in No./100 ml, and Total Coliform in No./100 ml.

Table C.1: Summary of mean measurements of some parameters at certain sampling stations on Lake Edward

KAZINGA CHANNEL ENTRY TO LAKE EDWARD – MWEYA JETTY

Depth (m)	Cond (uS/cm)	DO(mg/l)	Temp (oC)	pH (units)
0	287	6.79	27.58	10.26
1.8	320	4.19	25.94	9.8
3.8	590	2.39	25.96	9.55

Sechi Depth (cm): : 21.0
Chlorophyll 'a' (ug/Litre) : 150.6
Total Coliforms (No./100 mls) : 4000
Faecal Coliforms (No./100 mls) : 2000

SEMLIKI RIVER EXIT – KYAVINYONGE, DR Congo

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (oC)	pH (units)
0.2	892	7.64	26.88	10.17
1.5	892	7.39	26.89	10.17
3.0	892	7.39	26.88	10.18

Sechi Depth (cm) : 208.0
Chlorophyll 'a' (ug/Litre) : 7.1
Total Coliforms (No./100 mls) : TNTC
Faecal Coliforms (No./100 mls) : 42

TNTC = Too Numerous To Count

INSHORE WATER – VITSHUMBI, DR Congo

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (oC)	pH (units)
0.1	892	7.69	27.84	10.41
7.4	896	7.07	26.65	10.23
14.6	945	3.25	26.58	10.42

Sechi Depth (cm) : 135.0
Chlorophyll 'a' (ug/Litre) : 10.0
Total Coliforms (No./100 mls) : TNTC
Faecal Coliforms (No./100 mls) : 18

CENTRE OF LAKE EDWARD – DR Congo/UGANDA

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (oC)	pH (units)
0.1	883	7.51	26.99	9.79
8.0	884	7.17	26.45	9.73
15.6	883	6.77	26.44	9.74

Sechi Depth (cm) : 168.0
Chlorophyll 'a' (ug/Litre) : 6.3
Total Coliforms (Number/100 mls) : TNTC
Faecal Coliforms (Number/100 mls) : 4

INSHORE WATER – KATWE/UGANDA

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (oC)	pH (units)
0.0	891	8.51	27.64	9.23
2.8	890	8.79	27.10	9.13
5.5	895	5.42	26.22	8.90

Sechi Depth (cm): : 157.0
Chlorophyll 'a' (ug/Litre): : 7.9
Total Coliforms (Number/100 mls): : 157
Faecal Coliforms (Number/100 mls): 8

Table C.2: Summary of mean measurements of some parameters at certain sampling stations on Lake Albert

ENTRY OF SEMLIKI RIVER INTO LAKE ALBERT, DR Congo

Depth (m)	Cond (uS/cm)	Temp (°C)	DO (mg/l)	pH (units)
0.0	637	27.19	9.89	7.37
4.1	637	26.92	9.86	6.72
8.1	637	26.87	9.73	5.09

Sechi Depth (cm): : 80.0
Chlorophyll 'a' (ug/Litre): : 11.2
Total Coliforms (Number/100 mls): : NR
Faecal Coliforms (Numbe/100 mls): : NR

NR = Not Required **ND = Not Done**

INSHORE WATER OFF NTOROKO FISH LANING, UGANDA

Depth (m)	Cond (uS/cm)	Temp (°C)	DO(mg/l)	pH (units)
0.0	635	30.21	9.69	7.99
1.6	633	26.80	9.20	7.18
3.1	635	26.62	9.17	4.67

Sechi Depth (cm) : 179.0
Chlorophyll 'a' (ug/Litre) : 9.9
Total Coliforms (No./100 mls) : 5
Faecal Coliforms (No./mls) : 0

OFFSHORE – MIDDLE OF LAKE ALBERT (DR Congo/UGANDA)

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (ºC)	pH (units)
0.0	639	6.69	28.40	9.61
22.4	640	4.83	27.52	9.53
44.7	664	0.15	27.53	9.26

Sechi Depth (cm) : 250.0
Chlorophyll 'a' (ug/Litre) : 10.7
Total Coliforms (No./100 mls) : ND
Faecal Coliforms (No./mls) : ND

OFSHORE – MIDDLE OF LAKE ALBERT OFF HOIMA RIVER, UGANDA

0.0	638	27.74	9.79	5.40
21.6	639	27.61	9.78	4.42
43.1	668	27.61	9.52	0.51

Sechi Depth (cm) : 250.0
Chlorophyll 'a' (ug/Litre) : 13.6
Total Coliforms (No./100 mls) : NR
Faecal Coliforms (No./mls) : NR

AT ENTRY OF VICTORIA NILE OFF WANSEKO FISH LANDING

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (ºC)	pH (units)
0.0	110	8.14	26.54	8.43
0.7	110	8.03	26.53	8.51
1.4	110	8.21	26.57	8.71

Sechi Depth (cm) : Could not be measured
Chlorophyll 'a' (ug/Litre) : 14.4
Total Coliforms (No./100 mls) : ND
Faecal Coliforms (No./mls) : ND

AT EXIT OF LAKE ALBERT INTO ALBERT NILE, UGANDA

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (ºC)	pH (units)
0.0	123	8.25	28.40	8.98
1.7	126	7.60	26.85	8.45
3.6	110	4.88	26.61	8.16

Sechi Depth (cm) : 79.0
Chlorophyll 'a' (ug/Litre) : 18.2
Total Coliforms (No./100 mls) : ND
Faecal Coliforms (No./mls) : ND

INSHORE WATER OFF MAHAGI PORT, DR Congo

Depth (m)	Cond (uS/cm)	DO (mg/l)	Temp (ºC)	pH (units)
0.0	622	6.38	27.86	9.79
7.5	617	6.19	27.76	9.81
14.9	650	0.08	27.46	9.60

Sechi Depth (cm) : 179.0
Chlorophyll 'a' (ug/Litre) : 17.4
Total Coliforms (No./100 mls) : ND
Faecal Coliforms (No./mls) : ND

Overall, the results from Dissolved Oxygen, Temperature, EC, pH profiles, measurements of Chlorophyll *a* and Secchi Depths and laboratory analysis of Total and Faecal Coliform appear to indicate that both lakes show a low level of pollution with a few localized pollution "hot spots". For example, very low values of DO occur in the bottom waters of the confluence of Kazinga Channel and Lake Edward and near Vitschumbi in DR Congo where high Chlorophyll 'a' counts and shallow Secchi Depth measurements were found. The bottom offshore water of Lake Albert are also devoid of oxygen. This reflects an accelerated nutrient loading from expanding human activities in the catchments of Lake George and Kazinga Channel that is drained into Lake Edward in addition to indicating serious sewage discharge directly into the area. Total and Faecal Coliform counts at these locations were also very high at 4000 and 2000 per 100 ml respectively. The other high counts of 157 and 8 per 100 mls were found at the Inshore Station near Katwe Fish Landing. Other areas of the two lakes still appear to be safe. Shallow areas at the entrance of River Semliki into Lake Albert and entrance of Victoria Nile near Wanseko Fish Landing also contain high algal concentrations (11 – 18 ug/L), but these could be due to the swampy environment at these locations in addition to nutrients arriving from the catchments of the two rivers.

The DO in most parts of the two lakes is above 4 mg/L level, and they can therefore support the lives of fish and other organisms. The mean value in Lake Edward is 7.4 mg/L with the exception of the bottom waters in the areas where the Kazinga Channel enters the lake near Mweya Hotel and near Vitschimbi. The mean value in Lake Albert is 8.2 mg/L except for the deeper waters of the lake (over 40 m) where readings showed levels between 0.15 and 0.51 mg/L. The high Temperature recorded averaging over 26^{o}C enhances biological activities especially enzymatic and biochemical reactions that are temperature dependent. Besides influencing the solubility of gases in the water, this level of temperature also increases the rate of chemical reactions and evaporation.

Apart from the bottom waters of Lake Albert at the mouth of River Semliki where the conditions are acidic (i.e. values between 4.67 and 6.72 units), the rest of the waters of the two lakes have pH values averaging 8.5. This is being attributed to leaching of volcanic soils from the rift valley catchments, and in the case of Lake Albert, also due to inflows from hot springs (Matagi, 2002). The high levels of pH and EC recorded, which are similar to previous records (Talling, 1965 and Matagi, 2002) indicate that the lakes are moderately alkaline. The isolated acidic case in southern Lake Albert could be due to the papyrus swamps through which River Semliki flows before entering Lake Albert.

Chlorophyll 'a' measures algal biomass. The values recorded in most parts of the two lakes, ranging from 6.3 to 10.0 ug/L in Lake Edward and from 9.9 to 18.2 ug/L in Lake Albert do not signify excessive eutrophication. However, Chlorophyll 'a' level was extremely high at the confluence of Kazinga Channel with Lake Edward at Mweya Hotel Pier (150.6 ug/L) and this could lead to eutrophication and algal blooms. Sechi Depth was also shallowest (21 cm) at this same location compared with other locations in Lake Edward (135 to 208 cm).

Generally, Lake Edward has low level TSS (>15 mg/L) except for the high level of over 50 mg/L encountered at the entry of Kazinga Channel into the lake at Mweya Hotel. Since TSS is associated with plankton abundance, the high level obtained near Mweya, indicates localized eutrophication. The high figures (> 400 mg/L) of Total Alkalinity obtained at all sampling stations is a sign that the lake is saline or has dilute saline water. This is pertinent in that the values of Phenolphthalein Alkalinity (PA) were found to be high (between 50 and 90 mg/L) at most sampling stations.

Total Nitrogen (TN), Nitrites, and Nitrates were found to be between 0.5 to 2.19 mg/L for TN, and 0.002 mg/L for Nitrite and 0.02 mg/L for Nitrate at all other Sampling Stations except at REE1 where it figured as 4.2, 0.008 and 0.03 mg/L for TN, Nitrite and Nitrate respectively. These are the direct indicators of agricultural, industrial, and domestic sewage runoffs laden with organic matter

from the catchments. Levels of Nitrates in excess of 5 mg/L NO_3-N usually indicate pollution by human or animal waste, or fertilizer run-off, besides levels of Nitrates in excess of 0.2 mg/L NO_3-N tend to stimulate algal growth and indicate possible eutrophic conditions (Chapman, 1992). In the case of Lake Edward, the values observed do not reflect serious pollution or high decay of algae except for the green soup of algae near Mweya Hotel where the values were found to be 0.02 mg/L and 0.04 mg/L NO_3-N in the surface and bottom waters respectively.

Measurement of Sulphates (SO_4^{2+}) averaged at 30 mg/L at practically all sampling stations in Lake Edward. Although sulphates are major components of proteins, they are not generally associated with eutrophication directly, and they are easily broken down to hydrogen sulphide (H_2S) in water.

Annex D
IMPACTS OF CLIMATE CHANGE ON THE ALBERTINE RIFT

The World Conservation Society has undertaken an assessment of the impacts of climate change on the biodiversity of the Albertine Rift. Details can be found on: http://programs.wcs.org/albertineclimate/ClimateChange/tabid/2804/Default.aspx

The project looked at climatic variables (temperature and precipitation) as well as selected key habitat variables, namely:

- Net Primary Production is defined as the net flux of carbon from the atmosphere into green plants per unit time, and in this case refers to herbivore habitat and biomass production
- Runoff is the amount of water available, and indicates the likelihood of floods occurring
- Heterotrophic respiration is the way in which organic matter is converted into CO2, mainly by micro-organisms in the soil.
- Total Carbon is calculated in terms of carbon stored in soil, litter and vegetation

The project assessed the impacts of carbon on the Albertine Rift as well as several landscapes. Those that are specifically relevant to the LEAF project area are the assessments for the Albertine Rift Landscape, the Murchison-Semiliki Landscape and the Greater Virunga Landscape. The assessments for each of these landscapes are presented in the following pages.

Albertine Rift Landscape

		1990	2030	2060	2090	
Mean monthly temperature	Max	26.01	26.98	28.13	29.71	°C
	Mean	22.73	23.6	24.73	26.28	
	Min	15.01	15.97	17.11	18.68	
Mean monthly precipitation	Max	157.25	158.32	164.03	174.85	mm
	Mean	99.92	102.78	107.24	117.18	
	Min	68.42	72.88	78.15	88.11	
Mean monthly cloud cover	Max	82.6	82.43	81.67	81.94	%
	Mean	67.16	67.41	66.94	67.14	
	Min	42.39	43.24	43.24	43.42	
Annual runoff	Max	723.19	760.22	870.77	985.96	mm
	Mean	263.51	286.05	326.56	433.29	
	Min	42.94	28.05	50.48	127.38	
Annual net primary productivity	Max	1520.1	1638.91	1747.7	1846.55	$gC\ m^{-2}$
	Mean	1059.85	1149.89	1241.99	1331.33	
	Min	724	795.54	868.07	955.92	
Annual heterotrophic respiration	Max	1278.03	1474.48	1630.64	1680.7	$gC\ m^{-2}$
	Mean	915.52	1007.42	1104.89	1202.7	
	Min	582.14	672.76	769.6	865.13	
Annual total carbon	Max	59.3	57.55	56.71	56.05	$KgC\ m^{-2}$
	Mean	32.99	33.09	32.94	32.81	
	Min	19.03	19.61	20.23	20.43	
Bean Yield	Max	1497	1443.33	1387	1331.67	$Kg\ ha^{-2}$
	Mean	798.93	754.29	721.46	627.17	
	Min	1	11.33	73	67.33	
Maize Yield	Max	3531	3538.67	3402	3111.33	$Kg\ ha^{-2}$
	Mean	1102.36	1103.05	1097.88	1025.49	
	Min	32	46	45.67	44	
Brachiaria Yield	Max	4147	4327.67	4577	4956.67	$Kg\ ha^{-2}$
	Mean	1663.09	1729.89	1883.54	1943.39	
	Min	2	3.67	6	15	

Source: http://programs.wcs.org/albertineclimate/ClimateChange/tabid/2804/Default.aspx

Murchison Semiliki Landscape

		1990	2030	2060	2090	
Mean monthly temperature	*Min*	21.28	22.15	23.28	24.84	°C
	Mean	23.99	24.88	25.98	27.55	
	Max	25.01	25.89	26.98	28.56	
Annual Precipitation	*Min*	919.00	936.50	1008.33	1141.17	mm
	Mean	1129.65	1147.35	1219.14	1354.13	
	Max	1433.00	1448.67	1515.67	1654.17	
Runoff	*Min*	64.49	80.60	110.63	157.65	mm
	Mean	102.09	104.92	142.20	212.76	
	Max	160.48	178.36	205.18	314.32	
Net Primary Production	*Min*	1162.83	1200.02	1338.46	1596.02	gC m-2
	Mean	1288.77	1408.94	1546.73	1666.62	
	Max	1446.39	1537.24	1692.67	1800.19	
Heterotrophic Respiration	*Min*	980.16	1064.30	1203.09	1399.79	gC m-2
	Mean	1063.62	1188.53	1327.46	1482.01	
	Max	1175.49	1317.59	1483.92	1629.81	
Bean Yield	*Min*	589.00	582.67	508.33	333.00	Kg ha-2
	Mean	830.17	792.48	752.09	625.98	
	Max	1200.00	1139.33	1070.67	988.33	
Maize Yield	*Min*	187.00	203.00	214.33	200.00	Kg ha-2
	Mean	1062.56	1032.36	1005.20	921.05	
	Max	2966.00	2932.00	2803.33	2717.33	
Brachiaria Yield	*Min*	66.00	86.33	96.67	97.67	Kg ha-2
	Mean	1637.31	1612.66	1732.35	1713.87	
	Max	3540.00	3720.00	3973.00	4166.33	

Source: http://programs.wcs.org/albertineclimate/ClimateChange/tabid/2804/Default.aspx

Greater Virunga Landscape

		1990	2030	2060	2090	
Mean monthly temperature	*Min*	16.57	17.45	18.58	20.18	°C
	Mean	20.42	21.32	22.45	24.04	
	Max	23.85	24.74	25.88	27.48	
Annual Precipitation	*Min*	740.00	747.17	790.67	904.00	mm
	Mean	1144.90	1152.86	1206.89	1331.58	
	Max	1653.00	1677.50	1738.50	1864.17	
Runoff	*Min*	42.94	28.05	50.48	127.38	mm
	Mean	146.70	148.15	191.87	319.97	
	Max	383.39	431.55	538.03	659.69	
Net Primary Production	*Min*	1131.38	1227.93	1334.57	1475.19	gC m-2
	Mean	1285.64	1382.62	1488.31	1560.48	
	Max	1403.95	1523.57	1658.69	1711.99	
Heterotrophic Respiration	*Min*	927.54	1002.18	1087.56	1247.09	gC m-2
	Mean	1090.70	1201.28	1332.84	1450.58	
	Max	1219.50	1326.36	1483.92	1596.86	
Bean Yield	*Min*	1.00	11.33	73.00	403.33	Kg ha-2
	Mean	994.66	969.37	950.27	869.77	
	Max	1497.00	1443.33	1387.00	1271.00	
Maize Yield	*Min*	46.00	213.33	667.33	570.67	Kg ha-2
	Mean	1941.22	1934.90	1908.03	1786.91	
	Max	3531.00	3538.67	3402.00	3111.33	
Brachiaria Yield	*Min*	2.00	3.67	6.00	15.00	Kg ha-2
	Mean	1778.34	1930.91	2193.73	2486.88	
	Max	3952.00	4059.33	4286.33	4956.67	

Source: http://programs.wcs.org/albertineclimate/ClimateChange/tabid/2804/Default.aspx