THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

SUMMARY OF THE ECONOMIC VALUE OF BIODIVERSITY AND ECOSYSTEM SERVICES IN LAKE NABUGABO WETLAND COMPLEX

FEBRUARY 2015

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

BAU	Business As Usual
BSA	Biologically Significant Area
CCBA	Climate, Community and Biodiversity Standard
GDP	Gross Domestic Product
GIS	Geographic Information System
NPV	Net Present Value
PREPARED	Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development
REDD+	Reduced Emissions from Deforestation and Forest Degradation
USD	US Dollar. At the time of writing the report, USD 1 = UGX 2,632
VCS	Verified Carbon Standard

OBJECTIVES, SCOPE AND FOCUS

WHICH BIODIVERSITY, ECONOMIC & MANAGEMENT ISSUES DOES THE VALUATION STUDY INTEND TO ADDRESS?

This report has been produced with an overall objective of supporting development of Conservation Investment Plans (CIPs) for biologically significant areas in Lake Victoria Basin. It contributes towards the USAID-funded Planning for Resilience in East Africa Through Policy, Adaptation, Research, and Economic Development (PREPARED) project.

Under the PREPARED Project, CIPs are being prepared for selected biologically significant areas (BSAs) in the Lake Victoria Basin. Targeted at potential donors and investors, CIPs present key conservation activities as a set of bankable investment packages, aiming to mobilise new funding flows and fill critical financing gaps. Information about the economic value of biodiversity and ecosystem services at each site – and hence the economic return on investing in conservation – provides a key part of the business case and economic justification for the CIP.

This report presents a rapid economic valuation exercise that was carried out in Lake Nabugabo Wetland Complex in Uganda. Towards the overall objective of providing information that can be used to provide an economic justification for the CIP, the rapid assessment of ecosystem service values seeks to answer four key questions: (1) how and for whom does the Lake Nabugabo Wetland Complex generate economic benefits? (2) what is the current value of biodiversity and ecosystem services? (3) what would be the costs of wetland degradation and loss? and (4) what would be the value-added from investing in enhanced wetland conservation and wise use?

The rapid assessment was conducted over a period of 10 days, and involved a field visit to Lake Nabugabo; stakeholder and expert consultations in Nabugabo, Masaka and Kampala; literature review; collation of existing national and district statistics; data entry, analysis and reporting. It draws heavily on the Management Plan that was prepared when the Lake Nabugabo Wetland Complex was first declared

a Ramsar site (WID 2004), and updates and builds on the valuation study carried out by the then Wetlands Inspection Division (Kiwazi et al. 2004). It should be noted that the study was carried out over a very short time frame, on the basis of only limited information. Very few socioeconomic and (especially) biophysical data are available on the Nabugabo area, and there are no accurate or up-to-date maps or land cover / land use estimates. For these reasons, the figures presented below are inevitably partial ones, remain highly approximate, and are based on many assumptions. It is to be hoped that as better and more reliable data become available, the ecosystem value estimates can be further improved and refined.

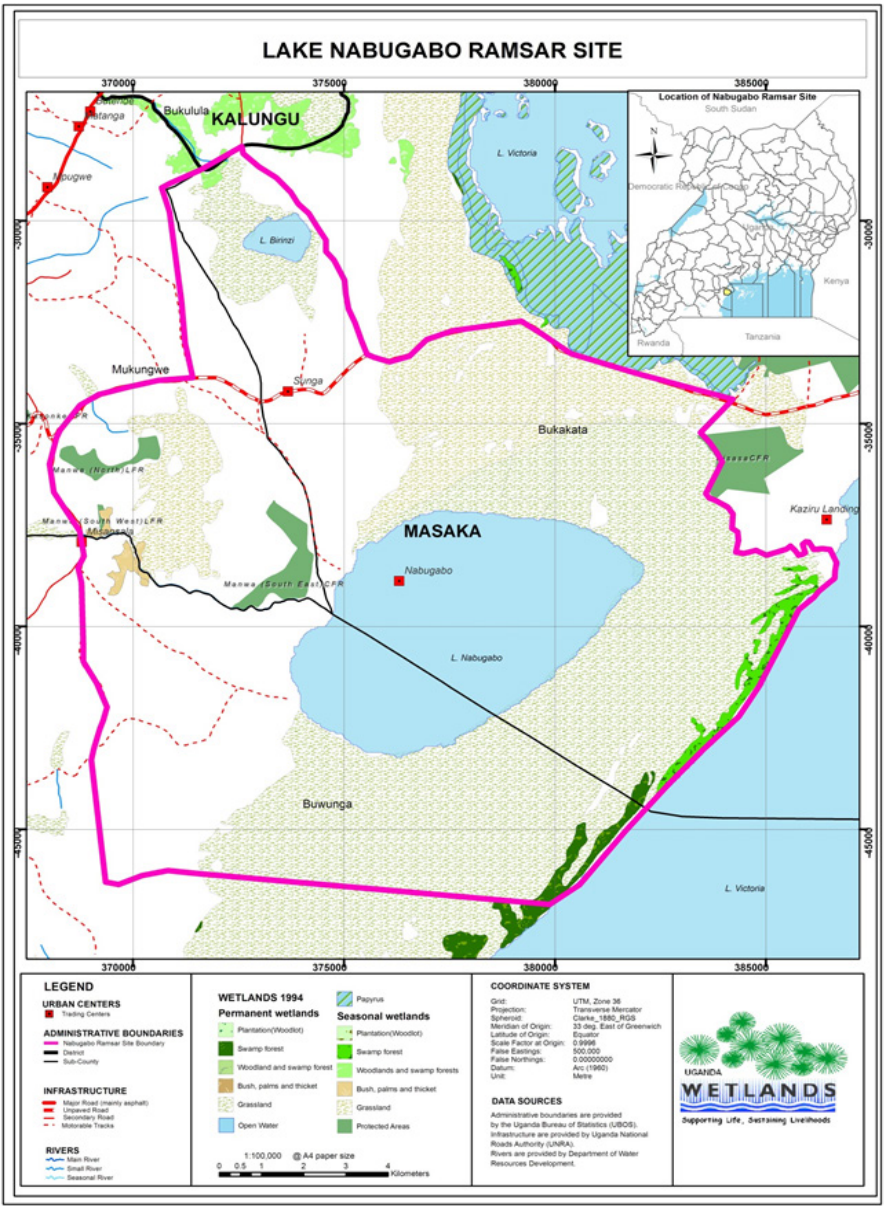


Figure 1: Location, boundaries and vegetation of original Ramsar Site

Source: Wetlands Management Department.

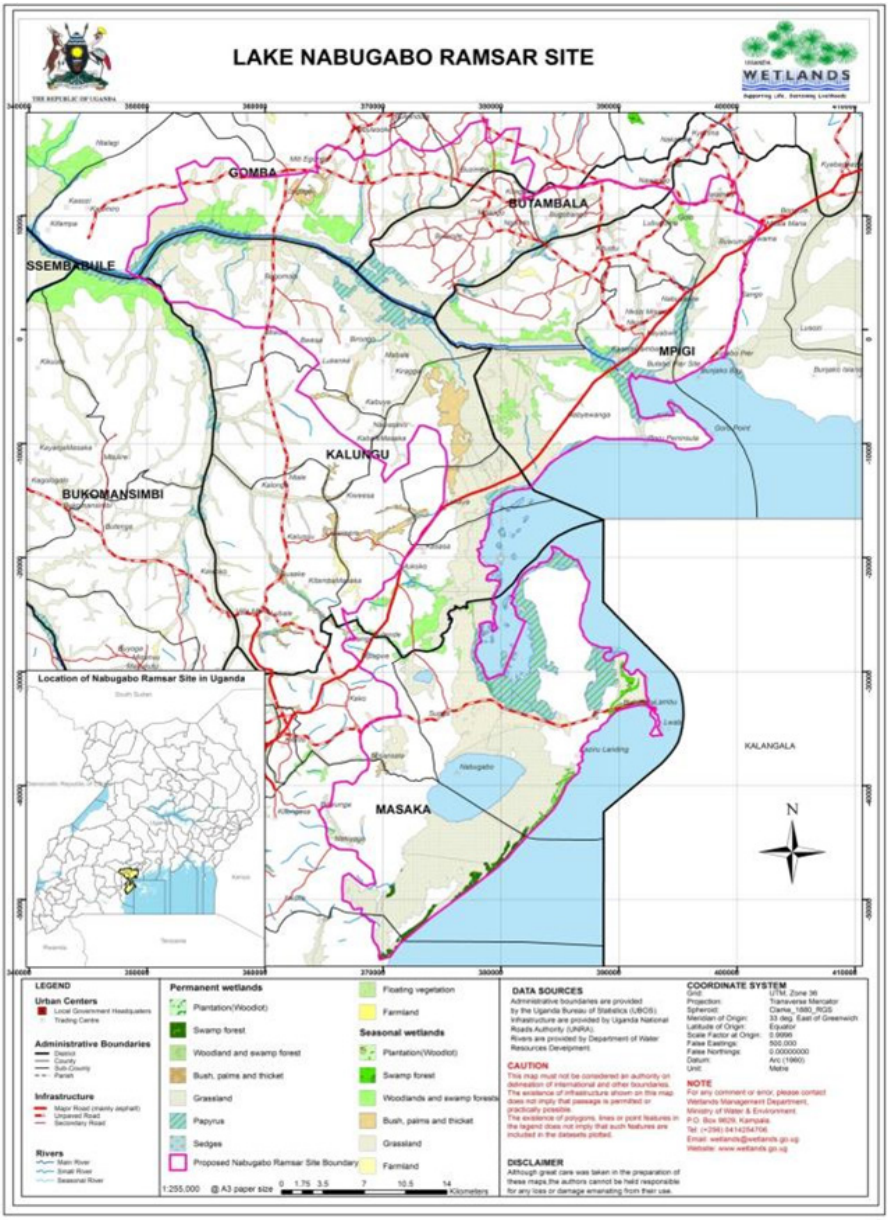


Figure 2: Location, boundaries and vegetation of extended Ramsar Site

Source: Wetlands Management Department.

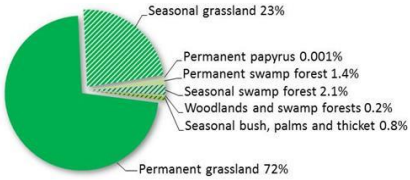
ECOSYSTEM-ECONOMIC LINKAGES AND KEY STAKEHOLDERS

HOW AND FOR WHOM DOES THE LAKE NABUGABO WETLAND COMPLEX GENERATE ECONOMIC BENEFITS?

In addition to Lake Nabugabo (3,600 ha), the wetland complex includes the smaller satellite lakes of Kayanja or Birinzi (110 ha), Manywa (30 ha) and Kayugi (<10 ha). In 2004, an area of 220 km^2 around the four lakes was declared a Ramsar Site (Figure 1). There is a proposal to extend the site boundaries further, across an area of 777 km^2 (Figure 2). This would incorporate several other important wetland habitats (most notably the 273 km^2 Katonga wetland complex which stretches north-west from Lake Victoria across Mpigi, Butambala, Kalungu and Gomba Districts, and the large tracts of papyrus swamp which fringe Lake Victoria to the north of Lake Nabugabo).

In addition to open water, the Ramsar Site contains a variety of wetland habitats (Figure 3). Much of this natural habitat has however been modified in some way by human activities, including crop farming, grazing, tourism development, sand and clay mining. Lake Nabugabo is fringed by Miscanthus and Loudetia spp., with swamp forest to the north-east and along the sandbar which separates it from Lake Victoria. Lake Kayanja/Birinzi is bordered by dense Miscanthidium and patches of swamp forest (dominated by Alochornea cordifolia and Beilschmiedia ugandensis). Lake Kayugi is bounded by Papyrus swamp, associated with Ficus congensi, while Phoenix reclinata-dominated woodlands and thickets are found in most of the seasonally-flooded zones around the lakes, in most cases mixed with grasslands. The proposed extension to the Ramsar Site contains large tracts of papyrus on the fringes of Lake Victoria and along the Katonga River, as well as grasslands, bushlands, woodlands and swamp forests. It also incorporates three gazetted forest reserves (Jubiya, Manwa North and South West, together covering 203 ha).

Wetland cover category	Area of original Ramsar Site (km^2)
Permanent papyrus	0.001
Permanent swamp forest	1.41
Seasonal swamp forest	2.11
Woodlands & swamp forests	0.25
Seasonal bush, palms & thicket	0.79
Permanent grassland	73.45
Seasonal grassland	23.67
Total	101.69



Wetland cover category	Area of extended Ramsar Site (km^2)
Permanent papyrus	6.33
Permanent swamp forest	5.55
Seasonal swamp forest	99.31
Woodlands & swamp forests	19.89
Seasonal bush, palms & thicket	305.82
Permanent grassland	227.94
Seasonal grassland	1.84
Seasonal farmland	110.64
Total	777.33

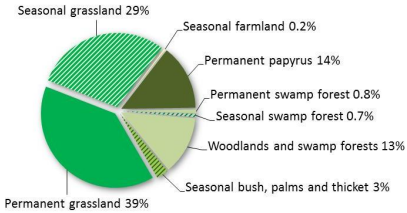


Figure 3: Lake Nabugabo wetland cover types

Source: Wetlands Management Department.

The main ecosystem service stakeholders are the communities that live in and around the wetlands. Four Parishes covering a populated area of 264 km^2 of Masaka District overlap the original Ramsar Site, while 38 Parishes extending over 1,425 km^2 of Butambala, Gomba, Kalungu, Masaka and Mpigi Districts coincide with the extended site[1] (Table 1, Figure 1, Figure 2). These contain a human population of more than 22,500 people or 5,500 households and 190,000 people or 42,000 households respectively. All are classified as rural (Mpigi District Local Government 2009; Masaka District Local Government 2012) and most depend on farming and/or fishing as their main source of livelihood (NCDA 2014a).

1 The total area of these Parishes is larger than the Ramsar Site, because most Parish extend outside the boundaries of the Ramsar Site. The analysis excludes those Parishes which only have a very small area overlapping the Ramsar Site.

District	Sub-county	Parish	Populated area (ha)	Total area (ha)	Persons	Households
Original Ramsar Site						
Masaka	Bukakata	Bukibonga	8,981	18,443	6,834	2,056
		Ssunga	7,095	8,526	5,234	1,161
	Mukungwe	Katwadde	3,735	3,735	5,834	1,260
	Buwunga	Kasaka	6,601	9,346	4,767	1,050
Total			26,412	40,051	22,669	5,527
Extended Ramsar Site						
Masaka	Bukakata	Bukibonga	8,981	18,443	6,834	2,056
		Ssunga	7,095	8,527	5,234	1,161
		Makonzi	11,087	14,062	2,467	686
	Mukungwe	Katwadde	3,735	3,735	5,834	1,260
	Buwunga	Kasaka	6,601	9,346	4,767	1,050
Mpigi	Nkozi	Bukunge	1,330	3,438	3,135	697
		Buseese	1,269	1,269	3,400	756
		Ggolo	1,652	7,661	5,334	1,185
		Kayabwe	2,104	2,429	4,600	1,022
		Mugge	6,233	8,238	5,602	1,245
		Nabusanke	1,310	1,310	2,635	586
		Nakibanga	1,667	1,667	2,400	533
		Nnindye	3,473	5,878	6,669	1,482
	Kituntu	Bukasa	4,553	4,553	6,234	1,385
		Bukemba	1,489	1,489	3,035	674
		Kantini	2,404	2,404	3,335	741
		Kasozi	1,837	1,837	3,967	882
		Luwunga	1,157	1,157	2,367	526
		Migamba	1,273	1,273	2,767	615
		Nkasi	1,289	1,289	1,867	415
	Buwama	Lubugumu	1,756	1,756	2,767	615
		Mbizzinya	2,252	2,252	8,769	1,949

District	Sub-county	Parish	Populated area (ha)	Total area (ha)	Persons	Households
Butambala	Bulo	Bulo	2,049	2,049	4,767	1,059
		Bule	1,278	1,278	2,767	615
	Ngando	Bukesa	1,989	1,989	5,234	1,163
		Butende	1,663	1,663	3,735	830
		Kasozi	2,199	2,199	5,334	1,185
		Lugali	5,060	5,060	4,334	963
Gomba	Kabulasoke	Kalwanga-Kakubansiri	7,467	7,467	7,769	1,726
		Lugaaga	3,260	3,260	4,234	941
		Matongo	2,449	2,449	4,103	912
Kalungu	Lukaya TC	Magezi-Kizungu	2,812	3,083	4,302	1,076
	Bukulula	Bugonzi	3,347	3,349	6,002	1,200
		Kiti	6,872	6,872	8,634	1,727
		Mukoko	6,330	8,172	8,301	1,660
	Lwabenge	Bugomola	7,962	7,962	7,501	1,500
		Bwesa	6,292	6,292	9,401	1,880
		Kiragga	6,919	6,919	9,001	1,800
Total			142,497	174,077	189,440	41,759

Table 1: Lake Nabugabo administrative units, area and population, 2014

Source: area from UBOS 2010b; administrative units and population from MDLG 2012; population projected from 2012 to 2014 figures by applying Parish-level average annual growth rates between 2009-2012. Populated area excludes water bodies, forest reserves and protected areas.

Twelve major categories of economically-important ecosystem services can be identified as being provided by wetlands in the Lake Nabugabo Complex (Figure 4). It should be noted that the study is concerned only with the economic values associated with living resources, wild species and predominantly natural habitats within the boundaries of the Ramsar site. This means that no attempt has been made to value activities such as sand mining, clay extraction and brick-making. In line with Ramsar principles, the study focuses on the values accruing from the wise use of wetland resources. It therefore excludes land and resource uses which are illegal or known to be unsustainable in biological and ecological terms, namely: commercial timber, charcoal and bushmeat harvesting.

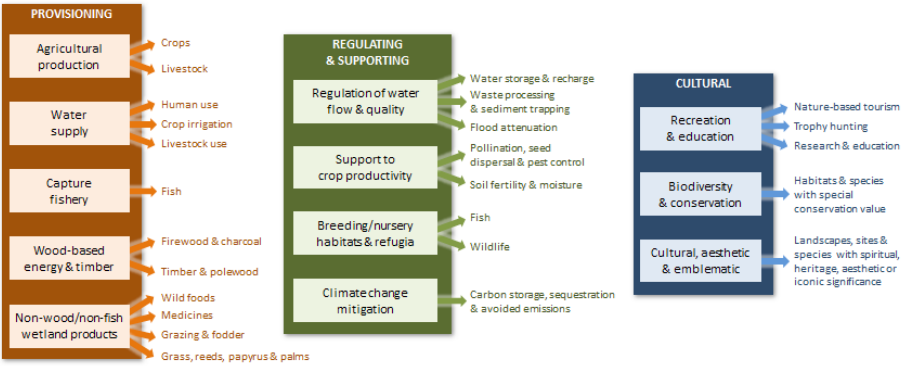


Figure 4: Lake Nabugabo key ecosystem services

Agricultural production forms the cornerstone of the local economy. Just over half of the households living in Parishes overlapping the original Ramsar site rely on farming as their primary source of subsistence and livelihoods, and two thirds of those living in and around the extended Ramsar site (UBOS 2002a). As well as providing land for cultivation, the wetland complex provides a source of pasture and fodder for livestock. This is especially important in the dry season, when other sources of grazing become scarce. Based on the land use and land cover maps prepared by the Wetlands Management Department as well as the average cropped areas and herd sizes for Masaka and Mpigi Districts that are recorded in the 2008 Agriculture and Livestock Censuses (MAAIF 2010a,b), the current Ramsar Site may support up to 2,000 ha of cropland and 6,000 cattle while 21,000 ha of crops and 76,000 cattle are found in the extended site.

The lakes and rivers of the wetland complex make a direct contribution to water supply. Lake Nabugabo and its satellites provide a seasonal (and in some cases year-round) source of water for nearby households. Only 6% or less of local residents have a water supply on their premises (i.e. via a private well, borehole or tap); around two thirds must walk up to a kilometre to access water, and a quarter or more must travel even greater distances (UBOS 2002a, 2010a, 2010b) – a trip that can take up to three hours, per household, every day (NCDA 2014a). The waterbodies found in the Ramsar Site also provide a source of water

for livestock and crops. Although very few households pump water onto their fields, a minority plant crops in temporarily or permanently flooded wetland areas. According to Masaka and Mpigi District records, up to 300 farmers in the current Ramsar Site and 3,000 in the extended site practice flood recession and/or wetland cultivation (MAAIF 2010b). Maps prepared by the Wetland Management Department indicate that seasonal wetland cultivation occupies around 43 has in the original Ramsar Site, and 184 has in the expanded Nabugabo area.

Lake Nabugabo supports a modest capture fishery. Fishing is carried out at a small-scale, artisanal level, almost exclusively using gillnets and wooden canoes. Approximately 100 fishers and 95 boats are estimated to operate on Lake Nabugabo and its satellites, two thirds of whom rely on fishing as their main source of livelihood (Lubuulwa 2005). There are three main landing sites (Kituti, Luwafu and Kaziru) on Lake Nabugabo, each with a distinct market and an associated group of fishers, fish mongers, and other stakeholders (Vaccaro et al. 2013). While the fishery is recorded as comprising eleven main species, the catch is dominated by Tilapia and Nile Perch (Chapman et al. 2003; Vaccaro et al. 2013). According to Masaka District Fisheries records, these comprised more than 97% of the total catch of 103 tonnes in 2013. Other species such as lungfish, catfish and various haplochromines are targeted by some fishers, or captured as bycatch (Ogutu-Ohwayo 1993; Chapman et al. 2003). Fishing is estimated to involve more than a third of the local population that lives in and around Katonga wetland in Mpigi District, generating average catches of 119 kg a week per fisher during wet season periods of March-May and September-November (Kateyo et al. 2014).

The majority of local household rely on natural forest, woodland and bush areas for wood-based energy and timber. Three quarters of household in the current Ramsar site and just under two thirds in the extended Ramsar site depend upon firewood as their main source of fuel for cooking, and around a half of houses are constructed from mud and poles, or wood (UBOS 2002a, 2010a, 2010b). Timber from the wetland area is also harvested for a wide variety of other household

utility items, including axe and hoe handles, furniture, boats and other fishing equipment, and bee hives.

A wide variety of other non-wood/non-fish wetland products are harvested for home consumption and sale. Almost all local households are reported to depend on wetland resources in some way for their basic subsistence needs (Bikangaga 2007). These include the use of palms, papyrus and reeds for ropes, mats, baskets and other handicrafts, grass cutting for thatch, fodder and mulching, the collection of wild plants for food and medicines, and a small amount of subsistence hunting. Based on detailed studies carried out in Nabugabo and other wetland areas of Central and Southern Uganda (see Emerton 1999; Emerton et al. 1999; Karanja et al. 2001; Kiwazi et al. 2004; Akwetaireho 2009; Wasswa et al. 2013; Kateyo et al. 2014), a third or more of local households may regularly harvest at least one non-wood/non-fish wetland product from the Ramsar site.

Wetland habitats play an important role in the regulation of waterflow and quality. Lake and swamp areas help to maintain year-round water supplies, and assist in surface and sub-surface water recharge (RCS 2003). These services have become particularly important over recent years, as water scarcity has worsened in the Nabugabo area (NCDA 2014a). Wetland water storage and flow regulation services also help to attenuate flooding in rainy seasons (Kiwazi et al. 2004). Although seasonal flooding is a characteristic, and economically valuable, feature of the wetland system, both the lakes and natural vegetation function to regulate the release of water, helping to avoid extreme or catastrophic flooding events. In addition, wetland habitats make a significant contribution to nutrient cycling, thereby regulating the physico-chemical dynamics of water nutrient availability in Lake Nabugabo and its satellites as well as Lake Victoria (Okut-Okumu 2010). The wetland systems are thought to play a particularly important role in diluting and purifying the wastewater and other effluent discharges from the settlements and tourist beaches that are located around Lake Nabugabo, and in trapping silt and sediment that is transported from surrounding agricultural areas during rainy seasons (RCS 2003; WID 2004).

In addition to providing land for crop cultivation and livestock rearing, wetland ecosystem processes and functions provide a variety of secondary or indirect sources of support to crop productivity. Without the wetland, local agricultural potential and productivity would be even more limited than is currently the case. Cultivation would be confined to dryland crops, or would need to be irrigated by manual or mechanical means. At the same time, soil fertility would reduce and crop yields would be lower (or would require increased applications of artificial fertilisers to maintain yields) in the absence of the nutrients and sediments which are transported and deposited by the wetlands and the seasonal flooding which is associated with them. Wild species and habitats also make a contribution to crop productivity via pollination, pest control, nutrient burial and decomposition processes. These services are provided by many insect species (Losey and Vaughan 2006), as well as several species of birds and bats (Bauer and Wing 2010).

Wetland ecosystems serve as important breeding/nursery habitats and refugia for fish and wildlife species which have key livelihood or commercial value. Papyrus, reeds and other swamp vegetation for example protect indigenous fishes from introduced predatory fishes (Chapman et al. 1996), and major nursery areas for Nile tilapia occur in the small wetland bays in the south and south-east of Lake Nabugabo (Chapman et al. 2003; Vaccaro et al.; 2013). The Ramsar Site also provides habitat for game animals that are utilised for trophy hunting in neighbouring Sango Bay, including the Sitatunga and Hippopotamus.

The natural vegetation and soils of the Lake Nabugabo Wetland Complex provide important services in terms of climate mitigation. These benefits can be categorised in three ways: the stock of carbon that is locked up in wetland vegetation and soils, the carbon that is sequestered each year by existing and new area of natural vegetation, and the emissions avoided by maintaining vegetation cover and habitat quality rather than allowing it to degrade or be converted to alternative land uses.

The Ramsar Site provides an important resource for recreation and education. A large number of one-off studies and long-term research projects on lake and wetland species and habitats have been or are

being been carried out in the Lake Nabugabo Area, including several international projects. Lake Nabugabo has long been a popular leisure destination, attracting day-trippers and weekenders from Kampala, Masaka and other nearby towns, as well as international visitors. Tourism development commenced in the 1960s when conference centres were established on the lakeshore by the Anglican and Catholic churches, and today four beach resorts are in operation, with a number of additional facilities planned or under construction. In addition to food, drink and accommodation, a wide variety of nature-based activities are offered, such as swimming, boating, bird watching and hiking. The largest hotel, Sand Beach Resort, regularly organises events and entertainments such as motor rallies, boat regattas and concerts, which attract large numbers of visitors to the area during weekends and public holidays.

The wetland complex has major biodiversity and conservation significance. It is recorded as having the highest biodiversity ranking of 93 wetland sites surveyed by the Uganda Wetland Biodiversity Study, based on plants, dragonflies, birds and fish (RCS 2003). Nine species of indigenous fish of the family Cichlidae have been recorded in Lake Nabugabo and its satellites, including five endemic species of Haplochromis not recorded elsewhere in Uganda and two which are endemic only to Lake Victoria and Kyoga (Chapman et al. 2003). The Lake Nabugabo area has been designated by Birdlife International as an Important Bird and Biodiversity Area. It hosts five globally threatened bird species, and serves as a key stop-over/destination for migratory birds (Birdlife International 2014). It also supports an unusually high diversity of plants, with to 300 species recorded (WID 2004). Other fauna include Hippopotamus and Sitatunga, Vervet Monkeys are a common sight and troops of Black and White Colobus are found in small forest patches within the Ramsar site (NCDA 2014b).

The Ramsar Site contains numerous sites, species and habitats with cultural, aesthetic and emblematic importance. To a certain extent these values are reflected in the recreational, research and conservation interest that is associated with the area. A number of sites around the lakes have local cultural importance, and are used for traditional rituals

and ceremonies. There is also a shrine to the Catholic martyr St. Charles Lwanga located close to Lake Kayanja/Birinzi. It has been reported that a number of cultural taboos and restrictions associated with these traditional sites and belief systems have served to limit fishing pressure on Lake Nabugabo and its satellites, discourage destructive practices and instil a culture of respect for natural resources in the area (Lubuulwa 2005).

BASELINE BENEFITS AND BENEFICIARIES

WHAT IS THE CURRENT VALUE OF BIODIVERSITY AND ECOSYSTEM SERVICES?

The estimates of the current baseline value of biodiversity and ecosystem services in the Lake Nabugabo Complex refer to the original Ramsar Site, and the 5,500 households that live in the four Parishes that overlap it. All are expressed at 2014 US Dollar values. In order to account for inflation, a consumer price index deflator has been applied to price and value data that were generated in past years. Where benefit transfer techniques have been used, weights based on relative Purchasing Power Parity valuations of per capita Gross Domestic Product (GDP) have been applied to adjust for real price differences between Uganda and the country from which the transferred value is taken. Figures reflect the gross primary value of ecosystem services, and are based on the "wetlands-edge" price of raw, unprocessed products.

Not all ecosystem services in the Nabugabo area can be attributed wholly to the wetland. For example, some level of water supply, crop and livestock production values would be available even in the absence of natural habitats and species. To count the full amount of agricultural production and water consumption as a wetland ecosystem value would be an overestimate. The economic analysis therefore focuses only on the value-added to these activities by wetland products and services: on the fodder, grazing and water provided to livestock production, the soil fertility/moisture and natural pollinator/seed dispersal/pest control effects on crop productivity, and the enhanced maintenance of waterflow and quality for human consumption. In order to avoid double-counting, some ecosystem service categories are valued in combination. The benefit of wetland breeding/nursery habitats and refugia for fish and wildlife is taken to be reflected in the value of fisheries, nature-based tourism and trophy hunting activities. Due to the considerable ethical and data issues involved, most cultural, spiritual and other non-use values are not valued, except for those that are linked to tourism and recreation.

In total, it is estimated that Nabugabo Ramsar Site currently generates ecosystem services worth just under USD 4.6 million a year: an average of USD 333 per ha of wetland habitat (Table 2). Local harvests of wetland products and water regulation services each account for around a third of this value, while nature-based tourism contributes 17%, carbon sequestration 5% and underlying support to agricultural productivity 13% (Figure 5).

Ecosystem service	Total value for the Ramsar Site (USD mill/year)	Average habitat value (USD/ha/yr)
Capture fishery	0.20	54
Wood-based energy & timber	0.54	1,172
Non-wood/non-fish wetland products	0.82	60
Support to livestock production	0.17	18
Pollination, seed dispersal & pest control	0.41	205
Water storage & recharge	0.76	1,759
Regulation of water quality	0.54	1,256
Flood attenuation	0.07	164
Carbon storage & sequestration	0.25	24
Nature-based tourism	0.80	221
Total	4.55	333

Table 2: Baseline value of wetland ecosystem services in the original Ramsar Site, 2014

Note: habitat values refer to only those wetland habitat types that provide the ecosystem service in question, not to the entire Ramsar Site, and reflect the current ecosystem service value averaged across the entire area of that habitat.

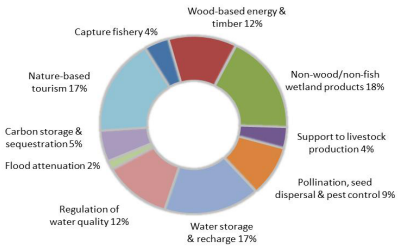


Figure 5: Composition of baseline value of wetland ecosystem services in the original Ramsar Site, 2014

The value of the capture fishery is calculated by looking at the 2013 catch recorded at Kituti, Luwafu and Kaziru landing sites for each of Nile perch, Tilapia, Mukene and Nkejje (as recorded in Masaka District Fisheries statistics). This translates into a total weight of 103.65 tonnes of fish, worth some USD 196,000 – an average value of USD 54/ha across the surface area of Lake Nabugabo.

The value of wood-based energy and timber considers firewood, polewood and other wood harvests by local households. Overall, some 77% of the population is recorded to depend on firewood as their primary source of domestic cooking fuel and 51% have houses which are constructed from poles or wood (UBOS 2002a, 2010). We assume that half of these products are obtained from non-farm areas of natural forest and woodland. Findings from other studies carried out in similar wetland and woodland areas of Eastern and Southern Africa are used to come up with average annual per household values for firewood, polewood and other timber of USD 165, USD 116 and USD 14 respectively (see Emerton 1999; Turpie 2000; Sjaastad et al. 2003; Turpie et al. 2006; Adekola et al. 2008; Kasthala et al. 2008; Akwetaireho et al. 2011; Kipkoech et al. 2011; Ngugi et al. 2011; Lokina et al. 2012; Kaatevo et al. 2014). This gives a total value of USD 0.54 million or an average value of USD 1,172/ha across all forest and woodland areas.

The value of non-wood/non-fish wetland products considers thatch, mulch, wild food, medicinal plants, papyrus, palms, reeds and honey (fodder and pasture are covered below under support to livestock production). Around a quarter of the population are recorded to live in thatched houses (UBOS 2002a). Other studies carried out in similar wetland and woodland areas of Eastern and Southern Africa suggest that around 10% of households utilise wetland grass for mulch, while between a fifth and a third harvest other forest and wetland products for home use and sale. Benefit transfer techniques are also used to calculated average annual per household values for thatch, mulch, wild food, medicinal plants, papyrus and palms/reeds of USD 149, USD 72, USD 46, USD 90, USD 171 and USD 79 respectively (from Emerton 1999; Emerton et al. 1999; Emerton and Muramira 1999; Turpie 2000;

Karanja et al. 2001; Sjaastad et al. 2003; Turpie et al. 2006; Kasthala et al. 2008; Lannas and Turpie 2009; Akwetaireho et al. 2011; Lokina et al. 2012; Kakuru et al. 2013; Kateyo et al. 2014). Just under 1% of local households are recorded as owning bee hives, producing around 700 kg of honey a year worth some USD 1,500 (UBOS 2010). Together, the value of all these non-wood/non-fish wetland products is calculated to total just under USD 822,000, or USD 60 per ha of wetland habitat.

The value of support to livestock production draws on the findings of studies carried out in similar sites in Eastern and Southern Africa which look at the contribution of wetland fodder, pasture and water to livestock production (see Emerton 1999; Emerton and Muramira 1999; Seyam et al. 2001; Sjaastad et al. 2003; Bush et al. 2004; Lannas and Turpie 2009; Ngugi et al. 2011; Kakuru et al. 2013; Katoey et al. 2014). These studies suggest that around a third of local cattle herds are grazed and watered in wetland areas on a seasonal or year-round basis, to an average annual value of USD 48 per livestock unit in terms of productivity effects and cost savings on purchased feeds. Applying these figures to the 6,000 indigenous cattle that are kept by households in the Ramsar Site translates into an annual value of USD 172,000 or USD 18 per ha of grassland.

The value of pollination, seed dispersal and pest control is calculated using a tool developed by FAO and INRA for assessing national vulnerabilities to insect pollinator declines (Gallai and Vaissière 2009). This provides dependence ratios which establish the share of crop value associated with insect pollination services. The analysis focuses on the major crops grown in the Nabugabo area (banana, coffee, maize, beans, cassava, sweet potatoes and vegetables). The FAO/INRA tool is applied to the approximately 2,000 ha of land under crops in the Ramsar site, giving a gross value of USD 410,000 or an average of USD 205/ha.

The value of water storage and recharge transfers the findings of studies carried out in similar sites in Uganda which look at the saved costs of replacing wetland water sources with borehole water (see Akwetaireho 2013; Kakuru et al. 2013; Kateyo et al. 2014). This gives an average figure of USD 645/household/year, which is applied only to water for

human consumption (livestock and crop water are already reflected in other wetland ecosystem service estimates). A total of just under 890 households regularly travel more than 1 km to fetch water and are assumed to rely on the lake and associated wetlands for part or all of their domestic supplies, while a quarter of the 1,200 households who have access to water within half and one kilometre of their premises are assumed to collect water from the lake in the dry season. This translates into an annual value of USD 760,000 USD 1,759/ha of wetland habitat.

The value of regulation of water quality applies the findings of studies carried out in similar sites in East and Southern Africa which look at the avoided replacement costs and mitigative expenditures associated with the water treatment services provided by natural wetlands (see Emerton et al. 1999; Karanja et al. 2001; Turpie et al. 2010; Simonit and Perrings 2011; Wasswa et al. 2013). This gives an average value of USD 1,256/ha, which is applied to the approximately 430 ha of swamp and wetland areas which fringe Lake Nakivubo and its satellites. This translates to an annual value for the Ramsar site of USD 0.54 million.

The value of flood attenuation is calculated based on the findings of studies carried out in similar sites in Uganda which look at the avoided damage costs and mitigative expenditures associated with the flood control services provided by natural wetlands (see Kakuru et al. 2013; Wasswa et al. 2013). This gives an average value of USD 164/ha, which is applied to the approximately 430 ha of swamp and wetland areas which fringe Lake Nakivubo and its satellites. This translates to an annual value for the Ramsar site of just over USD 70,000.

The value of carbon storage and sequestration applies annual sequestration rates for different wetland vegetation classes, based on the findings of research carried out at similar sites in Uganda and elsewhere. These studies yield estimates of above and below-ground carbon storage ranging between 0.4-0.9 tC/ha/year for woodland, swamp forest and bush areas, 0.84 tC/ha/year for floodplains, 1.29 tC/ha/year for seasonally-flooded grasslands and 4.8 tC/ha/year for papyrus swamps (see Stromgaard 1985; Saunders et al. 2007; William's et al. 2008; Mitsch et al. 2012; Chidumayo 2013; LTS 2013a,b; Lupala

et al. 2014). It should be noted that no data were available with which to calculate avoided emissions, which are likely to be substantial. Carbon is valued according to the prevailing voluntary carbon market price of USD 7.03/tCO_2e for issued credits from Climate, Community and Biodiversity Standard (CCBA), Verified Carbon Standard (VCS) and Reduced Emissions from Deforestation and Forest Degradation (REDD+) projects, using a factor of 3.67 to convert between tC and tCO_2e. This gives an annual value of just over USD 245,000 or an average of USD 24/ha for the entire Ramsar site (excluding open water areas).

The value of nature-based tourism reflects the value-added to the economy from visitor spending. There are approximately one hundred beds available in Lake Nabugabo resorts, and space for half this number of tents. Based on the average occupancy rate of 20% recorded for budget tourist standard establishments outside Kampala (Thomas et al. 2011; Weiss and Messerli 2012), this equates to just under 11,000 visitor nights spent in the Ramsar Site each year. It is assumed that an additional 5,000 visitors a year travel on day-trips or to attend the special entertainment events that are held at the Lake, half of whom stay overnight. This translates into annual spending of just under USD 740,000 on transport, entry fees, accommodation, meals and drinks, calculated at prevailing prices. It should be noted that this value only accounts for visitors to Lake Nabugabo beach resorts. It excludes day-visitors who do not eat or stay around the Lake (for example bird watchers or other visitors who make a stopover at Nabugabo en route to other destinations). Half of the expenditures made on trophy hunting Hippopotamus and Sitatunga in neighbouring Sango Bay (Rakai/Masaka Districts) are attributed to the Ramsar Site (these two species rely at least partly on habitat provided by the wetland complex). Taking account of various fees, charges and safari costs, this translates into annual spending of just over USD 55,000.

ECONOMIC CONSEQUENCES OF ECOSYSTEM CHANGE

WHAT IS THE COST OF WETLAND DEGRADATION AND LOSS?

In order to assess the economic consequences of ecosystem change, two possible policy and management scenarios for the Lake Nabugabo Complex are considered. One is "business as usual (BAU)", under which wetland species and habitats outside the current Ramsar Site continue to be converted, degraded and over-exploited. The other is the "Conservation Investment Plan (CIP)" scenario under which the Ramsar Site is extended, used wisely and conserved effectively. The analysis focuses on the area of 777 km^2 that has been proposed as an extended Ramsar Site area (i.e. the existing 220 km^2 original Ramsar Site plus the 557 km^2 extension area), and the 42,000 households that live in the 38 Parishes that overlap it.

First of all, the value of ecosystem services in the "extension area" (i.e. the difference between the original and extended Ramsar Sites) is calculated and added to the current baseline value (see above, Chapter 0). As well as accounting for the increased human population (and thus higher use rates) and expanded area of wetland habitats, two additional elements are included:

- The value of fisheries production in Katonga wetlands (a key habitat which incorporated into the extended Ramsar Site) is calculated based on the data on household participation and average income from fishing given in Kateyo et al. 2014. These figures are applied to the population of the 11 Parishes in the Ramsar Site that overlap the Katonga wetlands.

- The value of soil fertility and moisture for wetland cultivation is also included (no wetland cultivation is recorded in the existing Ramsar site). This uses the findings of studies carried out in other sites in Uganda which look at the additional production possibilities and saved expenditures on artificial fertilisers associated with wetland cultivation as compared to rainfed farming (see Emerton et al. 1999; Karanja et al. 2001; Akwetaireho 2009). The average value

of USD 443/ha is applied to the 184 ha of wetland cultivation that is recorded as taking place in the extended Ramsar Site.

The value of ecosystem services in the "extension area" is calculated at USD 39.46 million, bringing the total baseline value of the extended Ramsar Site to a figure of just over USD 44 million, or USD 566/ha (Table 2).

Ecosystem service	Original Ramsar Site (USD mill/ year)	Extension Area (USD mill/year)	Total extended Ramsar Site (USD mill/ year)	Average habitat value (USD/ha/yr)
Capture fishery	0.20	10.25	10.45	383
Wood-based energy & timber	0.54	2.78	3.31	253
Non-wood/non-fish wetland products	0.82	5.20	6.02	78
Support to livestock production	0.17	1.86	2.04	38
Soil fertility & moisture	-	0.08	0.08	443
Pollination, seed dispersal & pest control	0.41	1.91	2.32	111
Water storage & recharge	0.76	9.15	9.91	2,313
Regulation of water quality	0.54	4.84	5.38	1,256
Flood attenuation	0.07	0.63	0.70	164
Carbon storage & sequestration	0.25	2.77	3.01	39
Nature-based tourism	0.80	-	0.80	221
Total	4.55	39.46	44.01	566

Table 3: Baseline value of wetland ecosystem services in the extended Ramsar Site, 2014

Note: habitat values refer to only those wetland habitat types that provide the ecosystem service in question, not to the entire Ramsar Site, and reflect the current ecosystem service value averaged across the entire area of that habitat.

This ecosystem value baseline for the extended Ramsar Site serves as the as the reference case against which both the economic benefits provided by healthy and extended wetland ecosystems (under the CIP scenario) and the economic losses/damages resulting from the loss of these services (under BAU) are measured. The economic analysis looks at the incremental costs and benefits arising from wetland ecosystem

change, over and above (extended) baseline. It equates the CIP to a continuation of this current situation – in other words, it is assumed that, at a minimum, the CIP will serve to address current threats and there will be no further degradation of wetland ecosystems. This assumption is made because, as the CIP has not yet been prepared, it is not known which specific policies, measures and management activities are envisaged, or what improvements in wetland biodiversity and ecosystem status and integrity are anticipated. In the absence of such information, it is not possible to model the CIP scenario in any detail. In reality, it is of course to be hoped that the CIP will actually serve to improve the status of biodiversity and ecosystems. Once the CIP is actually developed, these indicators and targets can be incorporated into the economic model.

The BAU and CIP scenarios are modelled over a 25-year period. So as to account for changes in the quality, as well as area, of wetland habitats, the unit value of ecosystem services is assumed to decline by 0.25% a year. A 10% discount rate is applied to future costs and benefits, reflecting the prevailing opportunity cost of capital in Uganda. All factors other than habitat loss and change in Ramsar Site boundaries (and their impact on ecosystem values) are held constant. It is important to emphasise that, while this type of simplified economic model and ceteris paribus assumptions are justifiable given the time and data constraints facing the current study, they represent a considerable oversimplification of the actual situation.

The changes in land use and land cover that will take place under BAU are modelled by projecting past trends of land use change into the future. These changes are applied to the extension area only: it is assumed that, even under BAU, the current Ramsar Site will continue to be conserved and used wisely. Average annual rates of land use change recorded for different categories of wetland habitats in the Lake Victoria between 1994-2008 are used (as presented in NEMA 2010). To account for variation in the rate of habitat degradation and conversion over time, and to reflect for threshold effects, a curvilinear trajectory of change is assumed. Applying these projections suggests that, if current

trends continue, wetland cover across the extended Ramsar Site area will have reduced to 274 km^2 by 2039: an annual average loss of just over 4% (Figure 6).

Wetland cover type	Baseline area (km^2)	Area in 2039 (km^2)	Average annual loss
Woodlands & swamp forest	111	31	- 5.35%
Bush, palms & thicket	20	3	- 8.16%
Papyrus	111	26	- 5.60%
Grassland	534	213	- 5.16%
Wetland cultivation	2	1	- 4.50%
Total	777	274	- 4.08%

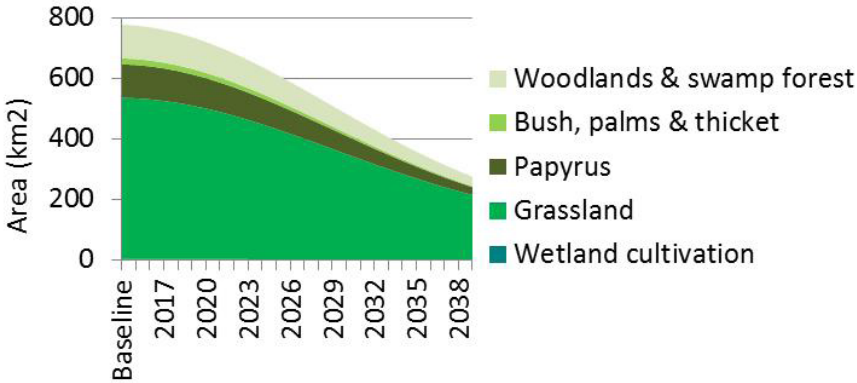


Figure 6: Change in wetland cover in extended Ramsar Site under BAU, 2014-39

Source: Baseline wetland cover areas from Wetlands Management Department; projections of land use change taken from NEMA 2010.

Under BAU, the gradual depletion, degradation and conversion of natural habitats will lead to a continuing decline in the value of wetland ecosystem services. Wetland values in the extended Ramsar Site area will fall to less than half their current levels over the next 24 years: from a baseline value of USD 44.55 million to just over USD 20 million by 2039 (Figure 7). Without additional action to enhance wetland conservation and wise use, it is therefore estimated that ecosystem services worth over USD 280 million will be lost over the next 25 years, with a net present cost of some USD 54 million (Table 4).

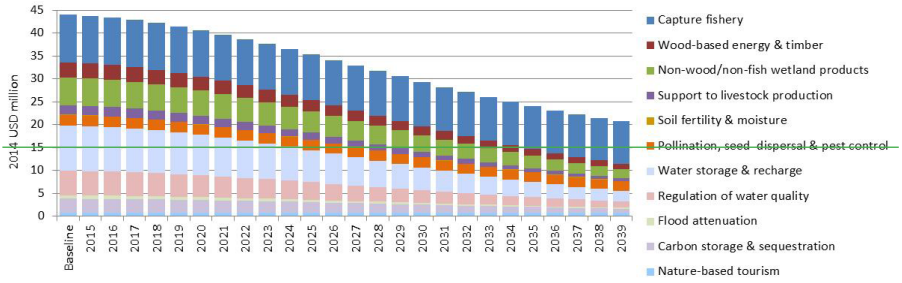


Figure 7: Change in wetland values in extended Ramsar Site under BAU, 2014-39

Ecosystem service	Baseline value (USD million)	2039 value (USD million)	Total cost over 25 years (USD million)	Net present cost (USD million)
Capture fishery	10.45	9.24	-15.99	-3.47
Wood-based energy & timber	3.31	1.14	-25.71	-4.90
Non-wood/non-fish wet-land products	6.02	2.07	-46.11	-8.73
Support to livestock production	2.04	0.64	-16.19	-3.06
Soil fertility & moisture	0.08	0.02	-0.64	-0.12
Pollination, seed dispersal & pest control	2.32	2.09	-2.97	-0.64
Water storage & recharge			9.91 2.32 -93.19	-17.99
Regulation of water quality	5.38	1.37	-49.28	-9.51
Flood attenuation	0.70	0.18	-6.45	-1.24
Carbon storage & sequestration	3.01	0.91	-24.54	-4.64
Nature-based tourism	0.80	0.75	-0.63	-0.14
Total	44.01	20.73	-281.73	-54.45

Table 4: Cost of ecosystem service value loss under BAU, 2014-39

CIP ECONOMIC JUSTIFICATION

WHAT IS THE VALUE-ADDED FROM INVESTING IN ENHANCED WETLAND CONSERVATION AND WISE USE?

The rapid economic assessment makes it clear that Nabugabo's wetland species and habitats make a substantial contribution to local, national and even global economies. They currently provide a source of products for subsistence and income for a large proportion of the 22,500 people that live in and beside the Ramsar Site, to an estimated annual value of around USD 1.75 million. The wetland regulating services that enable, protect and enhance human settlement and agricultural production are estimated to be worth an additional USD 1.8 million a year for wetland households. In total, Nabugabo generates goods and services worth an average of USD 200 a year for every member of the local population: a value that is equivalent to almost a third of Uganda's current GDP per capita. Meanwhile, the climate mitigation and recreational values that accrue to the larger national and international community are estimated to be worth more than USD1 million a year.

Undertaking the investments and activities that are required to improve the status of Lake Nabugabo Wetland Complex, have the potential to increase these values still further – from the current USD 4.55 million or USD 333/ha/year to more than USD 44 million or USD 566/ha/year (Table 5). The extended Ramsar Site would also serve to secure economically-important wetland resources for an additional 167,000 local stakeholders. Many of these goods and services are unavailable or unaffordable elsewhere for the wetland-adjacent human population, almost a quarter of which is categorised as living below the poverty line (Mpigi District Local Government 2009; Masaka District Local Government 2012).

	Total value (USD mill/year)	Average habitat value (USD/ha/yr)
Current Ramsar Site	4.558	333
Extended Ramsar Site	44.01	566

Table 5: Baseline ecosystem values in the original and extended Ramsar Sites, 2014

A comparison of wetland ecosystem service values under Business as Usual and conservation/wise use scenarios underlines the high economic costs, losses and damages that will likely arise from failing to take action to halt biodiversity loss and ecosystem degradation in the Lake Nabugabo Complex. It also presents a strong economic argument for investing in the CIP. The value-added and costs avoided from the CIP are substantial. This is the case even under the very conservative or minimal scenario modelled in the current study (that the CIP will serve only to halt any further degradation of wetland species and habitats). As mentioned above, it is to be hoped that the CIP would in reality serve to improve the status – and thus economic value – of marine and coastal ecosystems considerably above the current baseline.

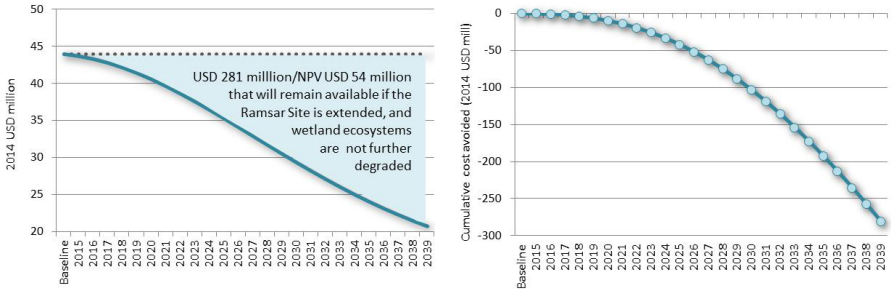


Figure 8: Value-added by the extended Ramsar Site and PIN activities, 2014-39

The economic assessment shows that extending the boundaries of the Ramsar Site and undertaking the activities and investments laid out in the CIP stands to safeguard more than USD 281 million of ecosystem service values over the next 25 years (Figure 8). These economic benefits will remain available if wetland resources and habitats are not further degraded, but would be lost if action is not undertaken to maintain and enhance wetland conservation and wise use. This value-added and cost avoided is apparent across the different categories of ecosystem service provided by Lake Nabugabo Wetland Complex (Figure 9).

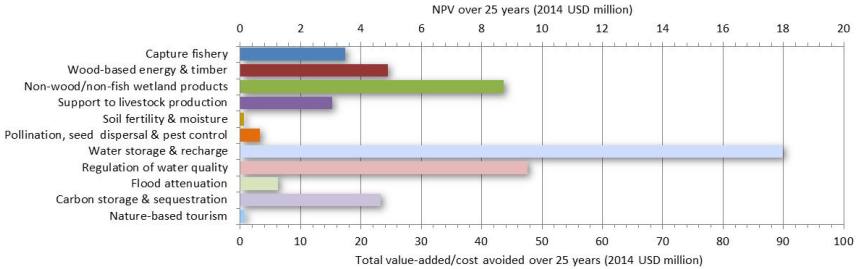


Figure 9: Value-added by the extended Ramsar Site, 2014-39

REFERENCES

Adekola, O., S. Moradet, R. de Groot and F. Grelot (2008) The economic and livelihood value of provisioning services of Ga-Mampa wetland, South Africa. In: 13th IWRA World Water congress, 1 - 4 September, 2008, Montpellier, France.

Akwetaireho, S. (2009) Economic Valuation of Mabamba Bay Wetland System of International Importance, Wakiso District, Uganda. Alps-Adriatic University of Klagenfurt.

Akwetaireho, S., Akugizibwe, T. and Plumptre, A. (2011) Socio-economic values of corridor forests in the Albertine Rift forests of the Murchison-Semliki landscape. Wildlife Conservation Society, Kampala.

Bauer, D. and I. Wing. 2010. Economic consequences of pollinator declines: a synthesis. Agricultural and Resource Economics Review 39(3): 368-383.

Bikangaga, S., Picchi, M., Focardi, S. and Rossi, C. (2007) Perceived benefits of littoral wetlands in Uganda: a focus on the Nabugabo wetlands. Wetlands Ecology and Management 15: 529-535.

BirdLife International (2014) Important Bird Areas factsheet: Nabugabo wetland. Downloaded from http://www.birdlife.org on 20/10/2014

Bush, G., Nampindo, S., Aguti, C., Plumptre, A. (2004) The value of Uganda's forests. a livelihoods and ecosystems approach. Wildlife Conservation Society, Albertine Rift Programme, EU Forest Resources Management and Conservation Programme & National Forest Authority, Kampala.

Chapman, L., Chapman, C., Ogothu-Ohwayo, R., Chandler, M., Kaufman, L. and Keiter, A. (1996) Refugia for Endangered Fishes from an Introduced Predator in Lake Nabugabo, Uganda. Conservation Biology 10(2): 554-561.

Chapman, L., Chapman, C., Schofield, P., Olowo, J., Kaufman, L., Seehausen, O. and Ogutu-Ohwayo, R. (2003) Fish Faunal Resurgence in Lake Nabugabo, East Africa. Conservation Biology 17(2): 500-511.

Chidumayo, E. (2013) Estimating tree biomass and changes in root biomass following clear-cutting of Brachystegia-Julbernardia (miombo) woodland in central Zambia. Environmental Conservation 41(1): 54-63.

Egeru, A., Kateregga, E., Jackson, G. and Majaliwa, M. (2014) Coping with Firewood Scarcity in Soroti District of Eastern Uganda. Open Journal of Forestry 4(1): 70-74.

Emerton, L. (1999) Balancing the Opportunity Costs of Wildlife Conservation for Communities Around Lake Mburo National Park, Uganda. Evaluating Eden Series Discussion Paper No. 5, International Institute for Environment and Development (IIED), London.

Emerton, L. and Muramira, E. (1999) Uganda Biodiversity: Economic Assessment. National Environment Management Authority, Kampala.

Emerton, L., Iyango, L., Luwum, P., and Malinga, A. (1999) The Economic Value of Nakivubo Urban Wetland, Uganda. Uganda National Wetlands Programme, Kampala and IUCN — The World Conservation Union, Eastern Africa Regional Office, Nairobi

Gallai, N. and Vaissière, B. (2009) Guidelines for the economic valuation of pollination services at a national scale. Food and Agriculture Organization of the United Nations (FAO), Rome.

Kakuru, W., Turyahabwe, N. and Mugisha, J. (2013) Total Economic Value of Wetlands Products and Services in Uganda. The Scientific World Journal vol. 2013.

Kansiime, F. and Nalubega, M. (1999) Wastewater Treatment by a Natural Wetland: The Nakivubo Swamp, Uganda. Processes and Implications. Doctoral Dissertation, Wageningen Agricultural University.

Karanja, F., Emerton, L., Mafumbo, J. and Kakuru, W. (2001) Assessment of the economic value of Pallisa District Wetlands, Uganda. IUCN Eastern Africa Regional Office, Nairobi.

Kasthala, G., Hepelwa, A., Hamiss, H., Kwayu, E., Emerton, L., Springate-Baginski, O., Allen, D., and W. Darwall (2008) An integrated assessment of the biodiversity, livelihood and economic value of wetlands in Mtanza-Msona Village, Tanzania. Tanzania Country Office, International Union for Conservation of Nature (IUCN) Tanzania Country Office, Dar es Salaam.

Kateyo, E., Nsereko, P. and Kansiime, F. (2014) Contribution of Wetland Resources to Household Incomes of Riparian Communities of Katonga Wetland in Mpigi District, Uganda. International Journal of Sciences: Basic and Applied Research 13(1): 274-286.

Kipkoech, A., Mogaka, H., Cheboiywo and Kimaro, D. (2011) The Total Economic Value of Maasai Mau, Trans Mara and Eastern Mau Forest Blocks, of the Mau Forest, Kenya. Lake Victoria Basin Commission Secretariat, Kisumu.

Kiwazi, F., Iyango, L., Kakuru, W. and Tinamanyire, T. (2004) Economic valuation of Lake Nabugabo system wetlands and possible management scenarios. Wetland Inspection Division, Ministry of Water, Lands and Environment, Kampala.

Lannas, K. and Turpie, J. (2009) Valuing the Provisioning Services of Wetlands: Contrasting a Rural Wetland in Lesotho with a Peri-Urban Wetland in South Africa. Ecology and Society 14(2): 18

Lokina, R., Mduma, J., Mkenda, A., Hepelwa, A. and Ngasamiaku, W. (2012) Economic Valuation of Ihefu Wetland: Poverty and Environment Linkages. UNEP/UNDP Poverty and Environment Initiative, Dar es Salaam.

Losey. J. and M. Vaughan. 2006. The economic value of ecological services provided by insects. BioScience 56(4): 311-323.

LTS (2013a) Above-ground Biomass Assessment. Scenario Analysis Technical Annex 4a. Integrated Assessment of Land Use Options in Malawi. Submitted to the World Bank and Government of Malawi by LTS International, HYDROC Consult, Bunda College of Agriculture, the University of Edinburgh and the Centre for Development Management.; LTS (2013b) Soil Carbon Assessments. Scenario Analysis Technical Annex 8. Integrated Assessment of Land Use Options in Malawi. Submitted to the World Bank and Government of Malawi by LTS International, HYDROC Consult, Bunda College of Agriculture, the University of Edinburgh and the Centre for Development Management.

Lubuulwa, M. (2005) The role of social, economic and cultural factors in the management of satellite lake fisheries in Uganda. LVEMP Socio-Economic Research Report 8., NARO-FIRRI, Jinja.

Lupala, Z., Lusambo, L. and Ngaga, Y. (2014) Management, Growth, and Carbon Storage in Miombo Woodlands of Tanzania. International Journal of Forestry Research http://dx.doi.org/10.1155/2014/629317"

MAAIF (2010a) Livestock Census Report 2008. Ministry of Agriculture, Animal Industry and Fisheries, Entebbe and Uganda Bureau of Statistics, Kampala

MAAIF (2010b) Uganda Census of Agriculture 2008/09. Volume III: Agricultural Household and Holding Characteristics Report. Ministry of Agriculture, Animal Industry and Fisheries, Entebbe and Uganda Bureau of Statistics, Kampala

Masaka District Local Government (2012) Masaka District Statistical Abstract 2012. Masaka District Local Government, Masaka.

Mitsch, W., Bernal, B., Nahlik, A., Mander, U., Zhang, L., Anderson, C., Jorgensen, S. and Brix, H. (2012) Wetlands, carbon, and climate change. Landscape Ecology DOI 10.1007/s10980-012-9758-8.

Mpigi District Local Government (2009) Mpigi District Statistical Abstract 2009. Mpigi District Local Government, Masaka.

NCDA (2014a) Health Matters at Nabugabo: A Discussion Document. Nabugabo Community Development Association, Bbale Village.

NCDA (2014b) The Lake Nabugabo Ramsar Site. Nabugabo Community Development Association, Bbale Village.

NEMA (2009) Uganda: Atlas of Our Changing Environment. National Environment Management Authority, Kampala.

Ngugi, G., Newton, L. and Muasya, A. (2011) The contribution of forest products to dryland household economy: The case of Kiang'ombe hill forest, Kenya. Ethnobotany Research and Applications. 9: 163–180.

Okut-Okumu, J. (2010) Seasonal physicochemical variation in the Nabugabo wetland. Int. J. Biol. Chem. Sci. 4(6): 2035-2045.

RCS (2003). Information Sheet on Ramsar Wetlands (RIS): Lake Nabugabo wetland system. Ramsar Convention Secretariat, Gland.

Saunders M., Jones M. and Kansiime, F. (2007) Carbon and water cycles in tropical papyrus wetlands. Wetlands Ecology and Management 15:489–498.

Seyam, I.M., A.Y. Hoekstra, G.S. Ngabirano and H.H.G. Savenije (2001) The value of freshwater wetlands in the Zambezi basin. Value of Water Research Report Series No. 7, IHE Delft, The Netherlands.

Simonit, S. and Perrings, C. (2011) Sustainability and the value of the 'regulating' services: Wetlands and water quality in Lake Victoria. Ecological Economics 70: 1189–1199.

Sjaastad, E., Chamshama, S., Magnussen, K., Monela, G., Ngaga, Y and Vedeld, P. (2003) Resource economic analysis of catchment forest reserves in Tanzania. Report to Ministry of Natural Resources

and Tourism. Forestry and Beekeeping. Division. Dar es Salaam, Tanzania.

Stromgaard, P. (1985) Biomass, growth, and burning of woodland in a shifting cultivation area of South Central Africa. Forest Ecology and Management 12(3-4): 163–178.

Thomas, F., Barya, G. and Kaongole, C. (2011) Uganda Inclusive Tourism. Opportunity Study, Inclusive Tourism Programme, International Trade Centre, Geneva.

Turpie, J. (2000) The Use and Value of Natural Resources of the Rufiji Floodplain and Delta, Tanzania. REMP Technical Report 17, Rufiji Environment Management Project, Dar es Salaam.

Turpie, J., Barnes, J., Arntzen, J., Nherera, B., Lange, G. and Buzwani, B. (2006) Economic value of the Okavango Delta, Botswana, and implications for management. IUCN Southern Africa Regional Office, Harare.

Turpie, J., Day, E.,l Ross-Gillespie, V. and Louw, A. (2010) Estimation of the Water Quality Amelioration Value of Wetlands A Case Study of the Western Cape, South Africa. Environment for Development Discussion Paper Series EfD DP 10-15, University of Gothenburg and Resources for the Future in Washington DC.

UBOS (2002a) 2002 Uganda Population and Housing Census. Uganda Bureau of Statistics, Kampala.

UBOS (2002b) Uganda Parish Location - Admin Level 6. Open Data for the Horn based on data provided by Ugandan Bureau of Statistics (UBOS), http://horn.rcmrd.org/layers/geonode:uganda_parish_2010 accessed 25 November 2014.

UBOS (2010a) Uganda National Household Survey 2009/2010. Uganda Bureau of Statistics, Kampala.

UBOS (2010b) Uganda Parish Location - Admin Level 6. Open Data for the Horn based on data provided by Uganda Bureau of Statistics,

http://horn.rcmrd.org/layers/geonode:uganda_parish_2010 accessed 25 November 2014.

Vaccaro, I., Chapman, C., Nyboer, E., Luke, M., Byekwaso, A., Morgan, C., Mbabazi, D., Twinomugisha, D. and Chapman, L. (2013) An interdisciplinary method to harmonise ecology, economy and co-management: fisheries exploitation in Lake Nabugabo, Uganda. African Journal of Aquatic Science 38 (Suppl.): 97–104

Wasswa, H., Mugagga, F. and Kakembo, V. (2013) Economic Implications of Wetland Conversion to Local People's Livelihoods: The Case of Kampala- Mukono Corridor (KMC) Wetlands in Uganda. Academia Journal of Environmental Sciences 1(4): 66-77.

Weiss, B. and Messerli, H. (2012) Uganda Tourism Sector Situational Assessment. The World Bank, Kampala; UBOS (2010) Migration and Tourism Report Volume VI. Uganda Bureau of Statistics, Kampala.

WID (2004) Lake Nabugabo Wetland Management Plan Wetland Inspection Division, Ministry of Water, Lands and Environment, Kampala.

Williams, M., Ryan, C., Rees, R., Sambane, E., Fernando, J. and Grace, J. (2008) Carbon sequestration and biodiversity of re-growing miombo woodlands in Mozambique. Forest Ecology and Management 254(2): 145-155.

Kanabahita , C. (2001) FOSA Country Report -Uganda. Forestry Outlook Studies in Africa. (FOSA), Food and Agriculture Organisation of the United Nations (FAO), Rome.

Aryamanya-Mugisha, H. (2011) 20 years of Wetlands Conservation in Uganda - Have Uganda's Wetlands become Wastelands Again? Paper presented at World Wetlands Day Public Talk at Uganda Museum, Kampala.

FAO (2010) Global Forest Resources Assessment 2010: Country Report Uganda. FRA2010/218, Forestry Department, Food and Agriculture Organization of the United Nations, Rome.