CASE STUDIES IN WETLAND VALUATION #7: May 2003

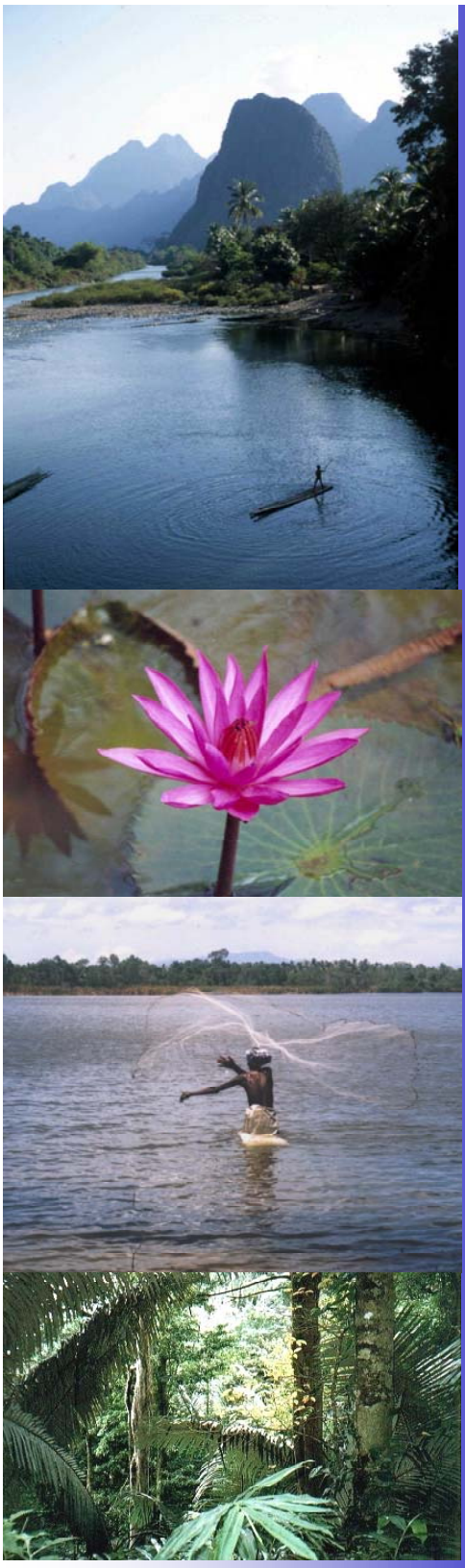
NAKIVUBO SWAMP, UGANDA: managing natural wetlands for their ecosystem services

Planning for urban development in Uganda

Wetlands in Uganda cover some 30,000 km², or about 13% of the country (Government of Uganda 2001). Although almost all of the wetlands in the country are under threat in some way, those located in towns and cities face the perhaps the most intense pressures. Over the last decade Uganda has entered a period of rapid economic growth, rehabilitation and urban expansion. Already over 14% of the country's inhabitants live in cities, and urban populations are increasing at a rate of more than 5% a year – almost twice the average in rural areas (UN-HABITAT 1999). There is a growing demand for housing and land for settlement, rapid construction is taking place, and industrial and commercial activities are increasing. To date, most of these developments have been implemented in the absence of proper planning and controls, and have involved wetland drainage and reclamation (NEMA 1996).

Slowly, ways of carrying out urban planning are beginning to change. The Wetlands Inspection Division of the Uganda Ministry of Water, Lands and Environment – the national government agency mandated with wetlands management in Uganda – has started to work closely with urban planners.

For one of the first times in Eastern Africa, valuation is being used to give a more complete picture of the economic desirability – and long-term viability – of reclaiming wetlands as part of urban development programmes, and to point to ways of managing them as an integrated component of city landscapes and services.



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Integrating Wetland Economic Values into River Basin Management

This case study describes a pilot study carried out in Nakivubo Swamp in Kampala, Uganda's capital city, which focused on the economic value of wetland wastewater purification and nutrient retention functions. The study made the point that, contrary to the dominant development imperative, residential and industrial development in Kampala's wetlands does not necessarily make good economic sense, and cannot be based only on consideration of immediate financial gain. These expectations of private profits also have to be balanced against the broader social and economic costs which arise from urban wetland degradation and loss.

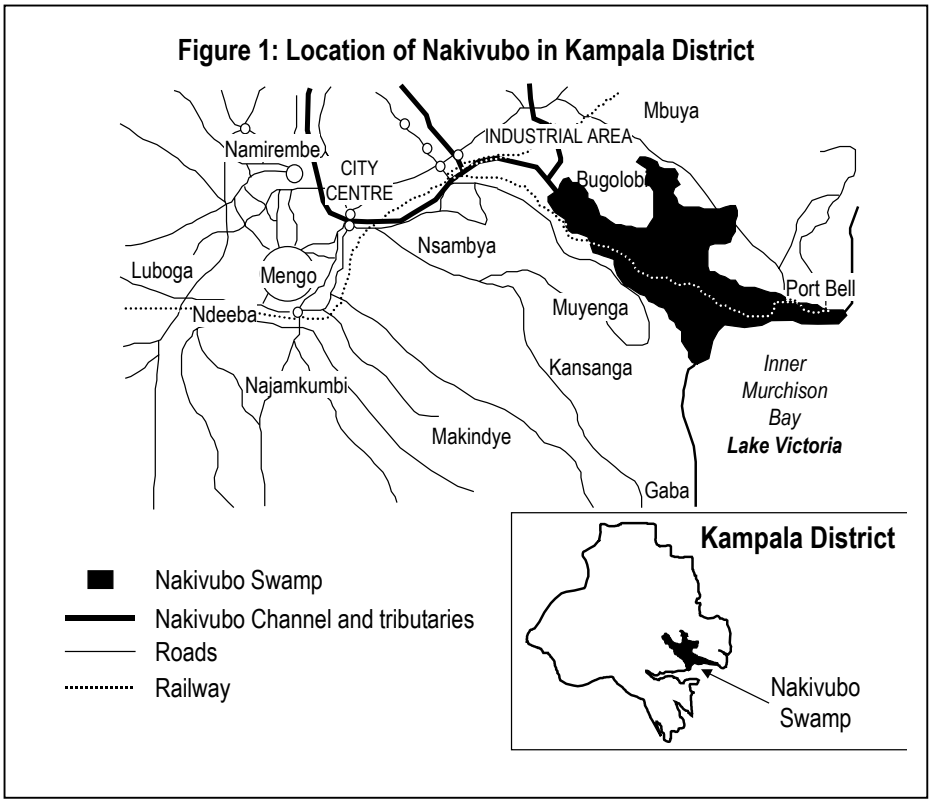
Nakivubo Swamp

Almost one sixth of Kampala, or 31 km², is covered by wetlands (Mafabi *et al* 1998). Despite the designation of most of the city's wetlands as "green corridors" in the 1994 Kampala Structural Plan, many have been zoned for urban expansion and development and have either been converted to industrial uses or have gradually been taken over by settlement (Government of Uganda 2001). Today it is estimated that about three quarters of the city's wetlands have been affected by human activities to a significant level, and up to 14% are seriously degraded (Muramira and Emerton 1999). If current trends continue, there is a real danger that Kampala's wetlands will soon be modified and converted completely.

Of the twelve main wetland areas of the city, Nakivubo Swamp is the largest. Covering a surface area of 5.29 km², it has a total catchment extending over 40 km². The wetland is fed by the Nakivubo River and its tributaries the Katunga, Kitante, Lugogo and Nakulabye. It is dominated by papyrus (*Cyperus papyrus*) grading to dry land through cat tails (*Typha sp.*) and common reeds (*Phragmites sp.*), with a large area on the north east side covered by *Miscanthidium* grass. The wetland is bisected by a railway line, running from the city to Port Bell on the shore of Lake Victoria. This effectively divides it into two zones of human influence. While wetland areas to the south of the railway are still relatively intact, northern parts have been modified substantially. Much of the shallow upper zone has been reclaimed for settlement and industrial development, or is under cultivation. The deeper, lower zone below the railway line comprises a floating papyrus swamp, and contains only a small amount of cultivation on its fringes.

The wetland runs from the central industrial district of Kampala, passing through dense residential and industrial settlements before entering Lake Victoria at Murchison Bay (Figure 1). More than 100,000 people live on the fringes of the wetland, including both high cost housing estates and low-cost, high-density settlements and slums. To the north of the wetland, Kampala's main industrial area

Figure 1: Location of Nakivubo in Kampala District



contains more than 200 large, medium and small-scale enterprises. These include breweries, soft drink manufacturers, distillers, oil and soap factories, dairy producers, abattoirs and meat processors, fish processors, paint producers, tanneries, bakeries, metal works and garages, plastic and foam industries, saw mills, battery manufacturers, pharmaceutical industries, shoe makers and paper makers. Although like most wetlands in Kampala Nakivubo has been subjected to a gradual process of conversion and reclamation, it currently faces some of the most extreme threats and pressures. The area around Nakivubo, including the wetland itself, are regarded as prime sites for urban development – due to their proximity to the city centre and industrial district, as a result of land shortage in the city, and because land prices are still relatively cheap as compared to other parts of Kampala.

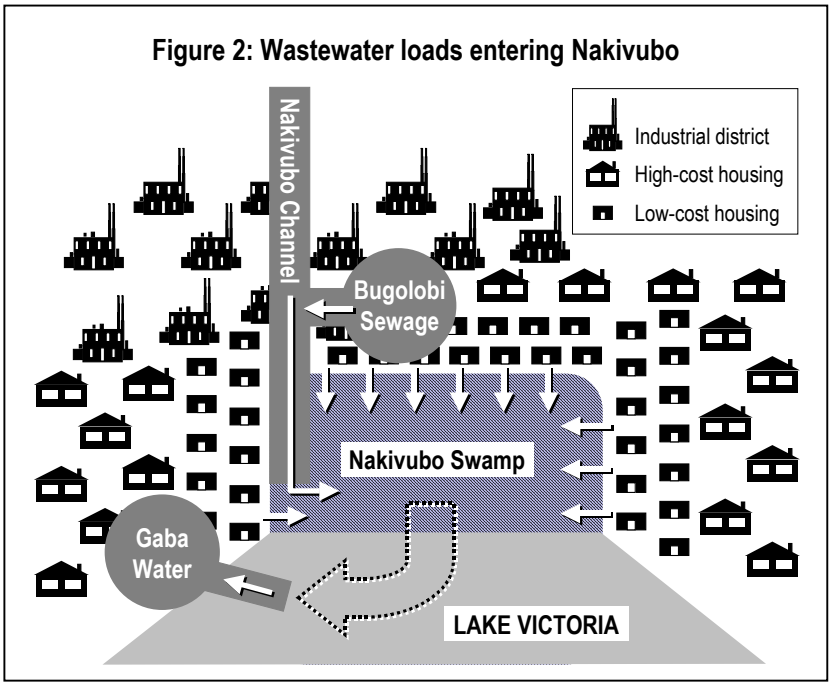
The role of the wetland in wastewater purification and nutrient retention

Nakivubo's characteristics and location means that it provides a unique and important set of services to Kampala's dwellers. It functions as a buffer through which much of the city's industrial and domestic wastewaters pass before being discharged into Lake Victoria at Murchison Bay (Figure 2). The Nakivubo River and its tributaries, which flow into the wetland, provide the main drainage channel for Kampala. They carry wastewater from the city centre, industrial area, and residential zones. Up to 90% of Kampala's residents are not connected to a piped sewerage supply and so these wastes are largely organic. Together they are equivalent to the raw sewage produced by almost half a million people – or 40% of the population of Kampala (COWI/VKI 1998). The outflow for Kampala's sewage treatment works, at Bugolobi, also runs into the wetland. Partially treated sewage is mixed with the untreated effluents already in the Nakivubo Channel before entering the wetland, where it contributes about 7% of the total nutrient load, equivalent to an additional flow of sewage from about 7,000 persons (COWI/VKI 1998).

The majority of the low-cost residential settlements abutting Nakivubo are excluded from the municipal sewerage system. More than 33,000 persons discharge domestic wastes into the wetland, either as runoff into the surface waters which enter it or through groundwater inflows from the infiltration of rainfall on hills beside the swamp, from pit latrines, septic tanks, soak pits and leaking waste pipes. At least three other point sources of wastes enter southern parts of the wetland directly, including effluents from Uganda Breweries and two sewage outflows from Luzira Prison. Nakivubo Swamp also receives industrial effluents. Up to a third of the enterprises in the industrial area have no treatment facilities, and so dispose of their wastes directly into the wetland. Effluents and pollutants contained in these untreated wastewaters, and in the industrial wastewaters which have passed through Bugolobi sewage treatment works, include detergents, lubricants, oils, acids, xenobiotics, nitrates, phosphates and heavy metals such as zinc and mercury.

At the same time, the intake for all of Kampala's piped water supply is located at Gaba, some 3 km to the south west of the

Figure 2: Wastewater loads entering Nakivubo



wetland's outflow into Murchison Bay. Nakivubo plays a significant role in maintaining the quality of both the city's water supply and the open waters of the Murchison Bay part of Lake Victoria. The wetland has a high nutrient retention capacity, and is effective in removing bacteria and microbes. It physically, chemically and biologically eliminates pollutants and sediments from the wastewater which passes through it, and reduces the pollution load entering Inner Murchison Bay through mineralisation and sedimentation processes. Of particular significance is the capacity of wetland plants to remove phosphorus and nitrogen, the accumulation of suspended solids, pollutants and pathogenic organisms in the wetland's bottom sediments and their decomposition, the conversion of heavy metals from soluble to insoluble forms and the dilution of effluents effected through density currents caused by the difference in temperature between wetland and bay water.

Valuing Nakivubo's services

The Nakivubo study aimed to quantify the value of wetland wastewater purification and nutrient retention functions, so that they could be balanced against the potential gains from wetland conversion for industrial and residential developments. It was the first time that any attempt had been made to quantify the value of Ugandan wetlands' ecosystem services. A key concern was thus to choose methods which would not require complex, lengthy or costly primary data collection, which could be easily replicable in other Ugandan wetland sites in the future, and which were achievable given the time, financial resources and human capacity available for the study. At the same time it was necessary to produce an economic argument and set of recommendations which were convincing to urban planners and decision-makers, were defendable, and would stand up to outside scrutiny.

Two valuation methods were applied to the case of Nakivubo: the avoided costs of replacing natural wetland functions with man-made alternatives, and the foregone expenditures on mitigating or offsetting the effects of wetland loss. Either one of these values represents an estimate of the minimum economic benefit of the wetland in terms of alternative expenditures saved by not having to supply equivalent wastewater purification and nutrient retention services through other means. The study focused on assessing the value of Nakivubo in treating domestic wastes, as they contribute by far the greatest quantity of wastewater and highest proportion of the total nutrient load entering the wetland, both at the present time and for the foreseeable future. Industrial wastes, although containing much higher concentrations of toxic substances, currently add less than a quarter of total nutrients, and only yield low loads of heavy metals, BOD and COD.

Replacement costs included two components: connecting Nakivubo channel to an upgraded Bugolobi sewage treatment plant which could cope with the resulting additional wastewater load, and constructing elevated pit latrines to prevent sewage from low-cost settlements from entering the wetland. All of the data required to calculate these values were readily available. The additional capital and recurrent expenditures required to link Nakivubo Channel to the Bugolobi treatment works, and to extend its capacity to serve a population of more than half a million people had already been calculated by the National Water and Sewerage Corporation. The fact that these figures had been prepared as part of a feasibility study for a project that did not, in the end, take place merely served to highlight the importance of the existing services provided by Nakivubo. Information on the cost of building elevated pit latrines was acquired from a similar part of Kampala whose proximity to a wetland meant that there was a high water table and recurrent waterlogging.

The major mitigative or avertive expenditure required to offset the effects of impaired water quality arising from wetland loss would be to move the inflow for Kampala's water supply to an alternative location sited away from the outlet of wastewaters into Inner Murchison Bay. Again, estimates of these costs had already been prepared some years earlier, and were updated and incorporated into the study.

In addition to calculating the economic value of wastewater purification and nutrient retention functions, it was also necessary to estimate the costs incurred in managing the wetland to provide these services. The cost of constructing multiple outflows from Nakivubo

Channel, and their reticulation across the wetland, had to be deducted from the economic benefits of Nakivubo's waste treatment and water purification functions.

Although the presence of Nakivubo wetland results in a significant improvement of the quality of water entering Inner Murchison Bay, its waste treatment and water purification services are currently not being utilised to their full potential. This is because the two outflows of Nakivubo Channel, through which the majority of wastewater and between 75-85% of nutrients enter the wetland, do not spread wastes over the whole wetland area. Wastewater currently spends only 0.5-2 days in the wetland, and mainly accumulates in lower parts to the south of the railway bridge. To optimise wetland management for both its waste treatment functions and for maintaining ecological integrity, there is a need to spread wastes over a greater area, so as to utilise the upper wetland to its full capacity and to increase the time that wastewater is retained. Information was available about the costs of constructing and maintaining earth channels to carry and disperse wastewater, which could easily be related to the length and positioning of outflows that were required from Nakivubo Channel.

Integrating wetland values into the urban landscape

The results of the valuation exercise showed that the wastewater purification and nutrient retention services of Nakivubo Swamp have a high economic value – between US$ 1 million a year (using replacement cost methods) and $1.75 million a year (using mitigative expenditures methods). Even taking account of the costs of managing the wetland so as to simultaneously optimise its waste treatment potential and maintain its ecological integrity (some US$ 235,000) results in a significant net benefit.

These figures provided a powerful economic argument against further drainage and reclamation of the wetland. The study showed that the existence of Nakivubo Swamp saves the Government of Uganda's National Water and Sewerage Corporation a considerable sum of money each year, as it currently provides a much cheaper way of dealing with Kampala's wastewaters than other, man-made, options. There are currently insufficient public funds to invest in the infrastructure required to replicate these natural services. As well as having a lower cost, Nakivubo's natural ability to purify wastes is far simpler than artificial waste treatment and water purification facilities because it is based primarily on the use of human labour and simple earth channels to spread wastewaters across the wetland.

Another argument arising from the study that urban planners and decision-makers found convincing was that loss of wetland functions would give rise to untenable economic costs for some of the poorest sectors of the population, as well as imposing high economic costs on the public sector agencies who have the responsibility for providing basic services and assuring an acceptable standard of urban living. In Kampala, these groups are simply not in a position to bear such losses or expenditures.

The findings generated by the study lend strong support to various recommendations that have been made over recent years that that Nakivubo Swamp should be fully recognised to be, and designated as, an economically important and environmentally sensitive area within the city's zoning and structural planning processes. It also supports the call in Uganda's National Wetland Policy that reclamation of wetland areas for urban development should be curtailed (Government of Uganda 1995). The future survival of the wetland will depend largely on such public actions being taken. Although the value of wetland services are both large and influential at the level of the overall urban economy and social welfare, it does not instantly translate into private profits. As long as the firms and individuals who are currently modifying and reclaiming Nakivubo continue to do in the absence of proper planning and controls, they are unlikely to take these broader values into account.

This case study is adapted from 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

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This project aims to develop, apply and demonstrate environmental economics techniques and measures for wetland, water resources and river basin management which will contribute to a more equitable, efficient and sustainable distribution of their economic benefits at the global level and in Africa, Asia and Latin America, especially for poorer and more vulnerable groups.

For more information, please contact:
Lucy Emerton. LAE@iucnsl.org Tel: ++94 1 694 094

For information about project activities in Africa, Asia and Latin America please contact:

Eastern Africa: Francis Karanja.
FKK@iucnearo.org Tel: ++254 2 890 605-12
Latin America: Rocío Córdoba.
Rocio-cordoba@iucn.org Tel: ++506 241 0101
Lower Mekong: Sarah Porter.
sp.mekongwetland@online.com.kh Tel: ++855 23 222 311/2
South Asia: Shamen Vidanage.
SPV@iucnsl.org Tel: ++94 1 694 094