Promoting Development through Sustainable Wetland Management

Hellen Ipara
University of Eldoret, P. O. Box 1125-30100, Eldoret
hellenipara@yahoo.com

Paul Odwori
University of Eldoret, P. O. Box 1125-30100, Eldoret
okeloodwori@yahoo.com

Irene Mugalo
University of Eldoret, P. O. Box 1125-30100, Eldoret

Abstract

Although wetlands are critical ecosystems that support diverse biological resources, functions and services, their integrity and sustainability are currently threatened by unsustainable human activities. This study was conducted around Marula swamp in Kenya. The study assessed how sustainable wetland management through local community involvement is promoting development. The study specifically investigated the role of Marula swamp in promoting conservation and local development; assessed strategies used to promote local community involvement in sustainable management of the swamp and its biodiversity; and determined threats facing the swamp and their impacts, measures adopted to mitigate the threats, and challenges faced in implementing the measures. The study targeted the local community living adjacent to the swamp and key respondents drawn from institutions located near the swamp, government ministries and departments, non-governmental organizations and community based organizations involved in its management, and local leaders. Sixty respondents among them fifty local community members and ten key informants were interviewed. Data was collected using structured questionnaires, discussions, personal interviews and field observation, and analyzed using descriptive statistics (frequencies and percentages) and chi-square test. Results revealed that Marula swamp is endowed with resources like medicinal plants (90%) and wildlife (80%). These resources are exploited for domestic use, sale, and to support local development. Benefits accruing from the swamp include water (100%) and herbal medicine (90%). Although various strategies are used to promote local community involvement in conserving and managing the swamp, they have not been effective (χ^2=8.000, df=1, p=0.005) *in promoting sustainable wetland management. Hence, threats arising from draining the swamp to create farmlands and burning swamp vegetation among others threaten the sustainability of the swamp. Awareness creation on the link between sustainable management of the swamp, improved livelihoods and development should be promoted through public education and extension, community meetings and other grassroots communication channels.*

Key Words: *Wetlands, local Communities, Sustainable Management and Development, Marula Swamp*

INTRODUCTION

Wetlands have been variously defined by different authors and scientists. Although no consensus exists regarding a universally accepted definition, a wetland can be defined as land submerged under water with soils saturated with moisture either permanently or seasonally. The RAMSAR Convention Bureau (2000) defines wetlands as areas of marsh, fen, peat land or water, whether natural or artificial, temporary or permanent, with water that is flowing or is static, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters. Mitsch and Gosselink (1986) defined wetlands as lands transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface, or lands covered by shallow water. From these definitions, it can be inferred that wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

Wetlands include swamps, marshes, bogs, mires, fens, peat lands, slough, swale, moor, carr, muskeg, hearth and other wet ecosystems found throughout the world (Corwadin *et al.*, 1979). These ecosystems are considered the most biologically diverse of all ecosystems, and support a lot of biodiversity. Plant life found in wetlands includes mangroves, water lilies, cattails, sedges, tamarack, black spruce, cypress and gum among others, while animal life includes many different species of amphibians, reptiles, birds, insects and mammals (Mwanika 2000; Mitsch & Gosselink, 1993). The RAMSAR Convention recognizes five major wetland systems while others such as Dugan (1990) have identified up to seven main groupings. The major RAMSAR categories of wetlands include marine (coastal wetlands), estuarine (deltas, tidal marshes and mangroves), lacustrine (lakes and associated wetlands), riverine (rivers, streams and associated wetlands) and palustrine (marshes, swamps and bogs). Marula swamp which was the focus of this study falls in the palustrine category.

Wetlands account for about 60% of the global land area, and are among the most threatened ecosystems. Despite this, wetlands are highly productive ecosystems providing many benefits among them environmental goods and services, food, shelter and habitats for wildlife, spawning sites for aquatic species, and medicines. Wetlands play a critical role in the recharge, storage and discharge of ground water, provide nutrients that sustain primary productivity which is the basis of the food chain, and act as filters of polluted water and silt (Kloek& van der Duim, 2007a; Saarinem *et al*, 2010). Wetlands also provide breeding grounds for fish and other forms of aquatic and terrestrial life, and are important fishing grounds. Wetlands are also important sources of water for domestic, industrial and agricultural use, and function as natural reservoirs and regulators of river flows. In spite of their critical functions and the benefits they confer to humans, wetlands are threatened by unsustainable human use practices and activities manifested through unplanned developments and incompatible anthropogenic activities (Kloek& van der Duim, 2007a, 2007b). Lack of appreciation for the ecological values and functions of wetlands coupled with their continued degradation is undermining their capacity to provide environmental goods and services that are vital to humankind and other organisms, as well as their sustainability. These events call for concerted efforts to promote sustainable wetland management and rural development.

Wetlands contain diverse resources that can be used to stimulate development in their surroundings. Where wetlands such as Marula swamp exist, potential for development of tourism, weaving and basketry, brick making, pottery and agroforestry exists. Hence, if conserved and sustainably managed through local community involvement wetlands can confer direct benefits like craft materials, sand, clay, water and agricultural land, and indirect benefits such as employment through tourism (Kloek& van der Duim, 2008), and contribute to development, poverty alleviation and improved human welfare.

Sustainable wetland management entails wise use of wetlands and their resources with a view to the sustainability of resources and associated environmental processes for the benefit of the humans and other organisms. Promoting sustainability of wetlands implies configuring civilization and human activity so that the society, its members and its economies are able to meet their needs and appreciate the greatest potential in the present while preserving biodiversity and natural ecosystems for the future (Dugan, 1990; Mwanika, 2000). Sustainable management ensures that development promoted within or around wetlands is done within the ecological limits of the ecosystem, and also meets the needs of the present generations without compromising those of future generations (World Commission on Environment and Development, 1987; Keating, 1993). In the same vein, promoting development through sustainable wetland management calls for local community support for and involvement in activities that are compatible with wetland resource conservation to enhance improved human welfare and ecosystem integrity. Likewise, this calls for the integration of human needs with conservation and development goals.

The Ramsar Convention Bureau (2000) argues that wise use of wetlands encompasses their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem. Consequently, it is the duty of all stakeholders among them local communities to ensure that wetlands are well utilized to promote development. The need to soundly conserve and sustainably use wetlands like Marula swamp is greatest now since these areas are fragile. Unfortunately, wetlands have been subjected to indiscriminate use and incompatible activities leading to a decline in their quality.

Local communities residing within and around wetlands have a deep relationship with them, and utilize their resources to support their socio-cultural and economic needs. These communities have utilized their indigenous knowledge, taboo and belief systems and cultural practices to conserve, manage and utilize wetlands and their resources to support local development. Despite this, very few studies have been done to assess how local community participation in sustainable wetland management can promote development. Moreover, although there is increasing concern about promoting sustainable wetland management, no clear measures have been adopted to effectively mitigate threats and challenges wetlands like Marula swamp face. As Kloek and van der Duim (2007a, 2007b) have noted, lack of clear strategies to reverse challenges wetlands face, coupled with increasing levels of poverty, inappropriate policy guidelines, and lack of institutional coordination have accelerated the destruction and degradation of wetlands.

Agenda 21 has underscored the role local communities and their indigenous knowledge systems play in promoting sustainable natural resource management and development (Keating, 1993).The Millennium Development Goal number seven underscores the need to soundly manage natural resources to realize environmental sustainability for improved human welfare and development. Given the opportunity and technical support, local communities can reverse environmentally degrading impacts of past wetland use practices and also invest in the enhancement of valuable environmental services that can guarantee the prosperity of wetlands and their resources. In Uganda, increased local community involvement in wetland conservation and management has not only empowered communities in sustainable wetland use, but also stimulated local development through the establishment of handicraft industries, diversified employment opportunities and income sources, and conferred other benefits to local people thus improving their welfare (Akama & Sterry, 2002; Kloek& van der Duim, 2007a, 2008). Similar observations are documented about Kenya by Kloek and van der Duim (2007b) and Saarinen *et al.* (2010).

In spite of the foregoing efforts, wetlands are faced with numerous threats and challenges among them encroachment by agriculture, industry and urban developments, all of which have led to draining of wetlands to create land. Threats arising from mining, harvesting of firewood and medicinal plants, grazing and hunting have also had profound consequences on swamps and other wetlands (Maltby, 1986; Williams, 1990; Roggeri, 1995; Kloek and van der Duim, 2008). All these activities have potential to negatively impact on wetlands unless they are either sustainably done or regulated. Degradation of wetlands can alter hydrological processes and permanently damage resources leading to loss of biodiversity, while damming of rivers can lead to extermination of species and impact on livelihoods of people living downstream (Maltby, 1986; Dugan, 1990). Other threats facing wetlands include slashing and burning to create land for agriculture and settlement, overharvesting of resources and brick making. As a result, most wetlands have been subjected to unsustainable resource extraction thus increasing their vulnerability, and undermining efforts aimed at promoting sustainable management and development (Barbier *et al*., 1996). In Kenya threats to wetlands include reclamation, pollution from waste and agriculture runoff, overexploitation of wetland resources, eutrophication and salinization, industrialization and urbanization, invasion by alien species, over-grazing, increased sedimentation, and inadequate grassroots support. As a result, many wetlands have become temporary features that disappear, reappear and re-create themselves overtime (Barbier *et al*., 1996, Akama & Sterry, 2002; Saarinen *et al.*, 2010).

To mitigate the threats wetlands face, various measures have been adopted among them awareness creation, stakeholder involvement in wetland conservation activities, benefit sharing, co-management, and creation of partnerships between and among stakeholders. These efforts are aimed at sensitizing local communities and other stakeholders to adopt sustainable wetland utilization practices that can ease pressure on wetlands and their resources, and promote wetland sustainability and development. Against this backdrop, this study assessed the link between sustainable management of Marula Swamp and local development. Also investigated were the role played by the local residents in the conservation of the swamp and its biodiversity, threats facing the swamp, measures adopted to mitigate the threats, and challenges faced in implementing measures adopted.

This study was conducted in Marula Swamp in Kenya. Marula swamp is a 15 km stretch of papyrus swamp located to the east of Eldoret town in Uasin Gishu County, Kenya. The swamp‘s altitude varies from 2100 metres to 2700 metres above sea level. Temperatures range from 9°C to 26°C, while the average annual rainfall is 1103 mm per annum. The area‘s geology is dominated by tertiary volcanic rocks. Most soils comprise of brown clay silt of high plasticity, which undergoes marked shrinkage or swelling when subjected to changes in moisture.

The area‘s flora includes papyrus reeds and varieties of water lilies which provide habitats for diverse fauna and avifauna. Although there is no significant wildlife found in the study area, the fauna found includes small mammals like hares, rodents, bats, insects, fish, amphibians, invertebrates and reptiles all which depend on the swamp for food, nesting, migration, escape and cover. The avifauna found includes water birds like ducks, waders, the black-crowned crane, ibises and weavers. Land use and human activities practiced within and around the swamp include crop farming, horticulture, agroforestry, fish farming, livestock rearing and infrastructure development.

MATERIALS AND METHODS

The study's main objective was to assess how sustainable management of Marula swamp can promote development. Specific study objectives included investigating the role played by the swamp in promoting local development; assessing strategies used to promote local community involvement in sustainable management of the swamp and conservation of its biodiversity; and determining threats to the swamp, measures used to mitigate the threats, and challenges facing the implementation of measures adopted to mitigate the threats.

The study was conducted around Marula swamp, and targeted the community living adjacent to the swamp and respondents in institutions located near the swamp, government ministries and departments, non-governmental organizations (NGOs) and community based organizations (CBOs) involved in its management, and local leaders. A total of sixty respondents among them fifty local community members living adjacent to the swamp and ten key informants participated in the study. Local community members were randomly selected, while key informants were purposefully chosen.

Primary data from local community members was collected using structured questionnaires administered to heads of selected households or their representatives aged eighteen (18) years and above, informal discussions and field observations, while that from key informants was generated using personal (face to face) interviews guided by pre-designed structured questions. Secondary data was generated from review of published and unpublished works among them books, and internet. Data was analyzed using descriptive statistics (frequencies and percentages) and chi-square test. Results are presented using qualitative descriptions and tables.

RESULTS

Socio-Demographic Characteristics of Respondents

More female respondents (52%) than males (48%) were interviewed from the local community. All the respondents (100%) had access to formal education with 46% having attained primary education. 62% of the respondents were self employed and were engaged in activities like farming and business, 28% were unemployed and 10% were in salaried employment. All the local respondents interviewed lived within one kilometre from the edge of the swamp.

Resources Found in Marula Swamp and Benefits Accruing from them

Results in table 1 indicate that Marula swamp is endowed with diverse resources among them medicinal plants (90%), wildlife (80%) and pasture (52%). These resources confer various benefits to local communities living adjacent to the swamp and other stakeholders. Benefits that accrue from the swamp and which are used to cater for both subsistence and commercial needs include water (100%), herbal medicine (90%), game meat (80%), sand (70%), land (60%), clay (50%) and food such as fish and indigenous vegetables (30%) . Despite this, it is important to note that although the intensity of utilizing swamp resources has increased in recent years, economic (monetary) benefits derived from them is low. Further, it was evident that increasing poverty levels among the local residents coupled with the need for daily survival and income to meet basic needs like clothing and food, majority of the respondents (82%) alluded to diversifying their resource utilization activities to enhance survival. Diversification to enhance respondents' socio-economic well-being has however, compromised the integrity and sustainability of the swamp.

Strategies for Promoting Community Participation in Marula Swamp Conservation and Management

Various strategies are used to promote local community involvement in the conservation and management of the swamp. Notable among these are mobilizing people through environmental and conservation groups (34%), awareness creation and sensitization about the swamp through education and extension programmes (24%), community meetings (14%), organizing environmental days (10%), and public rallies (10%), and participation in conservation activities like tree planting (10%). Chi-square goodness of fit results ($\chi^2 = 8.000$, df= 1, p= 0.005) showed that strategies adopted to promote sustainable management of

the swamp and its biodiversity through local community involvement are ineffective.

Table 1. Resources found in Marula Swamp

Resource found/used	Frequency*	Percentage*
Medicinal plants	45	90
Wildlife	40	80
Pasture	26	52
Land	25	50
Papyrus	22	44
Clay	23	46
Water	23	46
Trees	16	32
Reeds	15	30
Grass	12	24
Fish	11	22
Sand	11	22

* - Multiple responses given

Role Played by the Community in Conserving the Swamp and its Resources

Respondents alluded to various roles played by the community in conserving the swamp and its resources. These include fencing homesteads to minimize access to and encroachment on the swamp (32%), protecting the swamp through fencing (20%), building bench terraces on farms adjacent to the swamp to minimize runoff (12%), regulating harvesting of swamp resources (10%), disseminating conservation information about the swamp to community members (10%), digging compost pits to minimize dumping waste into the swamp (8%), controlling diversion and usage of swamp water (4%) and sensitizing people to locate pit latrines away from the swamp to minimize pollution and water borne diseases (4%).

Threats Facing the Swamp and their Impacts

Results in table 2 further revealed that Marula swamp faces various threats among them reclamation and draining of the swamp (44%), over burning of swamp vegetation (16%), pollution from agricultural runoff and spills from car garages (16%) and encroachment (16%). Impacts of threats faced on the swamp include pollution (18%), species extinction (12 %), bad odour (10%) and blockage of water flow (10%) (Table 3). Despite this, 18% the respondents reported that there were no threats facing the swamp.

Table 2. Threats to Marula Swamp

Threats faced	Frequency*	Percentage*
Draining of the swamp	22	44
Over burning of swamp vegetation	8	16
Pollution from agricultural runoff and car repair garages	8	16
Encroachment	8	16
Overharvesting of reeds	5	10
Sedimentation due to erosion	3	6
Drought	2	4
Water diversions	1	2

* - Multiple responses given

Table 3. Impacts of treats faced on the swamp

Impacts of threats faced	Frequency*	Percentage*
Pollution	9	18
Species extinction	6	12
Bad odour	5	10
Blockage of water flow	5	10
Drying of swamp vegetation	4	8
Loss of the swamp‘s aesthetic value	4	8
Increased water borne diseases	4	8
Change in water quality and taste	3	6
Fragmentation of the swamp	2	4

* - Multiple responses given

Challenges to the Implementation of Measures Adopted to Mitigate Threats Faced and their Impacts

Lastly, results showed that the implementation of measures and strategies adopted to promote development through local community participation in the sustainable management of the swamp is faced with various challenges including widespread ignorance about the importance of the swamp (38%), negative attitudes and perceptions towards the swamp (38%), lack of grassroots support and goodwill (12%), conservatism (12%), lack of coordination in implementing the measures and strategies (14%) and laxity in enforcement of wetland conservation policies and laws (10%).

DISCUSSION

Marula swamp is endowed with diverse resources that confer both direct and indirect benefits to residents living around the swamp and other stakeholders. Direct benefits accruing from the swamp and which have contributed to the local residents' welfare and area's development include water for domestic and agricultural (irrigation) use, sand for construction, craft materials for making mats and basketry, game meat, land for settlement and farming, pasture, fish, firewood, medicinal plants, thatch grass and clay for pottery and house construction. The swamp and its biodiversity also support education and research as well as recreation activities like bird watching. Proximity to swamp water also supports aquaculture (fish farming), flower and horticulture farming.

The foregoing activities coupled with business enterprises established in nearby centres and institutions provide employment, and contribute to poverty alleviation, improved welfare and local development. Sale of firewood, fish, poles, thatch grass, water and papyrus sourced from the swamp provides income to those engaged in these activities. The swamp also harbours diverse wildlife. Birds and insects assist in pollination, while trees, reeds and wetland grasses provide habitats for wild animals and birds. In addition, the swamp and its surroundings have potential for various forms of tourism including cultural, agro and nature based tourism, avitourism and ecotourism.

Local communities living around the swamp have attached aesthetic values to resources to birds like the crowned crane, butterflies and insects due to their beauty and cultural attributes. There are also areas within the swamp that serve as cultural and religious (baptism) sites. These findings concurred with sentiments of all the key respondents interviewed as well as those of Kloek and van der Duim (2007a, 2007b, 2008) and Saarinem *et al.* (2010). The later argues that although wetland ecosystems have undergoing rapid transformation due to increasing human populations and implementation of incompatible resource use practices by adjacent communities, wetlands support local people in meeting subsistence household needs; contribute to people's socio-economic well being; and enhance environmental health, livelihoods, and ecological integrity by providing supportive livelihood resources and ecological functions and services.

Communities residing around Marula swamp have potential to promote sustainable management of the swamp, and should be involved in its conservation if strategies adopted to enhance their participation and support for development have to be effective. These communities have over the years utilized their indigenous knowledge systems to extract and utilize swamp resources for various reasons. However, to enhance the integrity and sustainability of the swamp, local needs should be integrated with conservation and development goals using a participatory approach that blends local knowledge and science on one hand, and active community involvement in swamp conservation and development on the other. Such an approach will ensure that while the ecological and hydrological functions of the swamp are enhanced, the community's socio-economic needs are also realized through wise use of wetland resources.

Majority of the people living around the swamp are self employed, and were engaged in activities like small scale crop farming, livestock keeping and trade (business). While undertaking activities like agriculture, the swamp is drained to create land for farming. This has reduced swamp land and interfered with the ecological and hydrological functions of the swamp. Digging irrigation trenches and sand harvesting destroys the substrate of the swamp and prevents free water flow and natural restoration of the swamp. Over harvesting of papyrus reeds for basketry has led to destruction of habitats and loss of biodiversity, while dumping of agrochemicals, plastics and other non-biodegradable materials from the flower farm, households and business enterprises, and grease and oil from motor repair garages has

polluted the swamp thus compromising its aesthetic value. This situation has further been aggravated by problems associated with encroachment on the swamp, overgrazing and periodic burning of the swamp's vegetation. These findings corroborate with those documented by Mwanika (2000) and Saarinem *et al.* (2010).

Marula swamp resources are used by different social groups among them women and men from adjacent households and institutions. As such the swamp is subjected to open access, and if access and use remains unregulated the swamp is likely to be subjected to the tragedy of the commons. To avert this, respondents alluded to various measures and strategies that have been adopted to mitigate the threats faced among them community sensitization and awareness creation through education and extension, public rallies and campaigns, environmental/conservation groups and community meetings. Although information disseminated through these forums has had varying impacts on targeted groups, chi-square results showed that strategies used in promoting local development through local community participation in sustainable management of the swamp have been ineffective. This situation can be explained by prevailing antagonistic attitudes towards the swamp and its role in development, poverty leading to adoption of unsustainable resource use practices, conservatism and apathy.

Lastly, the implementation of measures aimed at mitigating threats facing the swam as well as their impacts has been undermined by various challenges including inadequate grassroots support, antagonistic attitudes and perceptions towards strategies adopted, limited awareness on the ecological roles of the swamp, and ignorance among the residents. Other challenges highlighted include lack of coordination and collaboration among implementers of measures and strategies adopted, laxity in enforcing conservation policies and laws by government agencies like National Environmental Management Authority and Kenya Wildlife Service; lack of funds to protect the swamp, mobilize and sensitize communities, politicization of conservation and development issues, exclusion of local residents in the decision making process pertaining to the swamp, and poor land tenure practices. These challenges have undermined institutional efforts to protect and conserve the swamp and promote local development. These observations concur with those of Dugan (1990), Davies (1993), Kloek and van der Duim (2008) and Saarinem (2010).

CONCLUSION AND RECOMMENDATIONS

Promoting development through sustainable wetland management entails local community involvement in the conservation and wise use of wetland resources in a way compatible with the maintenance of natural properties of the ecosystem. Although Marula swamp is endowed with diverse resources that are exploited to meet the needs of local residents and other stakeholders, their exploitation is neither sustainable nor compatible with conservation. As a result, the swamp and its resources are faced with numerous threats that have compromised the integrity of the swamp. This calls for measures that will reconcile and harmonise local residents' socio-economic and cultural needs in the swamp with conservation and development goals.

To mitigate loss and degradation of the swamp and support its values and functions, a wetland policy should be formulated, implemented and enforced. This policy will ensure that the conservation and management of the swamp and other wetlands are an integral part of environmental conservation and development processes. The policy will also ensure that wetlands like Marula swamp are protected conserved, and sustainably managed, and contribute to development and improvement of livelihoods at local and national levels.

An inventory of resources found in Marula swamp should be undertaken to inform policy and development decisions. An evaluation of the swamp should be undertaken to determine its economic value vis-à-vis its conservation to guide utilization practices as well as conservation and development strategies and options. The aim should be to secure the integrity of the swamp and promote its sustainability.

Awareness raising and sensitization campaigns about sustainable use of the swamp and its resources should be intensified using modern and traditional communication channels like the radio, public rallies, newspapers, community meetings, drama and role play. Through these channels, conservation knowledge and information on values and functions of the swamp and other wetlands will be disseminated. These

channels will also act as forums through which local people and experts interact; share, enhance and analyze their knowledge and experiences on wetland conservation, management, use and development; and deliberate, plan and act on proposed measures to mitigate threats and challenges facing wetland conservation.

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BIO-DATA

Hellen Ipara is an Associate Professor in the Department of Wildlife Management, University of Eldoret, Kenya. She holds a BEd (Hons) Degree, University of Nairobi, M.Phil and DPhil Degrees in Environmental Studies, Moi University, and a Certificate in Environmental Impact Assessment and Audit from University of Eldoret. Besides holding leadership positions at university and community level, she has taught, examined and supervised students at diploma, undergraduate and post graduate levels since 1993. She has expertise in teaching, research, consultancy and proposal writing in socio-economic dynamics of wildlife, natural resource conservation and environmental management.