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## Detecting changes, causes and future prospects of Kenyan wetlands and their conservation

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### Abstract

Wetlands around the globe have been altered, degraded or lost through a wide range of human activities. A variety of conservation action is presently undertaken in response to these changes, and much of this work aims to: promote the wise and sustainable use of wetland resources, maintain ecological character at wetland sites, and also to prevent degradation and loss of wetlands at local, national and international scales. Kenyan wetlands play a number of roles in the socio-economic development of the country despite being under intense pressure. The driving forces continue to increase in intensity with time and there is a need for immediate action in order to restore their ecological character and integrity. The findings of this review provides an introduction, changes, causes, challenges and way forward as the conservation of Kenyan wetlands is concerned.

**Keywords:** Conservation, ecological change, challenges and wetland

### Introduction

Although there is admittedly no universally accepted definition of wetlands (Finlayson *et al* 2011; Copeland 2010) [6, 5], they are perceived as the ecosystems that integrate the characteristics of terrestrial and aquatic environments notably, water, soil and vegetation (Lathrop 2011) [12]. The degree to which these properties are combined exhibits spatial, temporal and wetland type variability. The latter accounts for the broad definitional base contained in Article 1 of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, popularly referred to as the Ramsar Convention whose overarching aim is to 'stem the progressive encroachment on and loss of wetlands.'

The Convention describes wetlands as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres' (Ramsar 1971) [27]

Wetlands in Kenya play a number of roles in the socio-economic development of the country. They are sources of water, provide critical habitats for biodiversity, provide economic benefits through fisheries, recreation and grazing lands, have very important hydrological functions of recharge and discharge of water and water purification. They also serve as spawning grounds for fish and resting ground for birds. Despite of all these ecological importance, they are under intense pressure that needs immediate action in order to restore their ecological character. Although natural activities like erosion, sea level rise, droughts, hurricanes, and overgrazing by wildlife negatively impact on wetlands, human activities substantially subject pressure on these ecosystems (Bjerstedt, 2011) [4]. The increasing population pressure at the beginning of the last century, tightly interconnected with the growing need for food resources, and combined with a poor knowledge of the ecological functions of wetland ecosystems, put a very strong negative pressure on wetlands all around the world (UNEP 2009; O'Connell 2003; UNEP/CBD 2011) [29, 21, 28], either in their loss or degradation- wetland loss being defined as "the loss of wetland area, due to the conversion of wetland to non-wetland areas, as a result of human activity", whereas wetland degradation is "the impairment of wetland functions as a result of human activity (Moser *et al.*, 1996) [17].

An important element of the conservation of wetlands and their biodiversity is protecting 'honeypot' sites from potentially damaging human actions. This can be either the result of statutory designation in accordance with qualifying criteria under national or international Agreements, or by being protected as reserves, often belonging to conservation organizations.

Outside of these high-profile sites, the sum area of unprotected wetlands, probably make up a significant part of the total wetland resource in many regions. At all wetland sites, an essential tool for conservation action is the ability to detect, measure and then reverse changes in the 'ecological character' of a site. Ecological character is as the structure and inter-relationships between the biological, chemical, and physical components of a wetland, derived from the interactions between its processes, functions, attributes and values (Ramsar Convention Bureau, 2000) [26]. Ecological change is therefore defined as an impairment or imbalance in any of the process or functions which maintain the products, attributes and functions of a wetland. Detecting changes in ecological character is different to 'bio-assessment', in which anthropogenic effects on the integrity of a wetland are examined and quantified (Rader *et al.*, 2001) [25]. In turn, integrity is defined as the residual between observed values of an 'indicator' at a site (e.g. taxonomic group, water chemistry, hydrology), and the value of the same indicator at an actual or hypothetical reference site where human influence is deemed to be negligible (Noss 1990; Bailey *et al.*, 1998; Hawkins and Carlisle, 2001) [20, 2, 9].

#### Factors leading to wetland loss or degradation in Kenya

With a 3.8% average annual population growth rate (Njiru *et*

*al.*, 2008) [19] and a population density of up to 1 200 persons per sq. km. in parts of Kenya (World Agroforestry Centre 2012) [30], the Lake Victoria basin has one of the world's densest rural populations. This high and rising population density is largely attributable to the abundant fishing opportunities and the favorable agricultural conditions (Mailu 2001) [14]. However, the population growth is also fuelling rapid urbanization, conversion of land to agriculture, industry and settlement (Odada *et al.*, 2004; Kairu 2001) [22, 10]. These are in turn depleting wetland resources at a rate that outstrips that of their natural replenishment as the reduction in fringing lakeside vegetation and in fish populations and diversity attests (Kairu 2001; Masifwa *et al.*, 2001) [10, 16]. These problems threaten the lake and wetland ecology, and potential recreational opportunities but also the lifestyles and livelihoods of local communities (LVBC 2011) [13]. For instance the major economic activities in the Mara river basin (MRB) are Large-scale and small agriculture, livestock production, forestry, tourism, fishing, dairy, gold mining, and trade. Over the past few decades there has been extensive land cover change in the MRB due to changes in land use, overexploitation of resources and environmental degradation. Table 1 below shows the extent of land use changes with major shifts in the ecosystem.

**Table 1:** Extent of land use/cover changes in the Mara river basin between 1973 and 2000 (Source: Mutie *et al.* 2006) [18]

Land cover type	1973 (km <sup>2</sup> )	1986 (km <sup>2</sup> )	2000 (km <sup>2</sup> )	Change	
				Km <sup>2</sup>	%
Forest	1008	893	689	-319	-32
Tea/ open forest	621	1073	1948	+1327	+214
Agricultural land	826	1617	2504	+1678	+203
Shrubland	5361	5105	3546	-1815	-34
Grassland	2465	1621	1345	-1120	-45
Savannah	3163	2867	2354	-809	-26
Wetlands	286	604	1394	+1109	+387
Water bodies	104	54	55	-49	-47

#### • Invasive Alien Plant Species

Rapid population growth and urbanization, non-point pollution from agriculture as well as increased siltation and sedimentation in the catchment area have led to a considerable nutrient load in Lake Victoria (Kateregga and Sterner 2007) [11]. The resulting eutrophication has led to the proliferation of the water hyacinth (*Eichhornia crassipes*). The most affected area in the Kenyan portion of the lake is the Winam Gulf (Mailu and others 1998; UNEP 2009) [15, 29] which marks the water body's easternmost limit. The proliferation of the water hyacinth has a range of negative ramifications.

#### • Sedimentation and Siltation

A rapid rise in the human population in the Lake Victoria basin has led to increased solid waste and sewage generation. Owing to the shortage of proper waste and sewage disposal and management systems, most of these end up in the lake. In addition, poor land management practices, including deforestation, reclamation and conversion of wetlands in the lake's upper catchment consisting of the Mau Forest Complex, Tinderet and Nandi Hills, have resulted in excessive sediment flowing into the lake (Ogutu 2011) [23].

#### • Changes in Hydrological Conditions

Canal construction, over-abstraction of water and sand harvesting in the basin wetlands have led to hydrological changes and fluctuations in their water levels. This affects the

hydrological characteristics of the wetlands, leading to increasingly impervious surfaces in the catchment and to significant inundation that spans widths of up to three kilometres near its outfall to Lake Victoria, disrupting water supply and adversely affecting crops that are intolerant to water logged conditions (GoK 2009) [8].

#### • Overexploitation of wetland goods and services

Increasing human pressure is leading to the intensification of land use and to overgrazing, overfishing, sand harvesting, brick making and the drainage of wetlands, mostly for agriculture. The synergistic effect of the above has been to appreciably reduce water levels and other resources such as sand and clay, organic matter and grasslands with the latter reducing the amount of nitrogen available in the top and sub-soils (Barasa 2011) [3]. This leads to exhaustion of wetland resources, competition and conflicts with wetland species and finally some species disappear completely.

#### • Water Pollution and Solid Waste Management

Point and non-point pollution of Lake Victoria results from agrochemical runoff, municipal effluents. This is a serious problem because of the considerable use of agrochemicals in irrigated and horticulture farms in the lake's catchment. These in turn increase the nutrient load in the lake consequently compromising its ability to carry out its traditional ecosystem functions. The risk of oil sludge pollution from the numerous

petrol stations and garages that operate in the commercial centres around the lake is also high. These have negatively impacted water quality and biodiversity within the wetland ecosystems thereby reducing their values. Increased nutrient loads from the catchment have led to eutrophication and episodes of algal blooms in wetlands near major settlements. In certain areas excessive abstraction of fresh waters, diversions, and catchments degradation, have led to increased salt concentration.

### **Challenges impeding the restoration of wetlands' ecological character**

Several challenges exist that hinder the conservation achievement as expected. The capacity of the institutions to deliver their mandates is low. In this regard, efficient and effective reporting systems will be essential in keeping track of performance. Governance issues require urgent attention since it affects all directly.

The challenges include inaccessibility, poor governance and unsustainability among others. Kenya is currently considered a water scarce nation and about 50% its population lack reliable sources of water. Generally the challenges facing the management and utilization of water resources in Kenya include

- **Transboundary conflicts**

Kenya shares a number of important wetland ecosystems with neighbouring countries. These include Lake Victoria, Lake Turkana, Lake Jipe, Lake Chala as well as the Mara River. As a consequence, a single wetland may be subjected to a plethora of complex and often inconsistent principles, regulations, policies and laws originating from various governments, public institutions and other stakeholders thereby heightening the potential for conflict. Cooperative regional governance based on the principle of integrated ecosystem management is therefore indispensable to ensuring the conservation and wise use of these vital but fragile transboundary ecosystems, shared water systems and the attendant migratory species.

- **Conflicts over Resource Use**

Conflict over the basin's wetland system's resources is rife between different resource-use interests such as crop farmers and herdsmen, water users and herdsmen, plant harvesters and fishermen, grass harvesters and clay miners, and herbalists and crop farmers. These conflicts often make it difficult for the local resource users to work together to sustainably use the wetland resources.

- **Industrialization and urbanization.**

Establishment of industries and urban centers, in addition to unplanned development activities including dam construction, coastal development, mining and quarrying has largely contributed to loss and unwise use of wetlands due to extension into wetland areas. Expanding industries and urban centers discharge their waste water into the neighboring wetlands, hence causing water pollution. Pollution renders water unhealthy for human and livestock use, ruins aquatic life and restricts recreation facilities.

- **Inadequate scientific information on wetlands**

Currently a comprehensive monitoring system for wetlands is virtually non-existent and as a result decisions affecting wetlands are based on inadequate information. Existing data has shortcomings in satisfactorily measuring the productivity of wetland ecosystems and their importance to food security and the national economy. Data on many other wetland

products essential to rural livelihoods such as shrimps, crabs and fish caught for household consumption have long been neglected. Lack of proper documentation of these values has led to long-term neglect of these values because they are seen to have little commercial importance. It is very important to know the actual value of a wetland because this is the only way people can appreciate and therefore conserve it and help in coming up with measures aimed at improving these values and also health and living standards of the people depending on wetland products.

- **Coordination among the stakeholders**

Inadequate coordination among the sectors concern within Kenya, and between Kenya and other states at regional as well as global levels. Institutional linkages, collaboration, networking and sharing of information is minimal due to selfish attitudes among individuals and institutions. Lack of multidisciplinary approach connecting various learning and research institutions both nationally and internationally affects the management and conservation of these ecosystems as there is no teamwork toward achieving their conservation objective.

- **Laws and rules enforcement**

Kenya as a nation has laws and regulations touching on the sustainable utilization of natural resources but the biggest obstacle is the implementation of these laws. Ineffective enforcement of the existing environmental and sectoral policies, legislation, regulations and rules touching on wetlands due to corrupt deals that exists in the offices that are bestowed with the responsibility of conservation and management of these ecosystems. This has hindered the conservation of wetland resources in Kenya.

- **Inadequate education and awareness.**

Wetlands are often degraded because the public is either not fully aware or does not appreciate the diversity of their functions and values. The National Museums of Kenya has been duly engaged in creation of awareness and public education on importance of wetland conservation among local communities, by using a wetland bird locally known as the grey crested crane (i.e. *Balearica spp*) as an indicator of the health of wetlands and hence as a key entrance point for wetland monitoring. Being the habitat of this bird, wetland degradation is associated with decline in the population of the bird. As such by monitoring the population trends of these birds, the local communities would simultaneously be monitoring the status of their wetlands.

- **Inadequate resources for conservation and management.**

Most institutions and organizations responsible for conserving the wetlands often don't have adequate skilled man-power, equipment and funds to carry out their work; personnel for monitoring, management, research and community awareness. Lack of management plans has exuberated wetland destruction and degradation e.g. Lake Naivasha.

These are significant challenges facing the wetland ecosystems and to address these challenges, the key research questions that should provide management interventions include:

- How does climate change and adaptation to these changes influence human interaction with wetlands resources?
- What are the dynamics in environmental flows in the river basins and the effect of e-flows on biodiversity in the ecosystem and socio-economic activities related to water use?

- What is the economic value of wetland resources in Kenya?
- What are the levels of implementation national legislations, regional policies, and global conventions that provide a framework for managing wetland resources?
- What are the wetland resource use conflicts?
- How does extensive reclamation/degradation of wetlands affect the nursery role of wetlands in sustaining fisheries?

### Conservation responses to changing wetlands

In response to the loss and degradation of wetlands, there has not been a great deal of conservation action implemented at local and national scales to enhance the maintenance of the integrity of wetland ecosystems for their effective functionality and delivery of services. The following are key to successful conservation strategy:

- Strict policy and legal framework
- Effectively addressing the threats
- Continuous research to enrich the scientific knowledge that is currently data poor.
- Development of a comprehensive national wetland inventory
- Resolution strategies of transboundary conflicts
- Capacity building among various stakeholders and awareness creation
- Financial support from government and other donors to support conservation process

The authorities have applied the above initiatives to have this rich ecosystem protected from the threats, but they have extremely failed simply because of lack of unity with purpose between the various stakeholders in management and conservation of Kenyan wetlands.

Evidence to date indicates that local people's involvement in wetland management can contribute significantly to maintaining or restoring ecological integrity and community wellbeing. Considering that every successful co-management initiative has the potential to stimulate positive initiatives anywhere in the world. It also provided an opportunity for "ground-truthing" the guidelines for establishing and strengthening participatory processes to involve communities and indigenous people in wetland management, which were then under development for the 1999 Conference of Parties of the Ramsar Convention on Wetlands (Ramsar Convention on Wetlands, 1999) [27]. The Ramsar guidelines summarize five major requirements for successful co-management:

- incentives for local and indigenous people's involvement and wise use: everyone must benefit in the long term
- trust among stakeholders
- flexibility
- knowledge exchange and capacity building, and
- continuity of resources and effort.

Understanding the concept of community-based resource management is the recognition that humans are part of the ecological system, and not separate from it. Today's wetlands, including those considered to be the most pristine, are the result of complex interactions among physical, biological, and human forces over time. Virtually all of the earth's wetlands have been influenced and altered by patterns of – more or less intense – human use (Gawler 2000) [7]. In the case of First Nations, wetland management by local people can have a history of thousands of years.

In this context, participatory management is generally defined as: *a partnership in which government agencies, local communities and resource users, and perhaps other stakeholders, such as NGOs, share the authority and responsibility for management of a specific area or set of resources.*

According to Addun and Muzones (1997) [1], there are five basic principles that are required for community-based resource management:

1. Empowerment: the actual transfer of economic and political power from the few to the impoverished many, and the operationalization of community management and control
2. Equity: communities as a whole, rather than a few individuals, benefit
3. Sustainability: inter-generational equity, based on the carrying and assimilative capacity of the ecosystem
4. Systems orientation: the community functions in the context of other communities and stakeholders, just as resources are ecologically linked to wider ecosystems
5. Gender-fair: women are involved in the control and management of community resources, and their practical and strategic needs are addressed.

The degree of community participation in the wise use of wetlands varies with the local context: from high levels of empowerment, to effective partnerships between government authorities and local communities, to situations where government remains firmly in control and stakeholders are consulted on decisions.

There is growing awareness that in areas where indigenous and traditional people have lived for several years, the authority for resource and ecosystem management must be devolved as much as possible to the local level. All over the world, indigenous peoples are demanding recognition of their rights, and a greater say in decisions affecting their lives. Fortunately, there is a growing understanding that rich biodiversity often coincides with cultural diversity. In these areas, the trend in ecosystem management is increasingly towards systems of collaborative management with indigenous peoples (Oviedo and Brown, 1999) [24].

### Conclusion

Wetlands constitute a valuable natural resource, in economic, cultural, aesthetic, scientific and educational terms. Their conservation and management are critical to the interests of all nations and governments. Immediate conservation action is needed in some instances where opportunities exist to set aside 'pristine' lake and river systems in large protected areas. The best practice is to involve the riparian communities through strong partnership between and among all the stakeholders in wetland management; this would contribute significantly to maintaining or restoring ecological integrity and community wellbeing. Based on the recognition that every successful co-management initiative has the potential to stimulate positive initiatives anywhere in the world.

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