A Framework for Integrated Management of Transboundary Basins: The case of Sio sub-catchment in East Africa

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Abstract

The Sio sub-catchment is transboundary, originating in Kenya and flowing into Berkeley Bay of the Lake Victoria basin. It forms an important sub-catchment of the Nile basin and a significant base for the livelihood of small scale farmers engaged in mixed farming, depending on agriculture and livestock keeping as well as a large population depending on fishing. Indeed, high population densities exceeding 300 persons per square kilometre and cattle densities of 38 have been noted within basin, and continue to increase pressing heavy demand on the watershed resources – water, soil, vegetation. Thus the basin continues to be deforested as demand for human settlements, agriculture and grazing land increases leading to land degradation that is characterised by fertility losses, erosion by water and increases in sediment load as it drains into Lake Victoria. The livelihood of the population has been adversely affected and has in turn lead to unsustainable natural resources utilization.

Integrated watershed management provides an appropriate analytical and management unit for sustainable utilization of resources. This is particularly important as a means of coping with the ever increasing population and can contribute to the Millennium Development goals particularly of reduction of poverty and sustainable environmental management (Förch et al 2005). This is particularly relevant to the Lake Victoria Basin (LVB), which supports more than 30 million people, with the increasing population, and the challenges of sustainable management of resources. Indeed the LVB forms a large part of the Nile basin, and changes in resource within it affect people in more than 14 countries in Africa. The LVB has been deforested as demand for

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Introduction

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human settlements, agriculture and grazing land increases leading to land degradation that is
characterised by fertility losses, soil erosion by water, wind as well as increases in sediment load
as they drains in Lake Victoria (Ogutu et al, 2005; Balirwa et al, 2003; Isabirye et al, 2001;
Yanda et al, 2001; and Shepherd et al 2000).

The Sio basin is transboundary in Kenya and Uganda, and the land use change are likely to
impact not only the livelihoods but also the environment. Indeed, human densities in the sub-
catchment exceed 300 persons per square km and cattle density 38 (MAAIF 1993). Thus a
framework is necessary for the simultaneous management of resources in Sio basin. The overall
objective of the ongoing research project is to study is to understand the interactions in the Sio
basins, and integrate local and scientific knowledge for sustainable management. A framework
for integrated management of the Sio sub-catchment will enable protection of the resources in
the basin, whilst allowing sustainable use of the same resources for this increasing population.

Methods

The research design is a case study being conducted using a multitude of procedures. Primary
data is being collected through participatory research methods which include key informants, in-
depth and household interviews. Geoinformation tools of Remote Sensing, GIS and GPS are
being used in data capture and analysis of changes in resource use. In addition data on soil
properties and tree biomass is being analysed. The study will use the Integrated System for
Knowledge Management (IKSM) as a conceptual framework (Allen et al., 1995; Bosch et al.,
1995) to integrate local and scientific knowledge for sustainable land management practices.
ISKM is an approach that is designed to support an ongoing process of constructive community
dialogue and to provide practical resource management decision support for land managers and
policy makers (Figure 1).

Study Area

The Sio sub-catchment is transboundary, originating in Kenya and flowing into Berkeley Bay of
the Lake Victoria basin (Figure 2). It originates in Kaujai and Luucho Hills in Bungoma District,
Kenya at an altitude of 1800m and flows into Berkeley Bay in Lake Victoria Basin in Uganda.
The upper 65% of this sub-catchment is in Kenya, while the remaining portion in Uganda. The
sub-catchment forms a significant base for the livelihood of small scale farmers engaged in
mixed farming, depending on agriculture and livestock keeping as well as a large population
depending on fishing.

Selection of study sites

The selection of study sites in the Sio sub-catchment in Uganda and Kenya were guided by field
visits, interpretation of existing topographic maps and literature. The selected sites in Uganda is
downstream of Sio River entering Lake Victoria, situated the mouth and in Kenya, in villages
representative as the midstream section of the sub-catchment (Figure 2). These study sites were
selected on the basis of the observed changes: through onsite observations and preliminary
interviews with key informants, through literature review.
Data Collection

Primary data on livelihoods has been collected through local community involvement using participatory research methods, which include key informants, in depth and household interviews, to capture the development-environment interaction in the river basins. A total of 400 in-depth questionnaires have been administered in the selected study sites within the sub-catchment to find out about the livelihood activities as well as perceptions on resource management.

Figure 1: ISKM – a Participatory Research Framework

Figure 2: Location of Sio sub-catchment and sampled sites
The land use change is being interpreted from satellite images and topographic maps over a 40 year period between 1965 and 2005. Soil samples have been collected along selected transects, and these will be used to provide information on the physical properties. Data has also been collected on tree biomass along selected transects to provide further information of tree resources.

**Data Analysis**

**Sources of livelihoods**

Analysis of questionnaires was done using the SPSS package as a means of finding out the impact of land use changes on community livelihoods. This included sources of livelihoods and perceptions of local communities on various issues, such as resource management and involvement of communities in management of these resources. Image classification is still ongoing and will be verified with field observations that will result in digitized land use maps, comprising the same categories. Laboratory analysis of the soil samples is also ongoing. Further, participatory mapping of the natural resources will provide an insight of the local communities’ views on the development–environment interactions and the livelihood options and strategies, providing a linkage between the local and scientific knowledge. This information will be useful in providing an integrated framework for sustainable management of transboundary river basins.

**Land use change and biophysical properties**

The land use change analysis is being done satellite images and topographic maps over three major periods between 1965 and 2005. The current topographic sheets for the study area were compiled using photographs of the 1960’s and form the baseline. The other periods selected are 1973, 1984/86, 1995 and 2004/05. Laboratory analysis is being done selected physical properties of soil collected along transects in the sites, and include particle size fraction analysis and organic matter content. These will be correlated with attributes from the sub-catchment. Data has also been collected on tree biomass along selected transects to provide further information of tree resources.

**Results and Discussions**

Results indicate that Sio sub-catchment has experienced land use and land cover changes which have exerted negative ecological impacts affecting the livelihoods of communities (Obando *et al* 2007). The issues identified in this transboundary sub-catchment include: encroachment on the river bank resources, reclamation and conversion of wetlands for cultivation purposes, conversion from perennial to annual crops.

The intensity of these land use changes is currently being investigated with regard to the effects on both the livelihoods and environment. Change in land use has been in various forms: from natural vegetation to agricultural uses, subsistence cropping to large scale cash crop farms, agricultural to grazing and from agricultural to secondary natural vegetation. These changes have been influenced by the changing resource base in the sub-catchment, as well as the ways it is utilized by a community which is increasingly becoming vulnerable and this in turn has led to the circle of unsustainable use of natural resources.
It is clear that there are differences within the sub-catchment in Uganda and Kenya in terms of sources of livelihood. The community perceptions and participation in the river basin management and the institutional capacity are varied in downstream and upstream sections of the sub-catchment. Given the dependence of the community on the natural resource base, there is need to manage the sub-catchment in an integrated manner since there are linkages and effects upstream affect midstream and downstream. The emphasis on community participation in decision making is having a positive effect on the management of resources, and creating awareness on the interdependence of the resources within catchments, and the need for sustainable management.

Conclusions

For sustainable management of transboundary river basin resources, there is need for regional coordination in planning and management, as well as integrated planning and district level with participation of local communities. In Sio Kenya, different institutions have been charged with management of the various resources, including the Water Resources Management Authority, the Ministry of Lands, Agriculture and Environment and Natural Resources. It is necessary to harmonise these various acting bodies in Kenya and synchronize them with the Ugandan institutions responsible for catchment management within an integrated framework for the East Africa. So the participation of communities should be of paramount importance. Such a framework needs to inculcate the core values of the East Africa Community vision and strategy framework for management and development of Lake Victoria Basin (LVDP 2004). The research is still on going and analysis of the biophysical and satellite images will enable further conclusions to be drawn with a view of proposing an integrated framework for the management of transboundary river basins.

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References


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