Second RUFORUM Biennial Meeting 20 - 24 September 2010, Entebbe, Uganda Research Application Summary

Sediments and nutrients hotspot areas dynamics in selected micro-catchments of the Lake Tanganyika basin in Democratic Republic of Congo

Azanga, E.¹, Majaliwa, J.G.M.¹ & Kansiime, F.¹ ¹Institute of Environment and Natural Resources, Makerere University, P. O. Box 7062, Kampala, Uganda Corresponding author: ekazanga@yahoo.fr, ekazanga@muienr.mak.ac.ug

Abstract	This study aims at mapping changes in landuse in the Lake Tanganyika micro-catchments in the Democratic Republic of Congo. It also aimed at assessing the level of pollution of L. Tanganyika resulting from offloaded material and nutrients from these rivers draining into the lake from the mico-catchments. Preliminary results showed that forest cover decreased significantly over time in favour of grasslands with scattered trees. The three micro-catchments loose considerable amount of sediments and nutrients annually. These unfortunately end up into the lake and may compromise the quality of its water and aquatic life therein. This therefore calls for establishment of means to maintain adequate forest cover in the micro- catchment, create awareness within communities in the micro- catchment about the risk of environmental degradation and its mitigation measures. Key words: Lake biodiversity, landuse, land degration, Uvira, water quality
Résumé	Cette étude vise à cartographier les changements dans l'utilisation des terres dans les micro-bassins versants du lac Tanganyika en République Démocratique du Congo. Il vise aussi à évaluer le niveau de pollution du Lac Tanganyika résultant de matériaux et éléments nutritifs déchargés par ces rivières se déversant dans le lac partant de ces mico-bassins. Les résultats préliminaires ont montré que la couverture forestière a diminué considérablement au cours du temps en faveur des prairies renfermant des arbres parsemés. Les trois micro-bassins perdent des quantités considérables de sédiments et de nutriments par an. Ceux-ci se déposent malheureusement dans le lac et peuvent ainsi compromettre la qualité de l'eau et la vie aquatique du lac. Cela nécessite donc l'établissement des moyens nécessaries pour maintenir une couverture forestière adéquate dans le micro-bassin et sensibiliser les communautés

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	vivant dans le micro-bassin sur le risque de dégradation de l'environnement et de ses mesures d'atténuation.		
	Mots clés: Biodiversité du lac, utilisation des terres, dégradation des terres, Uvira, qualité de l'eau		
Background	The massive tropical forest in D.R. Congo, strategically located around the equator, has been considered for a long period as a local, regional and global climate regulator (Majaliwa, 1998). However, the country has undergone decades of instability and poor governance coupled with an exponential demographic pressure which could have trigged significant land use/cover and livelihood change with regional and global climatic impacts. In the Lake Tanganyika basin (LTB) the change in land-use/ cover has accelerated land degradation which has negatively and significantly affected both water quantity and quality in the basin, and consequently peoples' livelihood (Cohen <i>et al.</i> , 1993; Alin <i>et al.</i> , 1999).		
	Considering the importance of this forest ecosystem and the uniqueness of its resources, a quick restoration strategy is imperative. This requires the identification of hotspot areas and understanding their land-use/cover dynamics.		
Literature Summary	For the last three decades the LTB has experienced high rate of land-use/cover changes compounded by climate change and variability. This has resulted into a wide range of effects, which have knock on consequences for food production, and therefore on human livelihoods around the lake (Pilsnier, 1999; Sarvala <i>et al.</i> , 1999; Rüber <i>et al.</i> , 1999; West <i>et al.</i> , 2001; Verburg <i>et al.</i> , 2003; Jorgensen <i>et al.</i> , 2004). These changes have increased the sediments and nutrients fluxes into water bodies and increased the entropy of the open cycle poor management- degradation- poverty (Rogers, 1990; Ryan, 1991; Groombridge and Jenkins, 1998; Kerby and Kats, 1998; Runde and Hellenthal, 2000; Donohue and Irvine, 2003; Majaliwa <i>et al.</i> , 2008). Assessing the impacts of these changes on the lakes is unfortunately complex because global warming may be making the lakes temporarily more oligotrophic while catchment changes increase nutrient and sediment flows to the lake. So responses to enrichment may be delayed more than the current oligotrophication trend (Reice and Wohlenberg, 1993).		
Study Description	Three micro-basins of Lake Tanganyika in the territory of Uvira in eastern D.R.Congo were studied: Kavinvira, Mulongwe and		

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Kalimabenge. The three rivers originate from the Mitumba Mountains (more than 2400 m above sea leavel for Mulongwe and Kalimabenge, and 1800 masl for Kavivira) and flow into Lake Tanganyika (779 masl). The D.R.C. catchment of the LTB covers about 40000 km²; representing about 20% of the basin. The climate is generally sub-humid with an average temperature of 25°C. The vegetation is dominantly woodland with scattered grasslands, and trees in cultivated lands. Landuse change in these catchment was assessed by comparing area under forest, secondary forest, cultivation, grounant, bare, built up and water bodies for the for the years 1974, 1986 and 2000. Landuse changes in the micro-catchment was mapped uisng landuse cover Modelar software. In addition, the flow, sediment load, total nitrogen and total phosphorus loads for the three different rivers in the Lake Tanganyika within Uvira city were determined.

Results

a) Land use change in the Mulongwe micro-catchment. Land use change in Mulongwe micro-catchment is presented in Figure 1 and the summary presented in Table 1. From 1974 to 2000, the major land use/cover in the micro-catchment was grassland with scattered trees (50.10% in 1974, 60.49% in 1986 and 72.96 in 2000). Forest cover decreased significantly over



Figure 1. Land use/cover of Mulongwe micro-catchment, Lake Tanganyika Basin, D.R. Congo.

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Uses	1974	1	1986		2000	
	Areas(ha) Percentag	e Areas (ha)	Percentage	Areas (ha)	Percentage	

205.80

202.19

1280.08

310.14

110.00

331.83

2116.51

0.00

8.30

9.73

9.56

60.49

14.65

5.20

0.00

0.39

15.68

100

208.44

148.41

13.53

125.50

0.00

0.00

76.51

2116.51

1544.11

9.85

7.01

72.96

0.64

5.93

0.00

3.61

0.00

100

9.46

31.33

50.10

1.60

4.31

1.00

2.20

0.00

100

200.17

663.01

1060.40

33.95

91.15

21.20

46.63

0.00

2116.51

Table 1. Land use change from 1974 to 2000, Mulongwe micro-catchment, Lake Tanganyika Basin,D.R. Congo.

time in the micro-catchment area, while cultivated land appeared as a new land-use within the catchment in 1986 and built-up areas in 2000. All the other land uses remained almost intact. In 1986, the swamp disappeared in favour of settlement and grassland. By 2000, the grassland had increased by 12% and the cultivated land disappeared.

b) Sediment and nutrients loads into Lake Tanganyika. Table 2 presents sediments and nutrient loads into Lake Tanganyika from the catchment, and is based on monthly measurements for a year. Kalimabenge has the highest flow and sediment load into Lake Tanganyika compared to Mulongwe and Kanvinvira. On the other hand, Mulongwe has the highest phosphorus and nitrogen loads.

Table 2. Sediment and nutrients loads into Lake Tanganyika.

Micro-catchment	flow m³/s	TSS mg/l	TP conc mg/l	TN conc mg/l	TSS load Mt/yr	P load t/yr	N load t/yr
Kavinvira	2.28	1472.04	0.062	0.63	104.5	4.40	44.74
Mulongwe	6.23	509.42	0.068	0.644	98.6	13.17	124.69
Kalimabenge	6.60	711.71	0.056	0.437	146.0	11.49	89.67

Recommendation

Built-up area Forest

Grassland

Woodland

Cultivated land

Lake

Total

Swamp

Grassland with scattered trees

There is need to:

- restore and maintain adequate forest cover in the selected micro-catchment, and thus reduce pollution of Lake Tanganyika.
- create awareness among all stakeholders including farmers, local leaders and policy makers on deforestation, the risk of

	 pollution on the stability of the catchment and the loss of bio-diversity in the Lake. identify best management practices in order to control soil erosion from agricultural land and increase their productivity.
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