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Participatory Geographic Information Systems (P-GIS) for natural resource management and food security in Africa

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Using P-GIS to reverse forest destruction

Comprehending the magnitude of problems in the Lower Tana River Basin

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The programme

The overall objective of this pan-african programme of research is to contribute to making available good quality, reliable and accessible information systems through the application of the P-GIS approach to improve natural resource management (water, land and forest in particular) and promote food security. The programme will also support social change in study countries (Benin, Kenya, Malawi, Rwanda, Senegal, Tunisia) by developing P-GIS as methodological tools for participation and to inform decision-making.

The Lower Tana River forest is located in the Tana delta along the coastal strip of Kenya as shown in Figure 1. The forest is under pressure from human activities such as illegal logging, cultivation, charcoal burning, overgrazing, and poaching. These activities threaten the sustainability of the forest biodiversity especially native species of trees and animal species (notably the Red Colobus monkey) as well as birds. Illegal cultivation of crops and settlements thus present a major threat to the integrity of the ecosystem. At the same time, livestock grazing continues to pose a major threat to the regeneration of the forest. Poaching of wildlife especially elephants, leopards, rhinos by Somalis has further exacerbated the biodiversity problem. The Lower Tana River Forest has thus become a remnant of a previously continuous forest that extended from central Africa to East Africa. It is a biodiversity hot spot and hence of great conservation value. The complex is the only habitat for two endemic primate species; Tana River red colobus and Tana River Mangabey. However, red colobus and mangabey are forest dependent and therefore the more reason to conserve. These two species are in the list of world's 25 most endangered primates. The forest is an outstanding example representing on-going ecological processes in terrestrial ecosystems. It is also home to the restricted Hunter's antelope. The forest hosts 61 plant species including Mangrove species (Figure 2) that are globally or nationally rare.

Figure 1: Landsat image showing the location of the Lower Tana River Forest

Proper management of Lower Tana River forest ecosystem is therefore crucial to the survival of the unique species, wildlife, biodiversity and thousands of people who depend on it for livelihood. This Kenya P-GIS study recently undertook to work with the communities living in and around the LTRF complex to trace the history of forest decline in order to draw awareness of the magnitude of the problem. This brief summarizes some of activities of the study and the key findings.

Figure 2: Mangrove forest along the Tana River. Note that the water is full of sediments

Why PGIS can arrest the decline in the Lower Tana River Forest complex

The recent upsurge in the implementation of GIS projects in local and indigenous communities has made it a useful tool for advocating for proper management of natural resources. GIS has continued to play an expanded role in the way spatial data is analyzed, our natural resources managed, viewed, and spatial phenomena understood. It has emerged as a popular field of GIS research for empowering the underprivileged groups. The practice (known as participatory GIS) is the result of a spontaneous merger of participatory learning and action methods with geographic information technologies. In this study PGIS and participatory resource mapping sessions were conducted with communities living in the forest to help them trace the trends in the decline of forest quantity and quality since 1970. Figure 3 below presents process of tracing the trends in forest decline undertaken during the study.

The participants of PGIS session listed and drew land use change mental maps showing some of the land resources within the forest and how these resources have changed over a period of 40 years. The features targeted during the drawing of the mental maps included natural forest mass, agricultural land area, water bodies, settlements and roads. The community considered these as the most important resources they depend on for their livelihood. From the community mental maps, agricultural land showed drastic expansion at the expense of forest

Figure 3: Community participants doing PGIS work

cover during the past 20 years. Most of the agricultural fields on the lower communities have been cultivated for less than 20 years. This decline in forest mass is captured by Figure 4 below.

Through the PGIS sessions, the participating community members noted that the flooding rate and flow volume of the Tana River has reduced over the past 40 years (Figure 5). The community associated these to silting of the river caused by increased agricultural activities. The silting has affected crop production by the communities living midstream. However it has not affected the communities near the Indian Ocean (i.e., downstream) because they depend on low and high tides from the Ocean which make the River to flood their agricultural lands.

Figure 4: PGIS maps showing changes in forest cover and agricultural land over time. From left to right: 1970, 1990 and 2011.

Figure 5: PGIS maps showing reduction of river flow volumes over time. From top to bottom: 1970, 1990 and 2011.

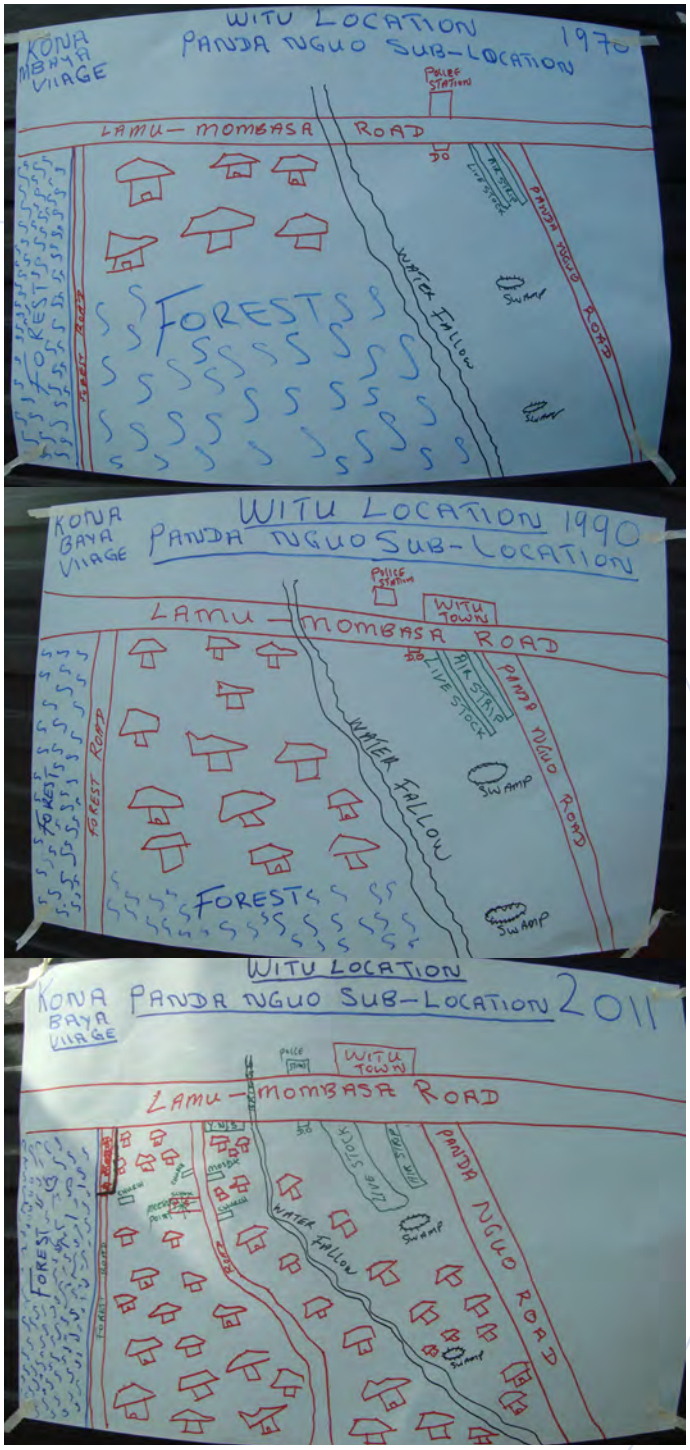

Figure 6: PGIS maps showing expansion of settlement area in LTR forest. From top to bottom: 1970, 1990 and 2011.

The PGIS session further noted that there has been an increase in settlements, roads and other social amenities in the area over time (Figure 6). The social amenities include schools and dispensaries in the area.

The PGIS participants outlined some of the problems they are encountering as a result of the land resource use changes from forestry to agricultural use in the study area. These include reduction in river flow volumes, erratic rains, high temperatures, disappearing of tree materials for making mats and boats. Most of the PGIS participants recommended the community managed regime as the most appropriate way to conserve the forest and hence biodiversity. The communities appreciated the PGIS forums for their diagnosis of the challenges they face and welcomed us for the final forum to discuss some of recommendations and the way forward to conserve the Lower Tana River Forest.