Sub-Programme 3: Water Resources and Environmental Engineering

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1. Abstract of the Paper presented at the **Conference on Collaborative Research for Technological Development**, held at Speke Resort Munyonyo, Kampala, Uganda on 17th to 21st November 2007. It was **Abstract No. 89** in the book of conference abstracts.

Title: A Preliminary Assessment of the Effects of Land Use and Cover Changes on the Water Yield of River Kafu Catchment in Masindi District, Uganda.

BY: Martin D. Tumutungire[1] and Gaddi Ngirane-Katashaya[2]

A mathematical model (The Coup Model) was used to carry out a preliminary assessment of the impact of land use and cover changes on the hydrology and water resources of the River Kafu catchment in Uganda. The catchment is delineated by the gauging station at River Kafu bridge on Kampala-Gulu highway.

The Coup Model simulates soil water and heat processes in many types of soil; bare soils or soils covered by vegetation. While the basic structure of the model is a depth profile of the soil, the central functional part is represented by two coupled differential equations for water and heat flow which are solved with an explicit numerical method.

The basic assumptions behind these equations are:

(i) The law of conservation of mass and energy and

(ii) Flows occur as a result of gradients in water potential (Darcy's Law) or temperature (Fourier's law).

The model is driven by meteorological data taken from the national Meteorological Stations while soil physical and plant physiological parameters for the model were taken from literature.

Model simulations of stream flow in River Kafu are used for identifying changes in the hydrological regime in response to postulated changes in land use or cover. The study combined the understanding and application of physical processes inherent in the catchment such as temporal evolution of evapotranspiration and runoff patterns.

Results revealed that the land use changes have not yet adversely affected the hydrological responses of the catchment. However reduced streamflows in River Kafu indicate long term reduction of catchment yield.

The results are a precursor for on-going research aimed at enhancing the capacity to develop and/or use decision support tools in land use planning and management of Water Resources in Uganda, especially at catchment level.

2. Abstract of Proposed Research Work

The study to be carried out is entitled, "The role of land use on water and carbon balances in a tropical rainforest".

The main objective of the study is to estimate the water and carbon balances in a tropical rainforest and assess how changing land use and climate impact on them. The specific objectives include:

- Making use of various sub models for estimation of the model input parameters.
- Testing and calibrating the CoupModel to describe water and carbon systems in a tropical rain forest
- Developing a simple annual water and carbon budget for the forest catchment.
- Estimating the changes in hydrologic conditions for postulated land uses e.g deforestation, sugarcane and palm oil plantations.
- Estimation of changes in the carbon balance for the same land use scenarios as listed above