DRAFT FACT SHEET ON ECOHYDROLOGY OF GREAT RUAHA RIVER

This fact sheet is produced by **RIPARWIN** (*Raising Irrigation Productivity And Releasing Water for Intersectoral Needs):* A DFID and IWMI – funded River Basin Management Research Project in Tanzania	**Authors**: Kashaigili J.J. & Rajabu K.R.M. **Date**: May 2003	**Location of Project**: MATI-Igurusi, Usangu Plains, Mbeya Region, Tanzania

Introduction

This fact sheet provides the summary information on the ecohydrology of the Great Ruaha River within the Rufiji Basin in Tanzania. It defines and explains the importance of understanding ecohydrology as a discipline that integrates the two areas of interest in river basin management namely ecology and hydrology. It also defines the terms ecology and hydrology. This fact sheet is therefore intended to add more facts into the current understanding of the interactions and interdependencies between hydrology and ecology thereby contributing to better management and conservation of our ecosystems and resources.

Ecohydrology - what is it?

Ecohydrology is a science, which seeks to describe the hydrologic mechanisms that underlie ecologic patterns and processes. It entails the functional interactions between hydrology and biota at the catchment scale.

Ecology is the study of interactions of organisms with each other and their environment. It is essentially a biological discipline that deals with the reciprocal relationships between all living organisms and their non-living environment.

Hydrology deals with the continual circulation, distribution, and interactions of water in the atmosphere, on the surface of the earth, and in the ground.

Ecohydrology is therefore defined here as the hydrology of rivers and wetlands with respect to the entire physical, chemical, and biological aspects of the system. It seeks to describe the effects of hydrological processes on the distribution, structure, and function of ecosystems, and on the effects of biotic processes on elements of the water cycle. It integrates the physical processes of hydrology with the biological processes of ecology. Together, these processes serve to regulate environmental conditions within aquatic systems, maintaining energy levels; water quantity and water quality within ranges suitable to the native flora and fauna. Ecohydrology brings an additional dimension of water management. It is a way to open up to this green wave, to apply methodologies in association with environmental solutions and co-operate with other scientists, ecologists in particular. It represents a way to share knowledge for a better identification of adapted solutions for the aquatic environment.

Why is ecohydrology important?

Ecohydrology is important for the management of river ecosystems because altered magnitude, timing, frequency, and duration of water levels disturb both terrestrial and aquatic communities of the large rivers. Improvement of impaired systems could result in significant economic benefits due to increased biotic productivity, as well as benefits associated with higher biodiversity. Ecohydrology, being an interdiscipline, aims at a better understanding of hydrological factors determining the natural development of wet ecosystems, especially in regard of their functional value for nature protection and restoration.

The Great Ruaha River (GRR) – Facts and figures

Physical and environmental characteristics

The Great Ruaha River is one of Tanzania's major rivers and an important tributary of Rufiji River draining an area of about 68,000 km^2. It is one of the three major river systems of the Rufiji River Basin, which is the largest basin in Tanzania, draining an area of about 177,000 km^2 (URT, 1995). The Great Ruaha River rises in the hills of the Usangu catchment, originating from a number of large and small streams at the Northern slopes of the Poroto and Kipengere mountains in the Southern Highlands between Mbeya and Iringa. From here it flows to the Usangu plains where several other rivers flowing from the highlands join it. The major rivers draining down to the Usangu Plains to join the GRR are Mbarali, Kimani and Chimala. During the rainy season, the Great Ruaha River spills onto the Usangu plains, forming the Usangu wetlands (Western-*Utengule* and Eastern) and feeding a perennial swamp (*Ihefu*) within the Eastern wetland. Water exits the Eastern wetland at Ng'iriama as the Great Ruaha River, then flows through the Ruaha National Park, providing the main water source to the park, collects the Little Ruaha River before being joined by the Kisigo River. It then passes through the Mtera reservoir (accounting for 56% of the runoff to the reservoir), before flowing westward to the Kidatu reservoir, being joined on the way by the Lukosi and Yovi rivers. From the Kidatu reservoir the GRR flows into Kilombero Plains before joining the Rufiji River (just above Steigler's gorge).

Water Users and Uses

The Great Ruaha Catchment is very important for supplying water to GRR and to downstream users and uses. The major users and uses include:

- Rural and urban domestic water supply;
- Agriculture (both rain fed and irrigated). Valley-bottom cultivation (Vinyungu) is widely practiced during the dry season in meeting the livelihood of the rural poor. Crops grown include paddy, maize, millet, cassava, sweet & round potatoes, beans, sugarcane, fruits and vegetables;
- Planted forests (e.g., Eucalyptus, pines) and natural vegetation (e.g., miombo woodlands, baobab trees, grass and bushes);
- Seasonal and permanent wetlands;
- Livestock grazing in the riverbanks, *Ihefu* and *Ifushiro* swamps;
- Fishing activities (in Mtera dam, the wetlands and rivers), brick making (along river banks);
- National Parks and Game Reserves (the Ruaha National Park (RNP), Usangu Game Reserve, Selous Game Reserve); and
- Mtera and Kidatu hydropower plants.

Available Water Resources

Rainfall

- Rainfall in the GRR sub-basin is extremely seasonal, highly localised and spatially varied.
- Two rainfall seasons, one rainy season (November to May) and one dry season (June to October).
- Mean annual rainfall in the plains (semi-arid climate) is about 500 mm
- Mean annual rainfall for the highlands is ranges between 1400 – 1600 mm

Runoff

- Runoff pattern is closely related to the rainfall pattern.
- The GRR starts rising in December with a peak in March-April.
- The GRR, with a mean flow of 140 m^3/s as it enters the Mtera reservoir, is completely regulated at the reservoir, thereby altering its hydrological regime as it flows downstream of the reservoir.

Groundwater

There is no adequate data on the groundwater resource of the Great Ruaha sub-basin. The only few available data are those from few drilled boreholes in the past years. No monitoring wells are currently available.

Water Quality

Available data show that the chemical quality of surface water sources is good, salinity of surface water is low and hence the water is good for irrigation purposes (SMUWC, 2001; Rajabu, 1997; Riddell, 1994). Bacteriologically, surface water sources are generally polluted. Even most of the analyses from the water supply schemes in the basin, which use surface water, show bacteriological contamination far above-recommended values. Turbidity was observed to be very high during the just ended rainy season.

Data on sediment transport is very limited. There is therefore a need to undertake new suspended sediment concentration measurements.

Current situation and changes in the flow regime of the Great Ruaha River

The Great Ruaha River flow regime has changed significantly with time. The changes in the river hydrology are dry-season changes, with dry season flows declining since the early 1970s. Nevertheless, the analysis of wet season flows for the Great Ruaha River show no long-term trend. Part of the Great Ruaha River, between the perennial swamp (*Ihefu*) and the stretch through the Ruaha National Park has first dried up during the dry season in 1993. Since then, the Great Ruaha River has continued to dry up each year with the period extending longer and longer during the dry season. The most common dry period is between September and December, but in some years the river dried even earlier and extended to March of the coming year. For example on 09/10/2003 the river ceased to flow at the Ng'iriama exit. This declining and drying of the river impacts the biodiversity and other water users.

Why is the Great Ruaha River drying up in the dry season?

The Great Ruaha River ecosystem has been highly disturbed by human intercession that has malformed significantly the river flows due to extensive upstream abstractions and dry season agriculture to all its joining rivers. This has greatly impaired the flow regime of the Great Ruaha River leading to flow cessation in the dry season. The ultimate effect is the ecological stress to flora and fauna.

Among other factors, irrigation on the Usangu plains is the main reason for this seasonal drying of the Great Ruaha River. During the dry season, irrigation is taking almost all the water that used to keep the Great Ruaha River flowing. For example it was observed during the last dry season (2002) that all the rivers draining down to the Usangu Plains, except Mbarali and Kimani rivers, were completely dry downstream of irrigation schemes from September to December.

The Ruaha River has changed its course during the wet season of the year 2000, and formed two channels at Ukomolinyi; one going to Ifushiro swamp through Mpapai and the other flowing to join Kimani River. However, 65% of the water flowing to Kimani River is diverted to Ifushiro swamp through Mapereme.

During the dry season (September-December) all the water flowing to Ifushiro swamp disappears within the swamp and does not rejoin the Great Ruaha River.

Impacts for the drying-up of the Great Ruaha River

GRR being an ecosystem by itself has been a potential habitat for mammals and predators that depend on it. Seasonal drying-up of the river has resulted into the following:

- Migration of hippos, birds and other animals away from the Ruaha National Park to upstream areas in search for water, while aquatic animals are visibly stressed from living in ever shrinking pools. This has a direct impact on tourism in the National Park;
- Suffering of villagers from water shortages as the rivers they once relied on now dry up. At the height of the dry season, women need to walk up to 20 kms to find water. This is very common in villages like Ukwaheri and Madundasi in Usangu Plains;
- Impact on peoples' economic livelihoods; there is less pasture available, fewer water sources for livestock and wildlife, previously cropped areas are now abandoned, and fish production has diminished;
- Conflicts arising from water shortages during the last dry season (2002), especially in the Mkoji sub-catchment;
- Death of some species of fish leading to loss of animal biodiversity;
- Change of behaviour of some animals, such as crocodiles embarking on eating baboons.

Is there a way of improving and ensuring a year round flow? If yes how?

There is potential for improving the year round flows for the Great Ruaha River. In this case, much water must be allowed to reach the river during the dry season. It can be hypothesized here that unless more water is allowed to go past the irrigation areas, the river will continue to dry up. Key to this is improving water and crop management within the irrigated areas, while still maintaining people's livelihoods. The provision of environmental flows is so vital here.

The on-going strategies

A realisation on the importance of ensuring ecosystem health through restoration of flows of GRR has started. The following ongoing strategy is worth noting:

- The Rufiji Basin Water Office through Sustainable Management of the Usangu Wetlands and its Catchment (SMUWC) project initiated the gate closure programme in the perennial rivers since the year 1999. The gates are closed every 1st July each year, directing water to its river course with only limited flows for maintaining the canals and domestic uses. However, the current RIPARWIN monitoring on the gate closure programme indicate that the programme is yet to register significant contribution in solving the problem of the drying of the Great Ruaha River as it has continued to dry up in the dry season.

Concluding Remarks

All living things need water to survive. Water in streams, rivers and wetlands allows plants to grow and keeps fish, insects and mammals healthy. It is also a peoples' basic need and important for the livelihoods of the poor. Water therefore needs to be used in a way that safeguards these benefits. Since every drop of water that humans take comes from the natural environment, there is a need to plan for the wise use of water to make sure that there is enough for meeting the needs while protecting plants and animals from damage. The authors hope that through these insights into our current understanding of the interactions of hydrology, water quality, and biological communities, in the Great Ruaha sub-basin, this Fact Sheet might contribute to better understanding on the need for the management and conservation of these unique ecosystems and resources.

NOTES:

More clarifications? We hope that you have found this leaflet interesting and useful. We are still collecting more data, through our research, on the many aspects of the ecohydrology of the GRR. Once the analysis of the data is completed, we will produce an updated version of this fact sheet. However, in case you have any comment, suggestion or question kindly please contact the RIPARWIN team:

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