



Overview of Hydrology, Water Resources Assessment & Availability for Agriculture in Great Ruaha River, Tanzania

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Research Workshop for the CLIVET Project

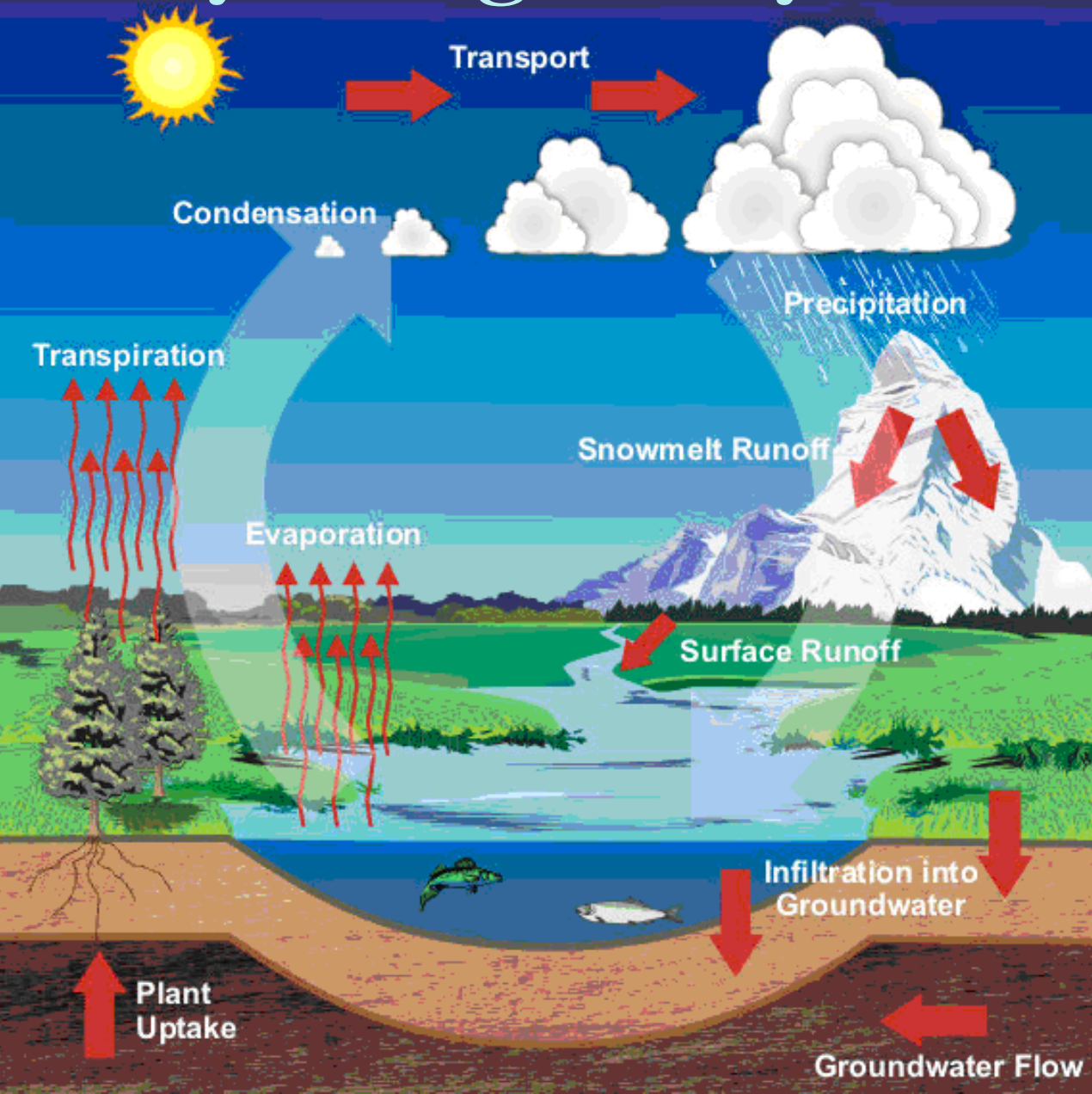
Copenhagen, Denmark 23-31 Aug. 2010



Presentation Outline

- Introduction
 - Land phase of hydrological cycle: key to WR Assessment
 - Tanzania, country profile
 - Rufiji River Basin
 - Important Ecosystems: Ramsar sites, Forests, Parks, Reserves
 - Physical features of catchment area: Valleys & Upland areas
- Hydrology & Water Resources of the Great Ruaha River (GRR)
 - Water towers, Usangu wetlands and river network
 - Social Economic Issues: Hydropower, Irrigation & Livestock
 - Water availability for agriculture - An approach
- Research Entry Point and Interests
- Need for capacities in Integrated Watershed Management
- The End, Lets Manage Water in an Integrated Manner !

Hydrological Cycle - Land Phase

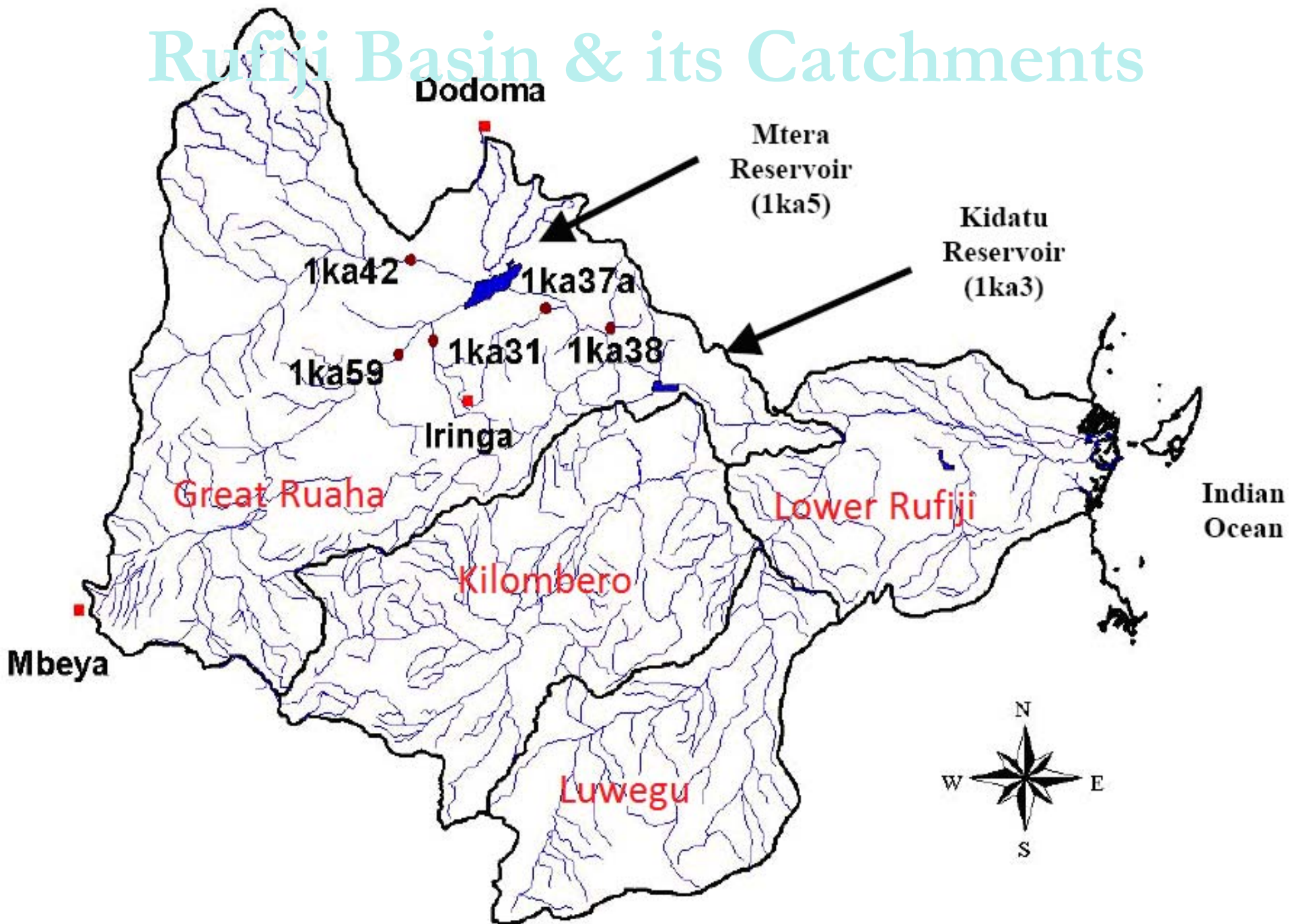


Schematic
Picture of Land
phase of the
Hydrological
Cycle (Internet,
2010), an
important
concept for
Water
Resources
Assessment for
a river basin

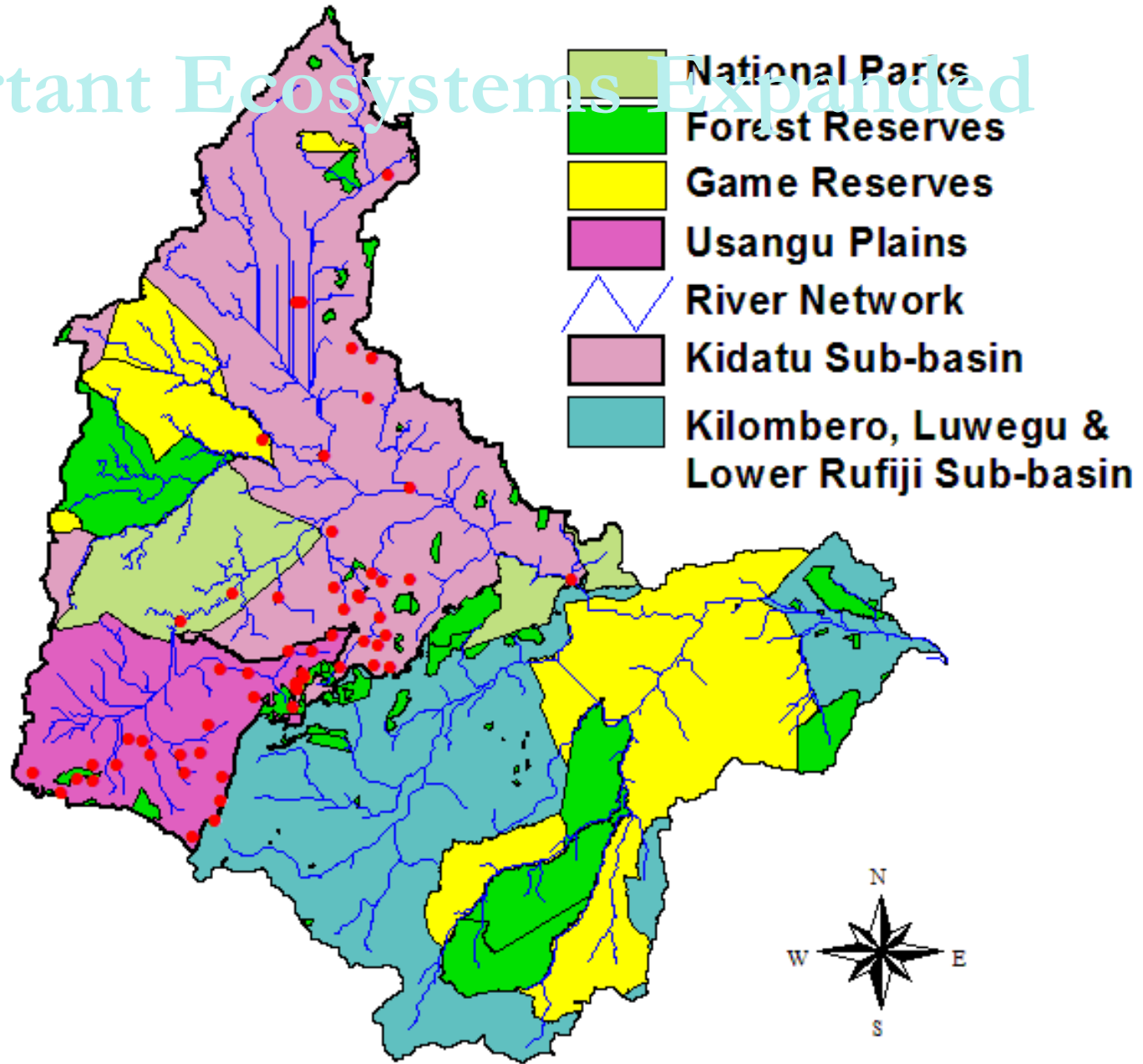
The Rufiji River Basin

- The **Rufiji drainage basin** covers about 177,420 km² (i.e. about **20% of the mainland** & is the largest in Tanzania)
- The **Rufiji-Mafia-Kilwa (RMK) Ramsar Site** is formed by the protruding **Rufiji Delta** into the Indian Ocean
- The basin includes **important catchment areas and inland deltas** such as the **Usangu Flat (Ruaha River)** and the **Kilombero Valley Floodplain (Kilombero River)** of which the latter has **Ramsar Status**. Also, it hosts **3 hydropower**
- The land use practices upstream in the upland areas of Rufiji Basin have an important bearing on the downstream areas and the whole Rufiji area because **contributory rivers** are responsible for the **dynamics of flows**

Rufiji Basin & its Catchments



Important Ecosystems Expanded



300

0

300

600 Kilometers

Rufiji River Hydrology

- The **mean annual flow** of the Rufiji River is about **900 m³/s** at its outflow to the Indian Ocean, however, this figure covers large variations between dry and wet seasons and between years
- The Rufiji River rises in various tributaries, principally from the **South-western Kipengere** and **Livingstone Mountain** Ranges. These tributaries provide more than **90 % of the total flow of the Rufiji River**, and the largest of these tributaries is the **Kilombero River**, contributing up to **62 % of the total flow** in Rufiji River

Great Ruaha River Catchment

- From the headwaters in forests on the Livingstone Mountains and the Kipengere Mountains, the Great Ruaha River descends to the Usangu plains (Upper GRR Basin)
- The Usangu plains (20,811 km²) are about 12% of the entire Rufiji Basin
- The Usangu plains are critically important region in Tanzania for irrigated agriculture (mostly rice) and livestock
- The wetland system of the Usangu plains is also important for the households around the area and for the adjacent Usangu Game Reserve
- From Usangu wetland, the GRR flows thru the RNP (10,300 km² - Kashaigili et al., 2005, covering about 13% of the Ruaha River Catchment)

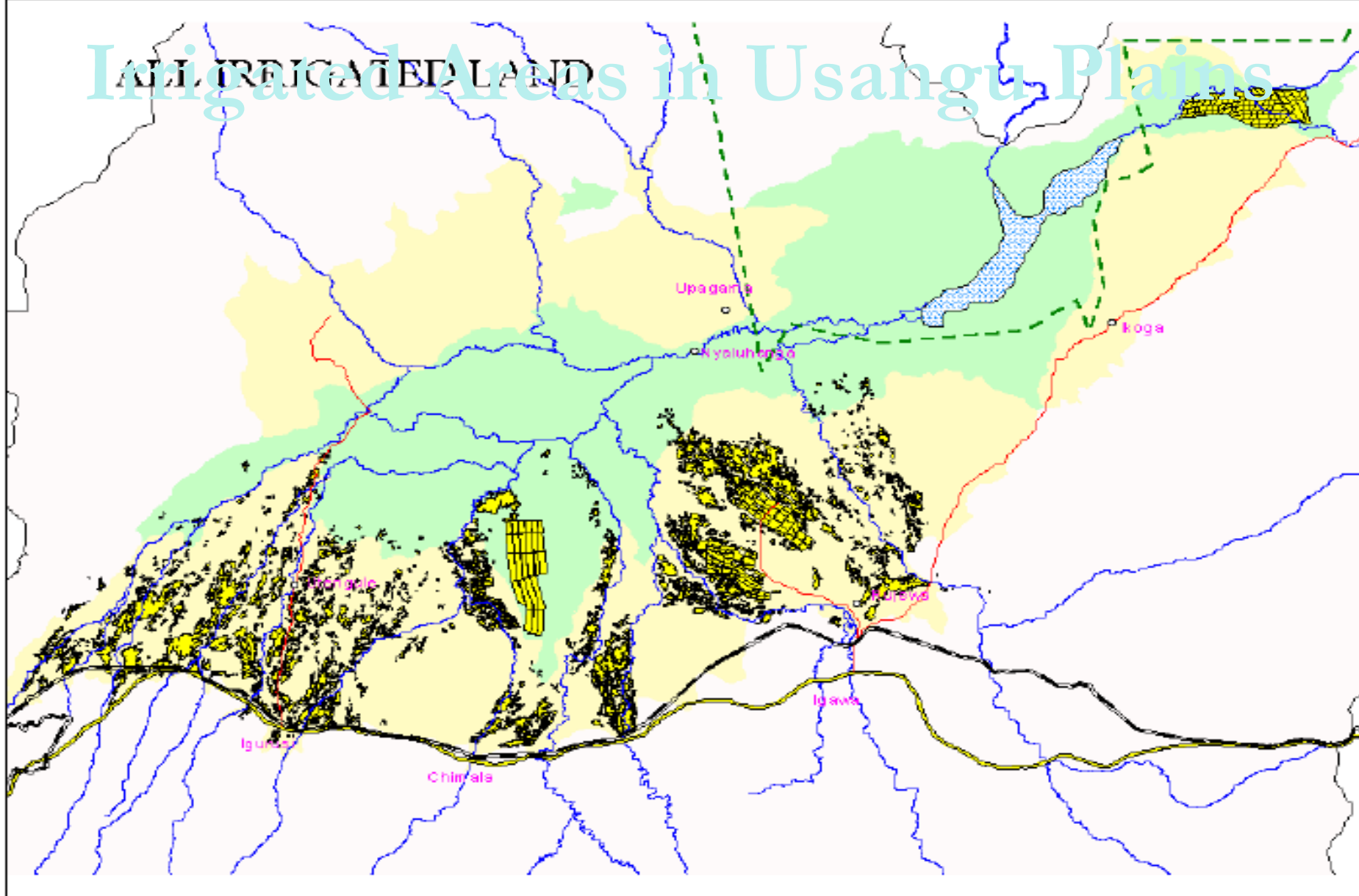
Great Ruaha River Hydrology

- Tributaries of GRR – **Major ones**: Mbarali, Kimani & Chimala; - **Small ones**: Umrobo, Mkoji, Lunwa, Mlomboji, Ipatagwa, Mambi & Mswiswi
- GRR flows as a single river through western wetland & a constriction at Nyaluhanga to supply the eastern wetland including a perennial swamp (Ihefu)
- The Great Ruaha River supplies about 15 - **20 % of the total flow** of the Rufiji Basin system

Mtera Reservoir inflow, flows & GW

- GRR provides about 56% of the total runoff to Mtera Reservoir (68,000 km² upstream of reservoir)
- Little Ruaha River, which joins the GRR d/s from the Usangu Plains provides an additional 18%
- Kisigo River provides 26% of the total runoff to Mtera (Kashaigili et al., 2005)
- Mean river flows (cumecs): 160 (1KA3 - Kidatu); 520 (1KB17 - Kwa Swero); 800 (1K3 - Stiegler's Gorge) (Yawson et al., 2006)
- There is relatively low groundwater potential in most parts of the basin (DANIDA/WB, 1995)

Irrigated Areas in Usangu Plains



Yellow area: irrigated lands; Green area: seasonal wetlands; Blue area: permanent wetlands

- Sources: SMUWC (2001) and RIPARWIN (2001?)

Major Irrigation Schemes

- Mbarali irrigation scheme (farm offtake)
(abstracting 2000-4000 l/s)
- Kimani irrigation scheme (200-500 l/s)
- Mbarali River (150-200 l/s)
- Kapunga irrigation scheme (600-1200 l/s)
- The above figures were for the wet season?,
Mwakalila, 2005
- Use of water resources assessment (rainfall,
evaporation, flows & losses) in order to come up
with water resources availability for agriculture

Assessing Water Availability

- Water supply (rainfall & river flows) patterns
- Water use (demand) patterns (evaporation & consumption)
- Water availability patterns (supply versus demand)
- Rainfall, evaporation & losses influence available water resources and can facilitate assessment of water resources in the basin; Flows analysis for understanding river flows characteristics in the basin & for model calibration
- Estimation of water abstraction from the rivers based on Irrigation Water Requirement & area under irrigation (about 90% of the area in the basin (Usangu Plains?) is under rice irrigation, Mwakalila, 2005)

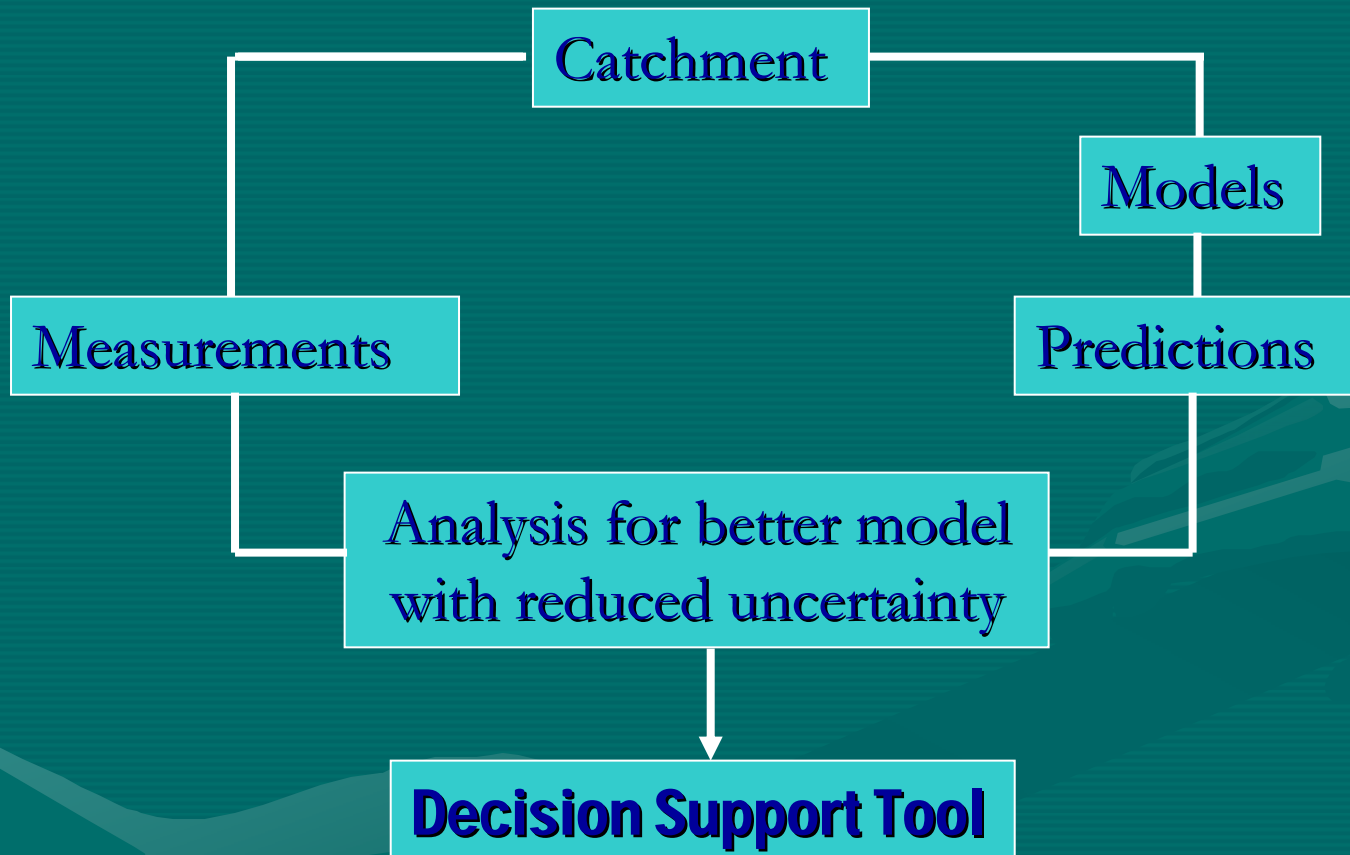
Research Entry Point

- The dynamics of water resources of the upper catchment areas of the Rufiji River Basin is not fully known : **WP 2**
- While, **flooding downstream** and the **hydrologically dynamics of the delta** is closely linked to the water catchments i.e. the Rufiji Floodplain, the Selous Game Reserve, and the sub-catchments of the **Luwegu, Kilombero and Great Ruaha Rivers**
- The huge Rufiji River Basin combined catchment area contains **two National Parks** (Ruaha and Udzungwa), **several Game Reserves and dams** containing more than **80%** of the hydropower generating capacity of the country
- If the **situation** in the catchment is **significantly altered** (CC, LULCC: **WP 1&3**) it will have consequences for the **downstream Ramsar Site and Social Economic Activities**

Research Interests

- Rivers are no longer perennial (became seasonal)
- During dry season, water resources are inadequate to meet domestic, livestock and crop production needs in the Great Ruaha River catchment
- Migration to irrigation areas to support livelihoods
- Encroachment in and around wetlands have contributed to catchment degradation
- Water pollution in densely populated areas
- Use of Decision Support Tools (**with rainfall for ungauged areas**), which integrates CC and human activities for planning, allocation and management

Decision Support Tool



- ◆ The tool can be used to account, link and monitor water resources in watersheds and assess impacts

Thank you for listening !

Lets Manage Water Integrally !

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