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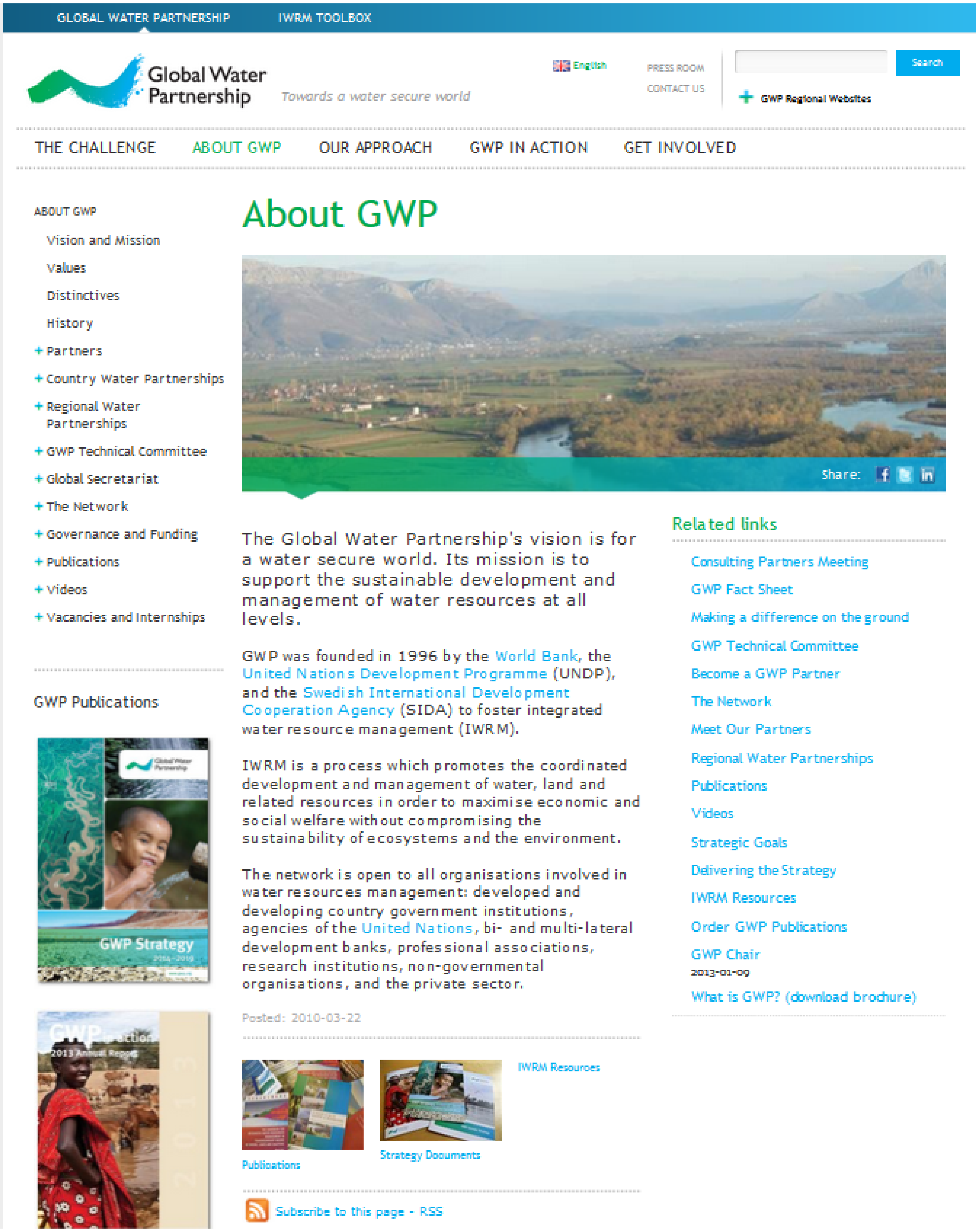

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TANZANIA – CRITICAL ANALYSIS OF RIVER BASIN MANAGEMENT IN THE GREAT RUAHA   CASE #121

Analysis of existing river basin management frameworks, multi-user perspectives and competition for water resources in the Great Ruaha River Basin, Tanzania.

ABSTRACT

Description

This case study describes different responses to growing water scarcity in the dry season in the Usangu Plains, a catchment of the Great Ruaha River in South-West Tanzania. The analysis – based on results of two DFID (Department for International Development) projects, SMUWC (Sustainable Management of the Usangu Wetlands and its Catchment) and RIPARWIN (Raising Irrigation Productivity and Releasing Water for Intersectoral Needs) – incorporates a critical examination of the appropriateness of newly established river basin management structures to the problems and issues found.

The Great Ruaha River is of national importance in terms of the utilisation of its water for significant rice production, maintaining a RAMSAR wetland site, meeting the ecological needs of the Ruaha National Park and the generation of hydro-electric power. Thus six main water resource users from upstream to downstream can be differentiated here:

- Rainfed farmers and domestic water users in the high catchment;
- Irrigators in the plains at the base of the escarpment;
- Domestic users and rainfed maize cultivators in the plains;
- Pastoralists and fishermen and women in the central wetland;
- Wildlife and tourists in the Ruaha National Park that surrounds the riverine reach;
- The Mtera/Kidatu hydropower schemes.

During the early nineties, a series of zero flows in this previously perennial river alerted the authorities to hydrological and environmental change in the Usangu Plains in the Upper Ruaha Basin. The research projects, in collaboration with the Ministry of Water and Livestock Development and other partners, examined the causes of the drying up of the river and proposed solutions.

Lessons learned

Several lessons are provided by this case study:

- The critical role and benefits of long-term, large-scale, interdisciplinary research;
- The difficulty in addressing entrenched views of ‘normal professionalism’ (a term used to describe a rather inflexible discipline-focussed approach) or the powerful local elite that result in maldistribution of water or inappropriate natural resource management;
- The need for local water development solutions to manage basin-level water scarcity.

Importance for IWRM

A key conclusion is that managers of IWRM should continuously review and enrich the knowledge base, perceptions and processes of hydrological and system change in river basins with the aim of refining ‘an appropriate institutional response’. In other words, we should not be satisfied with what *appears* to be an integrated water resources management approach, but critically unpack its components and identify modes of IWRM that are fully cognisant of the science, issues and responses at stake, and therefore deliver effective tailored solutions.

Main tools used

B1.3 River basin organisations;
B2.2 IWRM capacity in water professionals;
C1.2 Water resources assessment;
C6.2 Regulations for water quantity.

MAIN TEXT

1 Background and problems

The background to the issues is best described via the rationale for the project "Sustainable Management of the Usangu Wetland and its Catchment" (SMUWC) which resulted from national and local concerns about the management of water and other natural resources in the Usangu Basin in Southern Tanzania (see Figure 1). In particular, national power shortages in the mid nineties were attributed to low flows to the Mtera/Kidatu hydropower schemes from the Ruaha River. A reduction in low flows in the Great Ruaha, where it passes through the Ruaha National Park, was also noted. There has now been a succession of years in which the river in the park has dried up completely during the dry season, and for increasing periods. An increase in competition for water was noted in Usangu itself, leading to conflict and sometimes violence. Concern was also expressed that the wetlands in the project area were diminishing and were becoming degraded, and that a valuable natural asset was being lost.

The Usangu Basin, or Upper Ruaha Basin, covers an area of 21,500 km^2 and forms the headwaters of the Great Ruaha River, itself forming a major sub-basin of the Rufiji River. Usangu may be broadly divided into the central plain and a surrounding higher catchment. On average, the plain receives 600-800 mm annual rainfall, and the high catchment up to 1500 mm. Most of the rain falls in one season from mid-November to May.

Six water resource users are differentiated:

- Rainfed farmers and domestic water users in the high catchment;
- Irrigators on the plains at the base of the escarpment (see Figure 2);
- Domestic water users and rainfed maize cultivators on the plains;
- Pastoralists and fishermen and women in the central wetland;
- Wildlife and tourists in the Ruaha National Park that surrounds the riverine reach;
- The Mtera/Kidatu Hydro Electric Power (HEP) stations of the Tanzania Electricity Supply Corporation (TANESCO).

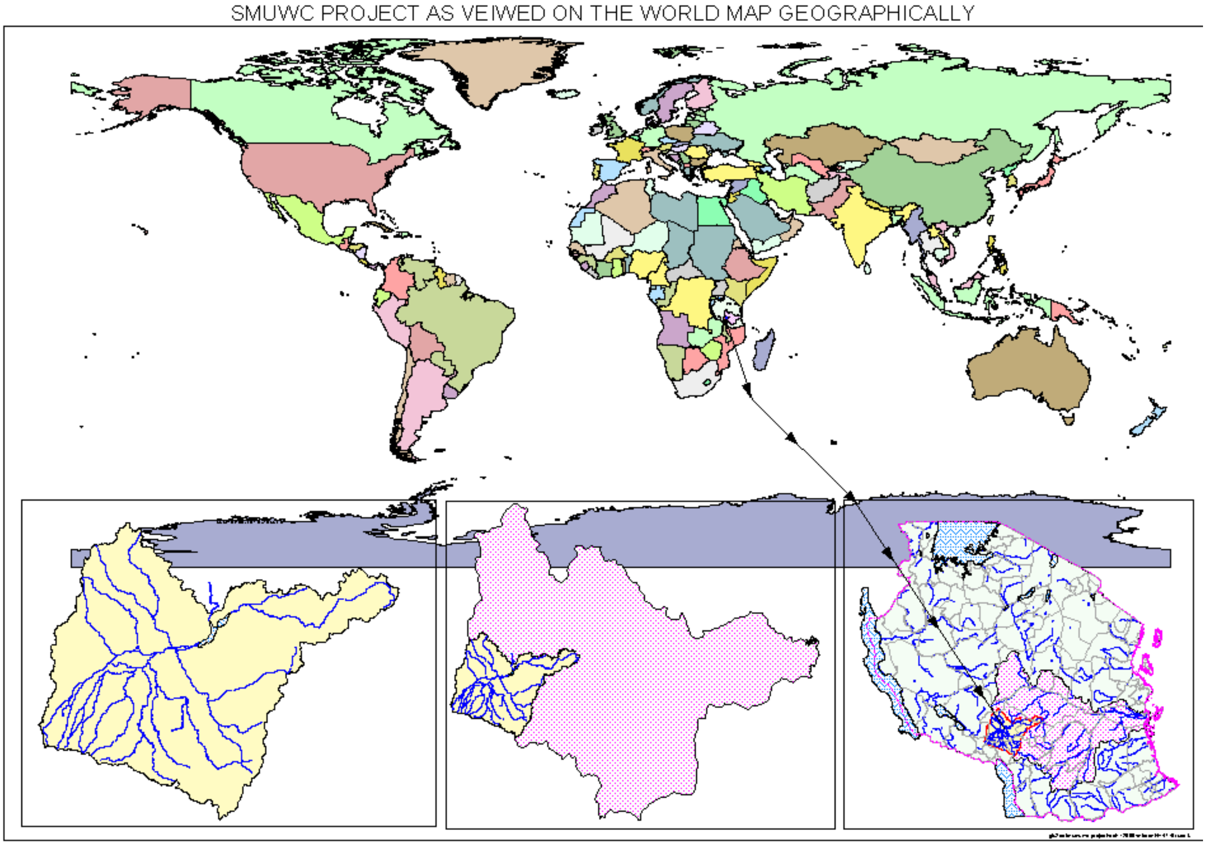
Below the HEP stations, the river has no further significant user, and after joining the Kilombero River, it flows perennially to the sea with practically no depletive use.

There are five perennial rivers and a large number of seasonal streams draining from the high catchment. Surface flows, rather than groundwater, are used for domestic and agricultural purposes because there is less groundwater and it is more difficult to determine its location. Most irrigation is located on the upper parts of the plains and consists of a number of different types of farms including large-scale, state-owned 'farms'; traditional smallholder; improved smallholder, and smallholder peripheral to the state farms. The total irrigated area ranges from 20,000 to 40,000 ha depending on annual rainfall. The large state farms are Kapunga (3000 ha), Mbarali (3200 ha), and Madibira (3000 ha).

Downstream of the irrigated areas, drainage discharges into smaller streams and swamps located towards the tail of the alluvial fans. Some streams reach the Ruaha River, the main channel supplying the wetland. Beyond the alluvial fans, the plain consists of savannah, woodlands and seasonal wetlands, and at the deepest point, a perennial wetland. At the end of the perennial wetland, there is a rock bar. When the water level in the perennial wetland is low, no water leaves the wetland. As the water level rises, water spills over the lip into the Great Ruaha River. Although the swamp is a maze of channels and lagoons, many of which are at different levels, it can be represented conceptually as a simple reservoir with a fixed spillway. After leaving the wetland, the Great Ruaha River is joined by a number of ephemeral rivers as it flows through the Ruaha National Park. Downstream, the Great Ruaha and a number of other rivers discharge into the Mtera Reservoir. Besides having an 80 MW generating capacity of its own, the Mtera Reservoir also acts as a regulating reservoir for the larger 204 MW Kidatu hydropower scheme further downstream.

Mbarali District is the largest district in the basin, covering 54% of the area. Other districts in the project area are Iringa Rural, Mufindi, Njombe and Makete in Iringa Region, and Mbeya Rural and Chunya in Mbeya Region.

Figure 1: Location of the Usangu Plains or Upper Ruaha Basin as a sub-catchment of the Rufiji Basin in Southern Tanzania



2 Decisions and actions taken

In the Usangu Plains, essentially three key river basin programmes have been devised and implemented under the Ministry of Water and Livestock Development (MoWL) within the last five years. These are:

1) *The Rufiji Basin Water Office (RBWO).*
   Basin Water Offices represent the new basin structure that the MoWL is gradually implementing nation-wide, with the Rufiji, the Pangani and Lake Victoria as the first pilot basins. A sub-office for the Usangu Plains in Rujewa, Mbarali District, was opened in 2001. The main activity of this sub-office is the issuing of water allocations.

2) *The River Basin Management and Smallholder Irrigation Improvement Project (RBMSIIP).*
   This project started in 1996 and is funded via a World Bank loan. The aims are:
   (i) To strengthen the government's capacity to manage water resources and address water-related environmental concerns both at the national level, and in the Rufiji and Pangani Basins (the river basin management (RBM) component under the MoWL);
   (ii) To improve the irrigation efficiency of selected traditional smallholder irrigation schemes in these two basins principally by the construction of concrete weirs and intake structures with control gates (the SIIP component under the Ministry of Agriculture and Food Security).

In the Usangu Plains, the RBM component is funding the sub-office of the Rufiji Basin Water Office. Also, two concrete intake structures have been constructed in streams shared by a number of traditional irrigation schemes under the SIIP component of the project.

3. *The "Sustainable Management of the Usangu Wetland and its Catchment" (SMUWC)*. SMUWC ran from 1998 to 2002. The direct client of this DFID-funded project was the MoWL (Rufiji Basin Water Office). The project also worked closely with the district administrators of the project area, as well as with the Ministry of Agriculture and Food Security. SMUWC intended to investigate the nature and causes of hydrological changes, and to assist the Government of Tanzania and key stakeholders (both local and national) in the development of a sustainable natural resource management strategy. Ultimately, it expected to contribute to the maintenance and improvement of rural livelihoods. It had four main outputs:
   - i) Understand the hydrological behaviour and water quality functions of the Usangu wetlands and their catchments;
   - ii) Assessment of the land resource utilisation, biodiversity and environmental impacts of management options in the Usangu wetlands and their catchments;
   - iii) Assessment of causes of conflict, community management options and institutional process relating to the natural resources of the Usangu Wetlands and their catchments;
   - iv) Increase local capacity (at different levels and in different institutions) to develop and implement an integrated natural resource management strategy, i.e. assist Rufuji Basin Water Office (RBWO) and provide policy guidance for the World Bank River Basin Management and Smallholder Irrigation Improvement Project (RBMSIIP).

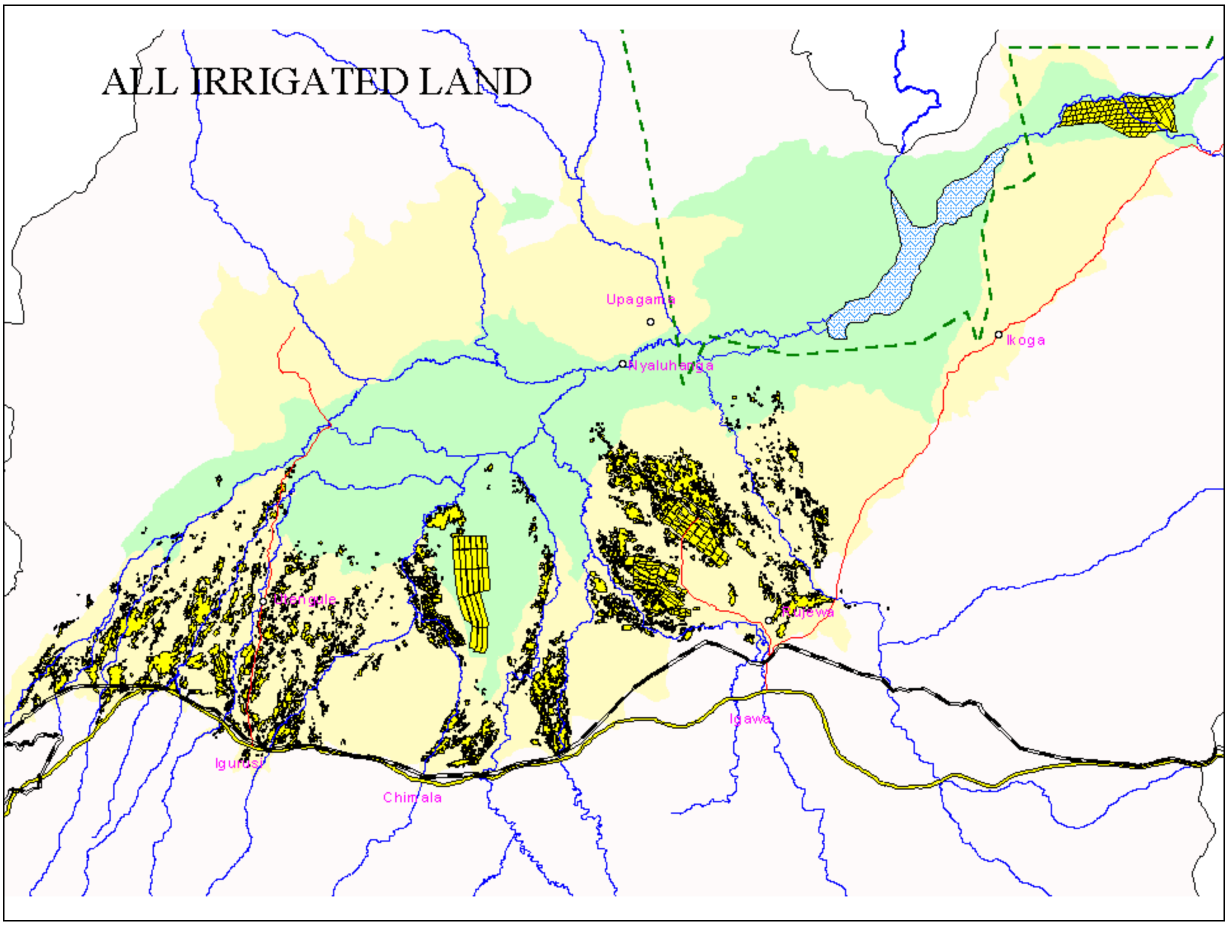
In partnership with the World Bank project, SMUWC contributed to the drafting of a national water policy, strengthening of basin management institutions and the rehabilitation and upgrading of the hydrometric network. In addition there were a number of specialist studies, the outcomes of which were shared. These included: groundwater assessment, catchment degradation and conservation studies, surveys of water use and water rights, participatory basin management, and water quality and environmental pollution monitoring. In partnership with the Rufiji Basin Water Office, SMUWC initiated a canal closure programme, designed to ensure that there was less water abstraction from three key rivers feeding the wetland. To this end, negotiations with three main state farms reduced their water allocations during the dry season to distribute just enough water for domestic uses.

To a lesser extent, the DFID/IWMI (International Water Management Institute)-funded 'Raising Irrigation Productivity And Releasing Water for Intersectoral Needs' project aims to continue to study the role of irrigation efficiency and productivity in releasing water for intersectoral needs. The main partners in this collaborative research are Sokoine University of Agriculture, the Overseas Development Group of the University of East Anglia, and the International Water Management Institute.

Besides these programmes, the Mbarali District Local Government, with the support of the Ministry of Natural Resources and the Ruaha National Park, pursues far-reaching land use measures to control livestock on the plains (so-called "Botswanisation"). These actions aim to conserve the Usangu Wetland and return to a perennially-flowing Great Ruaha. For example, in 2000, the area between the permanent wetland and the Ruaha National Park was defined as the Usangu Game Reserve. This implies that, formally, all human activity is prohibited. Also, in March 2001 the Tanzanian Prime Minister (probably galvanised by WWF Tanzania) declared to the Rio+10 Summit in London that the river should return to year-round flow by 2010. Since 2001 in the permanent wetland, major force has been applied to oust pastoralists and poor fishing families.

In addition, other possible projects are being formulated that seek to support the return of a perennially flowing Ruaha.

Figure 2: Location of irrigated lands within the Usangu Plains



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

3 Outcomes

This section critically describes three important outcomes of the above actions.

Contested Water Resources Assessment

SMUWC and the Ministry of Water and Livestock developed a hydrological model and a monitoring programme that suggested multiple causes of the changes in the Ruaha and wetland flow regimes. The model tested results of “what if” scenarios, such as the canal closure programme designed to ensure that dry season flows were untapped by major irrigation users. In addition, by undertaking monthly spot measurements in key locations throughout the plains, SMUWC pinpointed the exact losses of water.

These assessments challenged the original assumptions that the wetland shrinking and the zero flows in the Ruaha were mainly due to overgrazing and excessive consumption of water by livestock and a reduced ability of the wetland to act as a ‘sponge’ holding back water for later release into the Ruaha. The studies also refuted the strongly held belief that climate change and deforestation had caused a reduction in the baseflows of rivers flowing off the escarpment. Thus, the presence of an estimated 40-50 cumecs abstraction capacity from a total of 100-130 intakes on the plains was shown to play a more important role in dry and wet season hydrological change than climate change or deforestation. Yet the probable major cause of the electricity cuts in the Mtera/Kidatu hydropower plants was not water shortages in the Upper Ruaha (irrigation in Usangu uses 25-35% of the Great Ruaha, itself a proportion of the inflows into Mtera) but, rather, mismanagement of the drawdown curve and excessive releases to maximise electricity generation. In addition, the analysis showed how evaporation from rivers flowing onto the plains and feeding wetlands results in significant *natural* water losses. This factor makes outflow from the Usangu wetland highly sensitive to abstraction during the dry season when natural river flows are already diminished. Thus, below a certain threshold of about 6 to 7 cumecs entering the wetland, effectively no flow leaves the area.

Yet powerful downstream stakeholders contested these results in order to protect and even expand their existing land and water use and practices, blaming poor farmers upstream in the basin of overuse, thereby expecting them to release water. The electricity corporation continues to maintain that upstream irrigation reduces water inflows. Ruaha National Park's interest groups continue to seek dry season compensation flows. Similarly, in the case of the Usangu wetland, political expediency regarding the hydrological analysis 'allows' the Mbarali District Government to actively seek the removal of vulnerable fishermen and women and pastoralists whose livelihoods depend on the wetland. The Government argues that these users degrade the wetland by having too many livestock (another analysis that is contested).

Contested Water Allocations

The Rufiji Basin Water Office has been charged with the introduction of water allocations and fees at all irrigation intakes on the Plains and has records of approximately 300 irrigation users. These allocations are flow rate based (e.g. 0.6 cumecs), and focus on wet season rice – though allocations are generally halved for the dry season. Interestingly, few irrigators interviewed by the SMUWC team had ever met an RBWO officer and irrigators rarely knew if their association or co-operative possessed a traditional or formal RBWO water right.

While the water allocations promoted widely by the RBWO appear elegant (a simple flow rate) and may have worked in other countries, they may not be appropriate in Usangu. This is for a number of reasons.

In some cases, the allocations are simply water duties (command area multiplied by 2.0 l/sec/ha) without being reconciled with available water or downstream needs, in which case such water is not effectively available. In other cases, allocations are not determined in a transparent way; they are not related to the command area or crop water requirements, but appear to be based on traditional rights, de facto rights, whatever is available during the peak flow period, or on unexplained reasons. In addition, because rivers change dramatically from wet to dry seasons, and from wet to dry years, the Usangu approach of fixed allocations only works for 'statistically mean' flows. In dry years, the allocation is greater than the available water, legitimising the abstraction of water until the river is left dry. Conversely, for wet years, the allocation is less than the water available, and probably less than the actual abstracted amount, because intake gates are surcharged with high flows.

Relating water use to allocation is problematic, as it is unlikely that water will ever be metered or monitored and so farmers may take more than they have been allocated. Furthermore, with a fixed payment for their allocation, farmers may be inclined to use more water than necessary.

RBWO resources – for staff and transport to monitor water use – are restricted and are unlikely to increase, and access during the rainy season is difficult. Fees are rarely paid to the RBWO and so do not augment the finances required to manage water. It therefore appears that the RBWO's intent to fund itself through the collection of fees is highly unlikely. In summary, the water allocations appear to be so poorly attuned to the situation that they are at the very least having no effect, or worse, may be undermining the very outcomes they purport to achieve.

Contested Intake Structures

The pursuance of an irrigation intake upgrading programme by the World Bank project utilising irrigation-focussed engineering procedures is another case of mixed and unintended outcomes. Whilst this is supposed to raise irrigation efficiency, under close examination, the provision of concrete weirs and intake works shows that reliance on intakes alone does not, and cannot, raise irrigation efficiency to the levels expected by RBMSIIP (from 15% to 40%).

Secondly, such a programme, conceived as it is, is counter to a river basin perspective. Evidence indicates that the modernisation of indigenous traditional smallholder schemes does not necessarily result in improved water control, greater equity and reduced user conflict. Indeed, such programmes may aggravate these issues by not sufficiently understanding the complex situation. The concrete intakes reduce downstream compensation flows through the weir and enable upstream farmers to abstract water throughout the year. Thus, while the intake farmers are pleased to see less labour and time needed to maintain their intake, the downstream irrigators are deprived of water – acutely so during dry seasons and periods.

4 Lessons learned

The need for large-scale, long-term interdisciplinary research

This case study reveals the critical role and benefits that long-term, large-scale, interdisciplinary science, in partnership with key stakeholders, has in identifying complex factors underlying environmental and hydrological change. Yet more detailed hydrological studies are required, particularly covering two more dry seasons – the critical period of the year – to isolate with sufficient certainty the relative effects of drivers on hydrological and environmental change.

Another issue that urgently requires careful empirical analysis is the assumption that irrigation efficiency can be raised considerably and that the generated water savings can be delivered to 'more needy' non-agricultural sectors. The efficiency of irrigation may already be high, and savings unlikely to be forthcoming. Furthermore, even if possible, the outcome of transferred water is not guaranteed because of the social costs involved and because local irrigators may recapture 'spare' water.

Hydrological and irrigation research should be complemented by participatory socio-economic research on the role of water on people's livelihoods, and on formal and informal water management institutions. A close examination of issues such as local arrangements of water allocation on rivers where water is under competition from several users and of the de facto consequences of formal water rights may considerably reorient current directions of basin-level water management by the Ministry of Water and Livestock.

Challenging entrenched normal professionalism

Despite attempts, it has proved difficult to address the effects of 'normal water science professionalism' that results in the maldistribution of water during the dry season. The hallmark of normal professionalism is that which inflexibly pursues conventional, over-simplified or mono-disciplinary interpretations of policy. In other words, the interventions on water allocations and intake infrastructure improvements, as mentioned above, *initially* appeared to be technically correct, but were then inadequately tailored and refined by formal river basin institutions to the local situation and conditions.

Understanding the role of the powerful elite

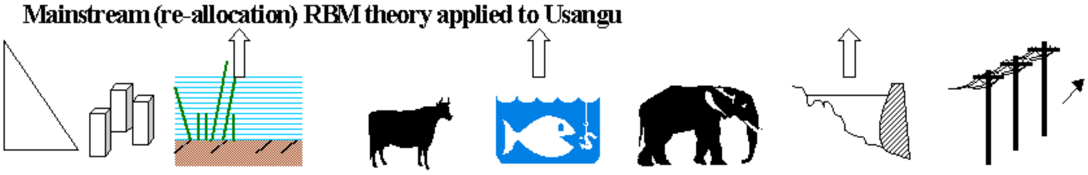
Related to the previous point are lessons gained from the role of the local, regional and national elite in decision-making and effecting change, although this does not fit with the mainstream notion that advocates local level user participation. It is clear that the statement by the Tanzanian Prime Minister in March 2001 to the Rio+10 Summit in London that the river should return to year-round flow by 2010 has ensured a surprising level of support for the canal closure programme at the District level. Also, the defining of the Usangu Game Reserve allows District officers to justify the forced removal of vulnerable fishermen and women and pastoralists. Equally, it has proved difficult to communicate fully with electricity corporation officials in ways that promote a more open understanding of why Mtera/Kidatu reservoirs became exposed to shortfalls of recharging inflows. This too allows TANESCO to claim a priority need of Ruaha waters. Similarly, SMUWC found that the delivery of messages of conditional and multiple causes of environmental change was only successful through its 'project champion' working amongst high-level stakeholders within Dar es Salaam.

The need for local water development solutions in managing basin-level water scarcity

Last but not least, a major lesson learned is that the Upper Ruaha Basin is still an open basin in the sense that physical water resources are still available, but need to be harnessed for human use. Therefore, downstream water scarcity can be solved locally by developing locally available untapped water resources, such as boreholes or stock dams in the Ruaha National Park or by improving the water management of the electricity-generating reservoirs. Even in the Usangu Plains, water scarcity during the dry season does not preclude further expansion of water use for irrigation during the wet season through new infrastructure development. The construction of more storage capacity or groundwater development could mitigate dry-season water scarcity especially for domestic users. From a livelihoods' perspective, such local water development is certainly a more desirable solution for basin-level water scarcity than the originally proposed reallocation of water from poor to powerful water users (see Figure 3).

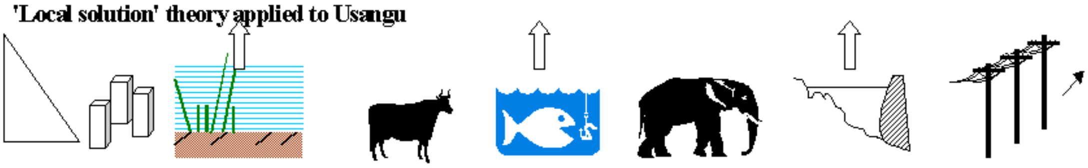
Figure 3: Schematic representation of local water development versus basin water reallocation approaches to IWRM.

Mainstream (re-allocation) RBM theory applied to Usangu



Slopes & rainfed maize	Domestic users; e.g. cooking,	Irrigated agriculture; rice with evaporation	Livestock keepers; watering and grazing on seasonal/ permanent wetlands	Usangu wetland; fisheries; livelihoods	Ruaha National Park; fish, river ecology; wildlife	Mtera/Kidatu HEP stations; power generation; evaporation	Power to urban centres; industry; lighting,
	Minor needs	Water savings required here	Minor needs	To give water here	To give water here	To give water here	

'Local solution' theory applied to Usangu



Slopes & rainfed maize	Domestic users; e.g. cooking,	Irrigated agriculture; rice with evaporation	Livestock keepers; watering and grazing on seasonal/ permanent wetlands	Usangu wetland; fisheries; livelihoods	Ruaha National Park; fish, river ecology; wildlife	Mtera/Kidatu HEP stations; power generation; evaporation	Power to urban centres; industry; lighting,
		Irrigation expansion here? Pro-livelihoods.		Allocation + weir? + fluctuation	Local boreholes, sand reservoirs, wetland channels.	Management of reservoir levels + raised weir	More HEP stations

Replicability/relevance in other areas or situations

The applicability of these lessons to other river basins depends on the configuration of rivers within those basins – on socio-economic aspects, institutions dealing with the rivers, and hydrology and environmental issues. For example, in Tanzania, these lessons apply to the Pangani River Basin which is the focus of similar Ministry of Water and Livestock projects. It might be possible to apply lessons in other Sub-Saharan rivers with comparable characteristics, such as a contrasting wet and dry season hydrology. For example, the Kafue sub-basin of the Zambezi would appear to be a possibility. Internationally, cases with contested hydrological interpretations and those requiring inter-disciplinary, multi-faceted solutions could draw on the lessons outlined here.

5 References

In the first instance please see reports and information held on the SMUWC website: www.usangu.org. Acknowledgments are given to the SMUWC team particularly Tom Franks, Mary Gillingham, Geoff King, Julie Thomas, Nick Mandeville, Lawrence Mbuya, Peter Baur, Paul Devitt, Alistair Graham, Jeremy Berkoff, Stan Western and Tom Boyd.

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