IRRIGATION AND DRAINAGE
Irrig. and Drain. **53**: 1–10 (2004)
Published online in Wiley InterScience (www.interscience.wiley.com). **DOI**: 10.1002/ird.123

MANAGING WATER AMONGST COMPETING USES: THE USANGU WETLAND IN TANZANIA†

TOM FRANKS,[1]* BRUCE LANKFORD[2] AND MAKARIUS MDEMU[3]

[1] *Bradford Centre for International Development, Bradford University, Bradford BD7 1DP, UK*
[2] *School of Development Studies, University of East Anglia, Norwich NR4 7TJ, UK*
[3] *Soil-Water Management Research Group, Sokoine University of Agriculture, Morogoro, Tanzania*

ABSTRACT

Demand for water in the Usangu Basin is driven by a number of competing uses. These include domestic supplies, irrigated agriculture, livestock, fishing, maintenance of the Usangu wetland, a National Park and major hydro-electric system downstream. As a result of a number of driving forces including the growing population, the water resources of the basin are becoming increasingly stressed, and downstream flows have now reduced to zero during the dry season. The paper is based on recent work to study to situation and work with local stakeholders to develop a sustainable management plan for the basin.

Irrigated rice is by far the biggest user of water in the basin. The paper traces the successful development of irrigation there since the 1950s, based both on state-managed mechanised farms and on smallholder production. However, the expansion of irrigation has been a major factor in the change in water availability downstream, particularly as the cropping calendar expands into the dry season, when river flows are at their lowest.

A number of initiatives are under way to try to reduce the impact of irrigation on the basin's water resources. These include projects to increase irrigation efficiency in smallholder systems, and improvements to water management institutions and processes. The aim is to restore dry season flows for downstream users by the year 2010.

KEY WORDS: Tanzania; water; management; institutions; competition; wetlands

RÉSUMÉ

La demande en eau dans le Bassin de Usangu est influencée par plusieurs usages concourants. Ceux-ci incluent des provisions domestiques, agriculture irrigué, l'élevage, la pêche, l'entretien du Marécage de Usangu, un Parc National et un système hydro-électrique majeur en aval. A la suite de plusieurs forces y compris la population croissante, les ressources d'eau du bassin deviennent de plus en plus accentuées, et les écoulements en aval ont réduit maintenant à zéro pendant la saison sèche. Cetartide est basé sur le travail récent pour étudier la situation et le travail avec les intéressés locaux pour développer l'utiisation rationnelle du bassin.

Le riz irrigué est de beaucoup le plus grand utilisateur d'eau dans le bassin. L'article trace le développement réussi d'irrigation là-bas depuis les 1950s, basé sur les fermes mécanisées de l'état et sur la production des. Cependant, l'expansion d'irrigation a été un facteur majeur dans le changement dans la disponibilité d'eau en aval, particulièrement parce que le calendrier de la culture prolonge dans la saison sèche, quand les écoulements de riviére sont les plus bas.

* Correspondence to: Tom Franks, The Cairn, Lower Constable Rd, Ilkley, Yorkshire LS29 8RD, UK.
E-mail: tom.franks@btinternet.com
† La gestion de l'eau pour des usage concourants: la terre marécageuse d'Usangu en Tanzanie.

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Accepted ???

II y a un nombre d'initiatives en cours qui essaient de réduire l'impact d'irrigation sur les ressources d'eau du bassin. Celles-ci incluent des projects pour augmenter l'efficacité d'irrigation dans les systèmes de petits, propriétaires, et les améliorations des institutions et des procédés de la gestion de l'eau. Le dessein est de restaurer les ecoulements de a saison sèche pour les utilisateurs en aval par l'année 2010. Copyright © 2004 John Wiley & Sons, Ltd.

MOTS CLÉS: Tanzanie; la gestion de l'eau; les institutions; la terre marécageuse

1. THE CONTEXT

The Usangu Basin in south-west Tanzania forms an important part of the upper catchment of the River Rufiji, Tanzania's largest river. Usangu (''the place where the Sangu people live'') covers an area of some 20 800 km^2 and is home to over 200 000 people, most of whom depend for their livelihoods on the natural resources of the basin.

The basin consists of two distinct parts, a mountainous and well-wooded area with high rainfall in the south, falling to an extensive flat plain in the north. Within the plain there are large areas of alluvial fans which support the majority of the settlements in the catchment, as well as irrigated and dryland farming. The alluvial fans in turn give way to an extensive wetland, comprising a seasonally flooded grassland and a much smaller area of permanent swamp (Map 1). The outflow from the swamp is controlled through a natural rock outcrop, whence all downstream flows from Usangu are channelled through the Great Ruaha River. The Great Ruaha flows first through the Ruaha National Park, and then to the linked Mtera/Kidatu hydropower reservoirs on the main Rufiji River.

The mountainous and well-wooded area which forms the upper part of the catchment reaches a height of 3000 m in places, and has a rainfall between 1000 and 1600 mm annually. It is well drained by means of a number of perennial rivers which fall sharply over an escarpment to the plain below. The plain is at a mean altitude of 1100 mm, with a much lower rainfall, at around 700 mm annually. This rainfall is concentrated in the period December to March, and is followed by a prolonged dry season. River flows are at their lowest in November.

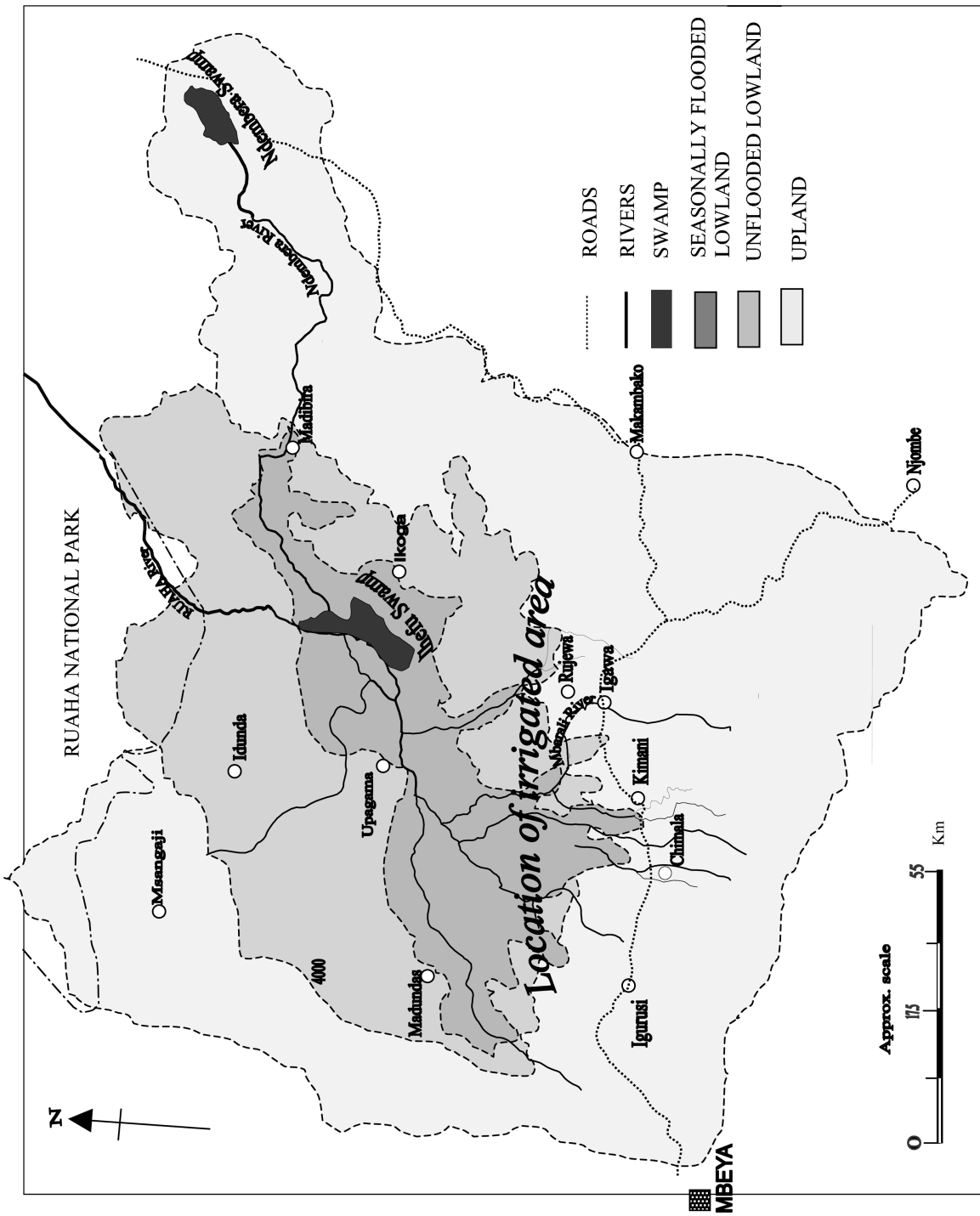
Hydrologically the basin and its downstream reaches can be considered as five linked subsystems:

- the upper catchment
- the alluvial fans
- the wetland
- the riparian reach through the Ruaha National Park
- the Mtera/Kidatu hydroelectric system

It is the linking of these five discrete subsystems, with their different physical and resource characteristics, which provides the context for water management in Usangu. In particular the Usangu wetland has been the focus of considerable interest in the recent past. Concerns for the future of the wetland gave rise to two linked projects which commenced in 1998 and which provided the findings on which much of this paper is based (SMUWC, 2001; RIPARWIN, 2002). More recently, Tanzania has become a signatory to the Ramsar convention. Although Usangu has not yet been gazetted as a Ramsar site, this commits the country to a general stewardship of wetland sites. However the whole catchment is large relative to the wetland. The total catchment is 20 800 km^2, whilst the maximum extent of the wetland is around 2000 km^2, and the permanent swamp itself is only some 80 km^2. In addition the catchment supports a large and dispersed population, who rely for their livelihoods on a diversity of natural resource strategies.

2. WATER USE IN USANGU

The water resources of the catchment have a number of competing and sometimes conflicting uses. Water for domestic purposes for the resident population is given highest priority under the recent Tanzanian Water Policy, but domestic use is in fact small in the catchment in volumetric terms. In the upper catchment water supports the extensive forest and bush cover. On the alluvial fans on the plains, water is used for agriculture. There is a



Map 1. The Usangu Catchment

considerable amount of rainfed farming, mainly of maize, and there is also a significant amount of irrigation, mainly for rice but also smaller areas of vegetables. Livestock-keeping is another important activity on the plains. The grasslands of the wetland provide a good resource for semi-nomadic pastoralism. The watering of livestock, though also not large in volumetric terms, is important because problems of access provide potential sources of conflict with other resource users.

Besides the domestic, agricultural and livestock demands on the plains, water is required to maintain the wetland, and particularly the perennial swamp. In doing this it has in the past also supported a small but flourishing artisanal fishing industry, though fishing has recently ceased as a result of the gazetting of a game reserve around the wetland. Downstream of the wetland, the Great Ruaha River flows through the Ruaha National Park and is a significant determinant in the ecological conditions in the park. Tanzania's National Park system is an important source of foreign exchange earnings for the country. From the National Park, the Great Ruaha River flows to the Mtera/Kidatu reservoir system, which provides over 50% of Tanzania's hydroelectric power.

The water resources of the catchment therefore have a multiplicity of uses, covering domestic supply, agriculture, livestock, fishing, environmental maintenance, wildlife, recreation and hydroelectric power generation. Of these, water for irrigation is the key use, since it is the largest anthropogenic consumptive use, and the most obvious point at which management actions can have significant impact.

On many counts, irrigation development in Usangu has been extremely successful. Irrigation has been practised there on a small scale over a century or more but commenced in a modern form with the arrival of settlers from Baluchistan in the 1930s. These settlers brought with them their knowledge of rice irrigation and the first small-scale but formal rice irrigation system was commissioned at this time. Thereafter there was a slow but steady increase in irrigated area, at the same time as large-scale land and water studies, typical of many such studies at that time, were being conducted on the resources of the Rufiji (FAO, 1960). The next major development was therefore the commissioning of the first of the large, donor-funded state-managed schemes at Mbarali. Although only covering 3000 ha, this was very much bigger than any systems then in operation in Usangu, and Mbarali acted as a spur and example for other farmers to take up irrigation on a small scale. The area under irrigation then continued to increase, so that, by the end of the 1970s, it had grown to 12 000 ha.

At about this time, there was a further important study (CFTC, 1978). Two particular points of interest arose from the CFTC study, which, unlike the Rufiji Basin study, focused specifically on the Usangu Basin:

- firstly, it saw the potential of irrigation in creating migration and employment opportunities for people from the Southern Highlands, where there was perceived to be a lack of resources to support the population;
- secondly, it explicitly considered the desirable mix of large-scale, mechanised, state schemes and smallholder, manual systems.

These two systems (large-scale state and small-scale smallholder) have continued to develop side by side, so that it is estimated that at present some 45 000 ha can be irrigated in a wet year. It should be emphasised that this is a very dynamic figure, varying from year to year in relation to water availability. The smallholders, in particular, are very flexible in their response to changing conditions and take up or abandon plots as they perceive the season is likely to turn out.

Table I presents the figures for the irrigated area over the past 60 years. These figures confirm the successful development of irrigation over this period, to the point where it is now a major source of livelihood for some 30 000 people. It is an important source of employment and, to a lesser extent, of food security (much of the produce is exported out of the basin to urban centres). It can therefore be seen as making appropriate use of abundant resources (good land, available water, and people) at least in the context in which the studies of the 1960s and 1970s were written. In economic terms the success of rice irrigation in Usangu is more questionable, since production costs are relatively high. Problems are now also arising in relation to water use for irrigation, as discussed more fully in section 3.

The institutional framework for water management comprises several related strands. Recently the government of Tanzania undertook a revision of its water policy, with assistance from a World Bank project. This was a well-managed participative process which resulted in a policy document which commanded a measure of consensus (MWLD, 2002). The policy accords highest priority to meeting the needs for domestic water supply, and then to

Table I. Growth of irrigation in Usangu

Date	Irrigated area (ha)	Date	Irrigated area (ha)
1930	101	1970	12 056
1935	263	1975	17 456
1940	1822	1980	19 017
1945	1830	1985	25 906
1950	4305	1990	29 906
1955	5738	1995	36 213
1960	7692	1999	40 378
1965	8380		

water for environmental maintenance. Other directly productive uses of water, such as irrigation, are accorded lower priority, though it remains to be seen how this hierarchy of needs will work out in practice.

The new water policy has not yet been enacted in legislation, so that water allocation for the time being continues to be practised under regulations resulting from the 1974 Water Act. This Act gives powers to water officers, at various levels, to issue licences for water abstraction (water rights), in return for a fee. In the case of Usangu the responsibility for allocating water rights lies with the Rufiji Basin Water Officer. He is advised by the Rufiji Basin Water Board, which provides a measure of stakeholder participation in the process. It is worth noting that water rights are issued only to users with an abstraction device, such as an irrigation offtake. Environmental uses, such as the wetland or the National Park, cannot be accorded a water right under the existing legislation.

3. COMPETITION FOR WATER RESOURCES

Many of the demands for water described in the previous section are increasing, or at least are perceived as increasing, with the result that there appears to be growing stress on the available water resources. The main driver in this process is the increasing population in the catchment, along with other socio-economic forces such as government liberalisation policies, resulting in greater demand for water and other natural resources in the catchment. The visible manifestation of this problem is that the Great Ruaha River downstream of the wetland now dries up completely during the dry season. This phenomenon was first observed in the mid 1990s and has become increasingly severe, to the extent that it now dries up for several months each year.

Although there are many other symptoms and implications of the change in water availability in the catchment, the drying up of the Great Ruaha was useful in focusing the attention of stakeholders on the extent of the problem and in stimulating appropriate action. In particular the Prime Minister of Tanzania was drawn into the situation. In a speech to a conference in London in March 2001, he publicly committed Tanzania to restoring dry season flows in the Great Ruaha by the year 2010. This intervention served to highlight the problem and indicate high-level support for its solution, but in fact the issues were already being hotly debated well before it took place.

However, part of the problem in Usangu has been that this debate was not well informed, and that it took place in a highly charged social and political environment. Therefore there have been many different causes put forward for the reduction in water resources. The two most common have been:

- the impact of deforestation in the upper catchment. Many stakeholders believe that deforestation reduces annual flows downstream, in spite of widespread evidence to the contrary;
- the impact of livestock and pastoralism on the plains. Pastoralism poses many difficult social and political issues, and it has for a time been convenient to add environmental damage to the other issues.

In addition there were many misconceptions about the size of the wetland, and its role in regulating flows downstream. It was difficult for stakeholders to realise that the Usangu wetland, like most other naturally regulated wetlands, acts as a sink and not a source of downstream flows.

It thus took time for a thorough analysis to be undertaken of the main causes for the reduction in water availability, and even longer for this explanation to be accepted. However, the recent studies confirmed that by far

the most important cause of this reduction is irrigation. These studies worked with the concept of irrigation impact as a simple way of demonstrating this point to the stakeholders in the basin. Irrigation impact is defined as ''the percentage of river flows abstracted for irrigation and not returned downstream through drainage''. It thus avoids the need to define different types of irrigation efficiency which are not in any case relevant to the main issues.

Irrigation has had an impact on flows downstream to the wetland and beyond firstly because of the steadily increasing area under irrigation (Table I). As discussed earlier, the area actually irrigated each year varies depending on the weather conditions. The maximum at present irrigated in a wet year is 42 000 ha (out of a possible maximum of 55 000 ha). In a dry year, this drops to 24 500 ha, of which about 22 000 is irrigated rice and the remainder other crops, mainly vegetables. Calculations carried out during the recent studies based on a variety of assumptions and approaches indicate that the annual impact of irrigation in Usangu is now about 35% in a normal to wet year, and 50% in a dry year.

The impact of irrigation on an annual basis is, however, only a part of the explanation for recent significant changes in water availability downstream. The catchment is marked by pronounced wet and dry seasons, and irrigation is having a proportionately greater effect on dry season flows. In the early years of irrigation development, it was assumed that the state farms would plant early (using machinery) to take advantage of higher temperatures at the end of the season but that the smallholder farms would only be able to plant during the rainy season, because of labour constraints (CFTC, 1978, p. 6.1). At that time it was assumed that individual field watering would last for about 160–170 days (for a 5-month crop) and that the total period for water abstraction would be 215 days. This abstraction would take place during October to April for the state farms and December to June for the smallholders.

By the late 1990s the cropping pattern had extended considerably, at both ends of the season. Abstractions for irrigation extend over about a full year for the state farms, with field watering increased from 160 to 260 days. This increase is mainly due to problems with mechanised operations, and patterns of labour availability. For the smallholders, the period for field watering has remained about the same, but the total period for abstraction has increased to around 300 days because of the large area and scattered nature of the smallholder plots. In addition, water is abstracted for domestic use, or for both domestic and irrigation supply. The overall effect is to increase the impact of irrigation during the dry season, to around 60–90%. At this time the natural flows in the rivers are small, and impacts of this magnitude have important consequences for the wetland and downstream.

Greater use of water over an extended season results in relatively low productivity of water. Calculations indicate that this is in the region of 0.14 kg of rice per m^3 of water. In many rice schemes in Asia, figures of 0.5 kg per m^3 are obtainable, indicating significant potential for improvement.

4. MANAGING WATER FOR COMPETING USES

A number of factors combine to make Usangu a key area for water resources management in Tanzania. The wetland provides one focus of interest, since the government has recently signed up to the Ramsar convention, and there is increasing concern both within the country and internationally on the importance of its wetlands. Changes in river flows in the Ruaha National Park are also important in stimulating interest and debate. Indeed it is these changes, rather than threats to the wetland itself, which led to widespread pressure from the international community that compensatory actions were needed, and eventually resulted in the involvement of the Prime Minister. The outcome is the definition of a simple target—to restore dry season flows in the Great Ruaha river—which is translated into a more precise working target of a minimum flow of 1 m^3/s^{-1} at the wetland outlet. In turn this requires minimum environmental flows in the rivers which feed the wetland.

Various issues of conceptual and pragmatic interest arise in the context of overall management of Usangu's water resources and the restoration of minimum flows for downstream users. Managing for wetlands is a comparatively new phenomenon, at least in Tanzania, and new thinking is required on how the interests of the wetland can be considered equally with other water users in Usangu. There is a need to increase understanding amongst the range of stakeholders in the basin of the problems and linkages between them, and to develop processes for negotiation across physical, administrative and cultural boundaries. In particular it is necessary to recognise that water resource management and use are intimately linked to management of other resources such as

land, and that there therefore needs to be a holistic approach to resource management within the catchment. There is also a need to support bottom-up, participative processes, and to integrate them within a plan for a catchment which covers a large area and supports a large resident population.

Whilst the importance of the broad and inclusive approach to resource management in the catchment is acknowledged, the wise use of water for irrigation will undoubtedly form an important part of any future resource strategy for Usangu. Certain stakeholders are looking for quick solutions through irrigation management and control (''closing the gates''), but this takes no account of the practical or moral difficulties of this approach. Irrigation structures are widely dispersed across the alluvial fans on the upper parts of the plains, and their use and operation have developed in some cases over many years. The most obvious organisation to control or reduce abstractions is the Water Office but it does not have the resources to undertake and supervise this. Such actions would also raise serious moral issues about depriving local people of their customary livelihoods derived from irrigation without first undertaking a painstaking process of discussion and negotiation. There are thus no quick fixes to the issues of water resource management in Usangu, but rather the need for continuing effort in a number of directions. To date, these have comprised a range of physical, managerial and institutional initiatives.

For example, over the past 15 years there have been a series of programmes aimed at improving smallholder irrigation (FAO, 1983; World Bank, 1996). In principle these programmes aimed to improve the ''efficiency'' of water use and thereby increase water availability downstream. They tended to focus on irrigation infrastructure and in particular on the construction of concrete intake works and other system modifications. Recent work has raised doubts, both about the theoretical basis for such programmes and its actual outcomes (Lankford and Gillingham, 2001). Theoretically, it is questionable whether smallholder irrigation is inefficient in the traditional sense, because water flows from plot to plot, and comparatively little is not used for crop growth. Practically, the physical improvements to the system were intended to give greater water control to farmers, particularly at the head of the systems, and they responded by taking more water, rather than less. The result has been to decrease river flows downstream. Recent critiques of irrigation improvement programmes have suggested modifications to the basic approach (Lankford, 2001). In this approach, offtake structures are designed to distribute the available flow on a proportional basis, whilst assuring a flow for environmental maintenance downstream. For the time being, new headworks and other infrastructure modifications are continuing to be implemented under donor-funded projects. However the pace of these is slow and the benefits not immediately apparent. Therefore attention is gradually shifting to the more difficult but potentially more effective aim of improving water management institutions and processes.

5. IMPROVING WATER MANAGEMENT INSTITUTIONS AND PROCESSES

A range of institutional initiatives are being undertaken in Usangu to improve allocation amongst competing uses and to reduce water use. Broadly, these comprise efforts focusing directly on water managers throughout the catchment, initiatives related to water use in particular sub-catchments, and institutional support from government agencies and donors. These are discussed in turn.

The Water Managers' Group

Initially this group was composed of the three water managers of the state farms in the catchment because they form an identifiable small group who are together responsible for 9000 ha, about 20% of the maximum currently irrigated. At its inception the group met intermittently under the auspices of the Water Office to discuss, in a non-formal and non-confrontational way, the context and issues of water management in Usangu, and to support one another in decisions about water use. Building on the initial success of the informal group, the first irrigation season in which the Water Managers' Group was fully functioning was 2001/2. Its membership was widened to include representatives of smallholder schemes, particularly those who lie on the same rivers as the state farms, whilst at the same time it was made more formal, with an established chairman, secretary and procedures. Financial support from the Water Office was also formalised, though this funding is intermittent and subject to other pressures on the Water Office. Because of these constraints, at present it appears that it is only

possible to hold meetings on an annual basis. Although it would be desirable to meet more often, such meetings provide valuable continuity in ensuring that key issues are kept under review. The financial support of the Water Office has also had an important impact on the group's sustainability, because it means it is independent of funding related to donors or projects.

Although it is too early to evaluate the impact of the Water Managers' Group comprehensively, anecdotal evidence is that its actions have resulted in some increased river flows downstream, and there is certainly now a greater appreciation of the value of dry season water. The main focus at the start was on abstractions at the end of the irrigation season, where it was apparent that some reductions could be made without detriment to agricultural yields. However, such reductions could not be achieved without providing domestic supplies to downstream communities who had become accustomed to using canal water for this purpose. Considerable discussion and negotiation with these communities were therefore necessary before any action could be taken, and only minor reductions were possible in the first instance. Following these discussions, a newly established programme in Usangu funded by the WorldWide Fund for Nature (WWF) supported three boreholes for downstream communities.

In due course the focus of the Water Managers' Group needs to shift to the more difficult issue of abstractions at the start of the irrigation season. These occur at the most important period at the end of the dry season, when flows are at their lowest. An interesting aspect of this issue is that water is used as an agricultural input for weed control and land preparation at the start of the season. Since the government schemes pay a flat rate water fee, dry season water has no incremental cost to them, even though it is then at its scarcest and most valuable for other uses such as maintenance of the wetland. Therefore progress in reducing water abstractions at this time is likely to be harder.

In summary, the Water Managers' Group provides a forum in which support and participative processes can play a role in water allocation and management, within an overall context of information and facilitation.

Water use in sub-catchments

A number of parallel initiatives are taking place to improve the institutional framework for resource management at the local level. These operate at the level of single sub-catchments within the overall basin, and are complemented by other similar initiatives being piloted at the level of local government. Efforts are being made to establish institutions (organisational structures, and the processes that link them) at the sub-catchment level, and then to support them as they provide a framework in which local people can negotiate with one another on the management of natural resources, including water. They face many of the problems of managing resources throughout the basin, such as developing processes for operating across boundaries (administrative and hydrological boundaries rarely coincide) but at a more manageable scale. Lessons learnt at this scale can then be evaluated for their application to the management of the whole basin.

The first of these initiatives was the Sub-Catchment Resource Programme undertaken with support from the SMUWC project and operating in the Kimani sub-catchment. Initially it comprised existing water user groups (both domestic and irrigation), as well as a pastoralist group and other groups at local government level. A major step was the formation of an apex body, in which all these groups could come together to negotiate resource use and management. The apex body has now evolved into MAMREMA (Mapogoro Mufumbi Resources Management Association), a water users' association registered under the legislation and responsible for managing water on the Kimani River. As a registered water user association, it is being supported by the Water Office, with additional assistance from the WWF and from the district through an existing community-strengthening programme.

In a similar way, an apex body for the Mkoji catchment (consisting of several perennial streams) is being established by the Water Office in collaboration with the River Basin Management Project supported by the World Bank. The formalisation has reached an advanced stage, and currently (mid 2003) the proposed constitution of the association is being reviewed by the village water users' groups (forming about 27 villages). The village water users' groups are the grassroots of the proposed apex. The formation procedures involved organising village water users' committees in a participative way so as to provide a supportive framework for the registration of the apex body to proceed. Three criteria were used for selecting Mkoji for the formation of this kind of apex body. Firstly, the sub-catchment covers two administrative districts. Therefore a transboundary body was felt to be important to

give a common sense of ownership within the two districts of water resources for sustainable management. Secondly, the area exhibits a high level of water use and is prone to conflicts over water use. Thirdly, it is a complex sub-catchment with many activities requiring water coordination and distribution.

Valuable experience is being gained in this way in the operation of local level institutions for resource management, and the processes by which water allocation and management decisions are taken. These are intended to result in increases in downstream flows, as in the Kimani, or in managing competition over water, as in the Mkoji. The sub-catchment groups complement the Water Managers' Group in providing a broad forum for negotiation over resources, within specific spatial boundaries.

Other institutional support

Government and other external agencies are undertaking a number of programmes to support these and related initiatives. The Water Office has established a new sub-office within the basin to provide a local presence. This has proved successful both in facilitating contact generally between water users and the Water Office and in dealing with difficult catchments, where the sub-office has been very active in responding to local conflicts. The district office of local government has also responded to the growing significance of irrigation as a means of livelihood and as a contested resource by establishing an Irrigated Agriculture Advisory Team, designed to advise the district on priorities for intervening in irrigation.

External donors continue to play an important role. The WWF programme focuses on dry season water management and impacts, particularly assisting in developing water users' associations, and in supporting boreholes downstream of the state schemes to reduce dry season abstractions. This programme shows a balanced mix of both physical and institution-strengthening objectives in its framework.

RIPARWIN, a research project funded by the UK's Department for International Development as a follow-up to the SMUWC project, is investigating impacts of various interventions, and one of its main functions is to advise on institutional and allocation issues. For example, it has initiated a role-playing game called the River Basin Game, which is proving successful with both local resource users and higher-level support organisations. This is a physical representation of a catchment with upstream and downstream intakes. Participants attempt to hoard glass marbles, acting as flowing water, as they seek to gain a livelihood, often depriving downstream users of their ''water'' (Lankford and Sokile, 2003). In addition, RIPARWIN has held two successful seminars to keep issues in front of decision-makers and is now organising a Ruaha + 10 seminar to mark 10 years of the drying up of the river. This seminar aims to review the ongoing institutional responses to changes in river flows, and to investigate whether these responses have aided or obstructed a shared vision of Usangu's resources.

6. CONCLUSIONS

Whilst good progress has been made and there are some successes, there are many threats to achieving the objective of a negotiated settlement for using and sharing water in Usangu. A major constraint is lack of resources to support local stakeholder initiatives (such as meetings) that promote dialogue towards a common vision. Although the requirements are not great by international standards, they are large enough to create difficulties for local institutions. Another risk stems from the small numbers of people who are able to organise such meetings; often these officers are working under a considerable range of other obligations and duties. Both of these mean that the time and money to follow through with a frequent schedule of meetings are lacking, and the initiatives may prove unsustainable.

Although the provision of downstream boreholes appears to reduce the need to abstract water during the dry season, its impact is not yet certain. Some of the villagers are concerned that the provision of the boreholes goes hand in hand with restricting the use of drain water from the government schemes for irrigation. The continuing demand shows how valuable the drain water is to downstream users for establishing rice, as well as for their domestic uses. Clearly, there is a need to manage water carefully, ensuring a conjunctive supply from both boreholes and drains.

Several institutional initiatives are being independently developed that will affect water use patterns and that therefore need more wide and inclusive discussion at the basin level. Reflecting recent calls for management

transfer to farmers, the Presidential Sector Reform Commission is activating the handing over of two of the state farms to smallholders. While this appears to be widening access to valuable irrigated lands, the size and rental cost of plot (6 ha at $50/ha) puts this out of reach of most of the poorest farmers. In addition, the organisation of water management under the new arrangements has not been clarified, and there is a danger that the systems will remain heavy users of water unable to distribute their share evenly between farmers. In addition, agreements over the partial canal closure programme made under the existing government scheme management through the Water Managers' Group may be threatened by the new ownership.

A second important development is that the President's Office has recently argued that dry season cropping should be allowed on state schemes to meet food security needs. Although the volumes of water available at this time would mean that a relatively small area would be cropped, this illustrates the problem of allocating water for competing, environmental uses during this critical period. The President's Office is indeed voicing what is increasingly likely to be a major trend in the future—pressures towards double cropping wherever possible. Such pressures, involving important dry season flows, should be very carefully considered, in the light of both supply and demand management provisions, rather than simply resulting from ad hoc growth, or a Presidential decree.

The various initiatives and developments described in this paper demonstrate the problems of managing water amongst competing uses in situations such as Usangu. The conflicting pressures of water for domestic purposes, irrigation, livestock watering, maintenance of the wetland and for downstream users mean that there are no simple solutions for allocating and managing water. Progress can only be made through the patient support and development of institutions such as the Water Managers' Group and the various sub-catchment groups described, working in a supportive and participatory process. Some successes are being achieved. There is now a greater appreciation of the importance of dry season water, and there have been some small reductions in the use of dry season water on the state farms. However, such improvements can easily be undone by other events and pressures (such as severe dry years which intensify the calls for double cropping). Much remains to be done if the Prime Minister's target of restoring dry season flows downstream in the Ruaha by 2010 is to be met.

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