

## Population, Migration, and Water Conflicts in the Pangani River Basin, Tanzania

**A**lthough essential for human survival, water is inherently inequitable, as it is rarely evenly distributed among populations. Local users compete to obtain their share, which can intensify existing tensions and sometimes lead to violence where the supply of water does not meet demand (Gleick, 2006; Huggins, 2000). Water availability is one of the major constraints on economic development, particularly for developing countries like Tanzania, because lack of water limits food production and economic activities such as industry and commerce (Madulu & Zaba, 1998).

Many conditions may trigger conflicts, including jurisdictional ambiguities, miscommunication, and competition between sectors and users. In this article, I describe how population growth and migration in Tanzania's Pangani River basin—arguably the most water-stressed basin in the country—have intensified local water conflicts.<sup>1</sup> Resolving these conflicts requires understanding the socio-cultural context of the local communities and increasing stakeholder involvement in water management.

For my case study, I selected about 10 percent of the households in every village in the study area (see map) with the help of village

leaders, and administered structured questionnaires to the heads of households. I sampled more villages in the highlands because they hold more of the population than the lowlands.

### The Pangani Basin

The Pangani River basin drains a large area in the northeastern part of the country along the border with Kenya, extending from Mount Meru and Mount Kilimanjaro down through the Pare and Usambara ranges. The major sources of water in the basin, which has a total catchment area of about 42,000 sq. km, are endangered by environmental degradation, climate change, and increased use (IUCN, 2003). Several studies show that the Pangani basin is already water-stressed—the river's flow has decreased dramatically in recent years—and water demand is expected to double by 2015 (see, e.g., IUCN, 2003).

The basin's water originates largely from rain falling on the mountains of Meru, Kilimanjaro, and Pare, and partly from snow melting from Kibo Peak (Mt. Kilimanjaro). The lowlands have reserves of underground water and springs, which are recharged by rain from the mountains. The climate of the Pangani basin varies widely by location and altitude. The relatively flat lowlands have an average annual rainfall of less than 500 mm, while the slopes of Mounts Kilimanjaro and Meru have an average annual rainfall exceeding 2,000 mm per year. More than 50 percent of the basin receives an average annual rainfall of only 500-600 mm; without the Pangani River the area would be semi-arid (Japanese International Corporation Agency [JICA], 1988).

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## Population and Migration in the Pangani River Basin

### Population Growth

The population of both rural and urban areas of the Pangani River basin—currently home to 3.7 million inhabitants—is rapidly growing (IUCN, 2003). In the first half of the 21st century, the population is predicted to double every 20 years in rural areas and every 10 years in urban areas (University of Dar es Salaam & United Nations, 1993). Ninety percent of the population lives in the highlands, leading to a population density of up to 300 people per sq. km, compared to 65 people per sq. km in the lowlands (IUCN, 2003). This rapid population growth and high population density could help generate conflicts over natural resources as scarcity grows (Mbonile, 1999a).

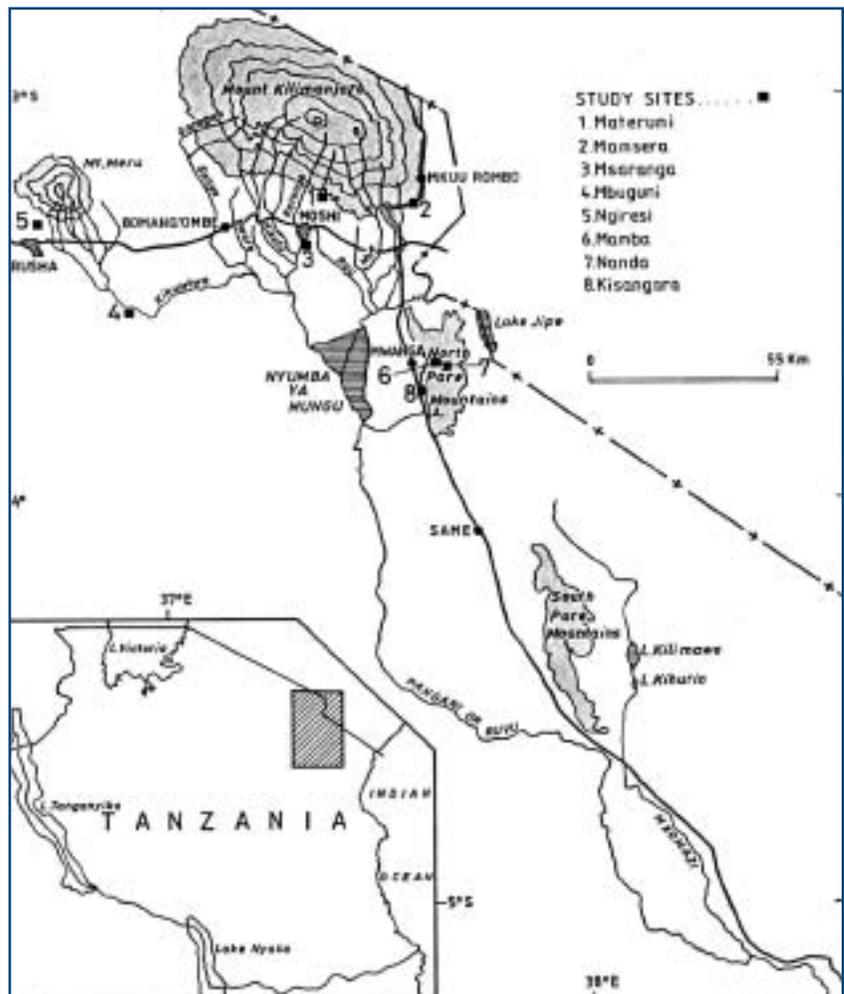
### Displacement and Mobility

The history of the Pangani basin is marked by the continuous marginalization of the indigenous population by both internal and external migrants. Despite widespread resistance from the indigenous population, during the colonial period land was commandeered for large-scale plantations of wheat, coffee, sugar cane, and sisal, and for resettling World War II veterans (Spear, 1996). This massive settlement led to one of the largest population displacements in Tanzania. Agro-pastoralists and herders forced to move from the better-watered Ngare-Nyuki area migrated to more marginal lands occupied by pastoralists like the Maasai.

After Tanzania's independence in 1964, the establishment of national parks and game reserves like Tarangire, Kilimanjaro, Arusha, and Mkomazi took land from both agro-pastoralists and pastoralists, leading to massive displacement and migration. Large tracts of land were also appropriated for the Kilimanjaro International Airport and more large-scale wheat farms in West Kilimanjaro (Campbell, 1999).

The population at the middle altitudes (2,500-3,000 meters above sea level) traditionally migrated to the higher altitudes (3,500-4,000 meters) to grow perennial food crops

## Location of the Study Area in the Pangani River Basin



Source: Mbonile (2005).

such as bananas and cash crops like coffee (Kimambo, 1996). More recently, as the population has grown and land in the highlands has deteriorated, people from the core middle altitudes instead colonized marginal agricultural land in the basin lowlands, which had previously been dominated by pastoralists (Maro, 1975; Maddox et al., 1996; Mbonile, 1999b). In addition, migrants moved from the highlands to more remote lowlands, escaping from drought and famine, or seeking more space for settlement (Gould, 1992).

### In-migration and Urbanization

Most migrants from outside the basin come from neighboring parts of the country. New

developments within the basin—such as the Lower Moshi irrigation scheme, new towns, and tanzanite mines—have attracted migrants from more distant regions. The development of Kilimanjaro International Airport and the increasing urbanization of regional headquarters like Arusha and Moshi have attracted in-migrants seeking access to water, schools, and health services. Water consumption in urban areas has grown more than 500 times since the first installations were built in the 1950s, and the number of connections has increased more than 300 times (JICA, 1988; Kironde & Ngware, 2000).

Large-scale migrant farmers from other parts of the country, motivated by the cultivation of new cash crops like soybeans and flowers, took over large tracts in the lowlands. Today, cultivation of marginal lands—areas previously reserved for pastoralists—extends to interior districts, generating new frontiers for land and water conflicts. Some pastoralists have been forced to change their social and economic activities; for example, young Maasai have migrated in large numbers to major urban centers in the country for employment (Kweka, 1999; Mbonile, 2001).

## Water Conflicts in the Basin

My study identified seven major groups of water conflicts in the Pangani River basin between the following users:

- Communities and conservationists;
- Upstream and downstream users;
- Hydroelectricity producers and other users;
- Communities and donor agencies;
- Farmers and pastoralists;
- Rural and urban areas; and
- Communities and river basin authorities.

Table 1 lists the results of the study according to type of conflict and cases reported.

### **Communities and Conservationists**

In the highlands, water catchment conservationists conflict with the community. The

establishment of national parks like the Kilimanjaro and Meru Forest Reserves to conserve catchment areas and increase tourism has generated conflicts between both farmers and pastoralists. The farmers would like to use the conservation areas for farming and fuelwood gathering. The pastoralists would like to graze or move their livestock in the conserved areas. Discussions with farmers and pastoralists, as well as village and court records, revealed 136 incursions between the community and the national park authorities and workers between 1998-2000. On most occasions, the community members were fined or ended up in court. Often, the community responded by setting fire to the forest or fetching firewood illegally, in addition to poaching wildlife.

To resolve this problem, government and national park authorities introduced community participation in natural resources conservation, including water conservation. In addition, the park authorities now employ young people as tourist guides. However, some villages and communities such as the Maasai still believe that the benefits they receive are relatively small compared to the amount of grazing land and other benefits they have lost.

### **Upstream and Downstream Users**

Traditional furrow irrigation schemes, largely organized by small-scale farmers, cover about 80 percent of the irrigated land in the upper Pangani basin (Pangani Basin Water Office, 1997; Kaniki, 1980). However, despite dating back to the 19th century, these irrigation methods are a major source of conflict because most of the time they use water inefficiently due to the lack of proper technologies and maintenance (Pangani Basin Water Office, 1997).

In the past, traditional furrow irrigation was concentrated in the highlands, but as migration increased this system spread to the lowlands; the increase in demand for irrigation caused the traditional system of rationing water to collapse sometime in the mid-1980s (Mwamfupe, 2001). In the highlands, stakeholders were not allocated adequate water by the controllers of

**Table 1: Type of Water Conflicts, Interested Groups, Number of Cases Reported, and Responses (1998-2000)**

ECOLOGICAL ZONE	VILLAGE	TYPE OF CONFLICT	INTERESTED GROUPS	CASES REPORTED	TYPE OF RESPONSE
HIGHLANDS	Ngiresi	Catchment area conservation and utilization of resources by community	Arusha National Park, Meru Forest Reserve, and community	136	<ul style="list-style-type: none"> <li>• Fires</li> <li>• Deforestation</li> <li>• Non-farming activities and out-migration</li> </ul>
	Materuni Mamsera	Catchment area conservation and utilization of resources by community	Kilimanjaro National Park and Forest Reserve	71	<ul style="list-style-type: none"> <li>• Fires</li> <li>• Deforestation</li> <li>• Non-farming activities and out-migration</li> </ul>
	Mamba Ndanda	Catchment area conservation	Pare Forest Reserve	28	<ul style="list-style-type: none"> <li>• Conservation of land</li> <li>• Out-migration</li> </ul>
LOWLANDS	Msaranga	Conservation of Njoro springs and Rau Forest Reserve; large-scale and small-scale irrigation; pastoralists and farmers; community and Moshi urban expansion	Irrigation authorities, local government authorities, and village governments	45	<ul style="list-style-type: none"> <li>• More water regulations</li> <li>• Fights</li> <li>• Invasion of wetlands</li> <li>• Resistance to urban expansion</li> </ul>
	Kisangara	Conservation of sisal plantations; reduction of water for hydroelectricity production; and lowland irrigation	Tanganyika Electric Supply Company, community, Sisal Authority	17	<ul style="list-style-type: none"> <li>• Invasion of sisal areas</li> <li>• Deforestation of bush lands and grasslands</li> <li>• In-migration</li> </ul>
	Mbuguni	Pastoralists and farmers; pastoralists and miners	Farmers, pastoralists, and miners	78	<ul style="list-style-type: none"> <li>• Fights and looting</li> <li>• Invasion of bush lands</li> </ul>

Source: Adapted from Mbonile (2005).

clan furrows, amplifying water conflicts. Small farmers in the lowlands reported that their share of the water was not adequate because upstream users were “too selfish” to share water with people downstream.

The same problem was viewed differently by large-scale farmers, pastoralists, and electricity producers, who all believed that water was being mismanaged in the highlands and that proper allocation required better coordination. However, an in-depth study of the study area revealed that the water shortage was the result of population growth—both in the highlands through natural increase and in the lowlands through migration—as well as poor maintenance of the furrows due to the loss of labor in the catchment area. As youth migrate away

from the highlands, the older people cannot manage the furrows frequently because they are located on steep slopes of the mountains.

### **Hydroelectricity Producers and Other Users**

The hydroelectric generating company, the Tanganyika Electric Supply Company (TANESCO), conflicts with other users over water. The establishment of three hydroelectric power stations along the Pangani River initially attracted fishing communities and workers. Later, small towns developed to serve these communities and increased the demand for water near power stations. In the 1990s, water withdrawn for irrigation caused some of the major tributaries of the Pangani River to almost



Mt. Kilimanjaro, Tanzania (© R. Strickland, courtesy of USAID).

run dry, leading to power rationing in the country in 1992, 1994, 1997, and 2000 (Ministry of Water, Energy and Minerals [MWEM], 1995; “Power sharing to begin very soon,” 2000).

Hydrological data collected by TANESCO suggest that water supply for its dams is declining due to uncontrolled irrigation in the upper part of the basin. TANESCO believes that since hydroelectricity is essential for industrial production and domestic consumption, it should be granted the entire right to withdraw water from the Pangani River, which is in violation of the 1991 Water Right Act.

The Water Right Act of 1991 established the first river basin authority in Tanzania in the Pangani River basin. Since that time, small-scale irrigators have complained that these water rights were introduced to protect the power generating plants, and feel that either they do not get their share of water or they get too little, too late. On the other hand, the large water users lament that they do not get enough water to produce power or food because the small farmers withdraw too much water and return very little to the river systems. The large-scale planters maintain they withdraw only enough water to supplement rainfall moisture and return excess water

to the river systems, arguing that the amount they use does not significantly affect power production. In this conflict, where the national interests are in jeopardy, large users like TANESCO and the plantations are likely to win. Nonetheless, all stakeholders must be involved if efforts to resolve this conflict are to be sustainable.

### **Communities and Donor Agencies**

The competition among donor agencies in the basin generates confusion in the community. These donor agencies are largely run by expatriates who serve the interest of their countries. At the same time, they exacerbate water problems in the basin because they compete for the same resources.

The donor agencies operating in the basin include the World Bank, United Nations Development Programme, Food and Agriculture Organization, International Labour Organization, JICA, GTZ of Germany, and the Norwegian Agency for Development, in addition to NGOs from the Netherlands and Belgium. Most of these agencies are involved in projects that rehabilitate existing irrigation schemes, encourage soil conservation, and improve water management.

Some of the projects collapsed after the donor left because they were directly funded by the agencies and thus bypassed the local community and ministries. A resident in Kisangara village describes a typical situation:

The whole Kisaranga village received clean water 10 years ago when the donor agency called JICA constructed gravity water pipes from River Kisangara. After their departure there is no single drop of clean water and so we are forced to rely on one pipe, which belongs to the sisal estate. Unfortunately the owner is an Indian who does not care about the welfare of the people. He has allocated about just an hour in the morning for all these people to fetch water and so most women sleep near the pipe just to get one bucket of water. (Mzee Sangiwa, personal communication)

### **Farmers and Pastoralists**

The study revealed a number of conflicts emerging from the co-existence of farmers and pastoralists. In my survey, every household raised serious concerns about the increasing number of livestock in the basin, which has risen dramatically over the last 20 years as low-land pastures far from the river degraded due to heavy use and drought.<sup>2</sup> Some blamed the high numbers of cattle for the current crisis at the Nyumba ya Mungu hydroelectric dam, due to their heavy consumption of water and land degradation from overgrazing.

Cattle entering fields and destroying crops and irrigation structures is a major source of conflict, sometimes leading to bloodshed or imprisonment. Agro-pastoralists established villages in areas reserved for livestock and have thus interfered with routes to cattle watering points (Campbell, 1999). Both farmers and pastoralists openly blame each other, categorically stating that in the past the boundaries between farmers and pastoralists were well-defined. In addition, the influx of cattle and other livestock in the basin has created a wave of cattle thefts, which is exacerbated by the Maasai belief that all cattle belong to them so they have the moral right to “recover” cattle from other tribes.

The large amount of livestock and cultivation in the lowlands’ more marginal lands has accelerated land degradation. Serious competition between livestock, population, and wildlife has far exceeded the basin’s carrying capacity leading to the heavy deterioration of biomass, which endangers the entire ecosystem. This conflict is clearly revealed by the Maasai residents of the Mbuguni village, one of whom categorically stated:

The people from the regional headquarters and Pangani Water Basin Office keep on telling us that this water belongs to the nation and we are supposed to share it with other people who do not know the importance of livestock to the Maasai. The name Kikuletwa is a Maasai name showing that the river belongs to us from time immemorial. We know they have big guns but we



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are going to defend it with our spears. (personal communication)

### **Rural-Urban Competition**

As the people migrate to urban areas, the demand for water in towns such as Arusha and Moshi rapidly increases for both domestic and industrial activities. Moreover, some large rivers have been dammed in order to supply the water for these towns, reducing the flow of water downstream and causing some of the rivers to dry up completely during the dry season.

In addition, these urban centers generate solid and liquid waste that pollutes the major source of water (Kalwani, 2001). In both Arusha and Moshi, less than 5 percent of the population is connected to the central sewage system and the rest use pit latrines or other elementary sanitation facilities (Chapuis, 1999; Kalwani, 2001). Water pollution increases as the urban areas grow and as farmers use more chemical inputs to grow enough food to feed the fast-growing population. As a result most downstream households are forced to drink spring water or boil their drinking water.

### **Communities and River Basin Authorities**

The government has attempted several times to introduce systematic state intervention in the



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water sector, culminating with the establishment of the Pangani Water Basin Authority in 1991, which transferred ownership of water to the government (MWEM, 1995). After the establishment of these authorities, most traditional water rights were treated as illegal, hence generating several water conflicts between the government and the community.

Documented water rights in the basin total about 33.4 m<sup>3</sup>/s but the inspection conducted by the Pangani Basin Water Office between 1992-1993 showed that the actual withdrawal of water for irrigation alone far exceeded this level, running to about 48 m<sup>3</sup>/s or more. Inspections by the Water Office revealed many withdrawals without water rights and a huge amount of water wastage, as well as many users withdrawing more water than allocated (Pangani Basin Water Office, 1997).

The government's water rights policy intensified the basin's water shortages, by discouraging some potential migrants from moving to villages that were paying for water and thus concentrating population in a few villages without water rights. Also, many of the water rights, which were allocated during the pre-independence period, allowed very high withdrawal rates because they were issued when the population was very low. Since these water rights still exist they have been a major source of water conflict (Huggins, 2000).

### Conflict Resolution and Policy Implications

Conflict resolution mechanisms in the Pangani basin must be designed to suit the type of water conflict they seek to address. For example, resolving the conflict between the community and conservationists requires protecting forests on the Meru, Kilimanjaro, and Pare mountain ranges from deforestation to ensure a sustainable supply of water. Conservationists should increase community participation and share the benefits of tourism and forest products with local communities. In addition, local communities must be trained in the best ways to conserve land and increase crop yields, since when

yields are poor people exploit the forests as a survival strategy.

Sustainable water management regimes have existed in the Pangani basin since the pre-colonial period, when the management of water was an integral part of the customary laws and behavioral norms of each tribe or community. These customary laws, most of which are still respected by a wide spectrum of the basin's people, insured that ownership of water resources was vested in the local community or clan rather than a household or individual. Community authorities distributed water after evaluating the demands of an individual or different water uses. For example, among the Maasai in the basin, any person could draw water from any point in the river for domestic use, but only clan members assigned that particular point could use it to water their cattle. This type of regulation ensured that there was no congestion of livestock at one point, thus avoiding land degradation and loss of water through evaporation. A similar principle was used by the Chagga in Mount Kilimanjaro: Any person or neighbor could draw water for domestic use from clan furrows, but only clan members could use it for irrigation. The violation of water regulations (e.g., washing at the source of water reserved for domestic use) was a serious offense and the victim was fined, beaten, or chased away from the village or community (Kimambo, 1996).

These customary regulations prevented the over-exploitation of water. Therefore, I argue that most modern interventions in water supply should not be superimposed on these systems. The concept that water belongs to the state is completely rejected by traditional communities. To resolve some of these water conflicts, traditional methods of water conservation should be revived and maintained, as sustainable water management cannot be achieved without involving the stakeholders.

The conflict between the community and basin authorities is the result of commercialization and state interference. Traditional conflict resolution mechanisms are undermined by decrees or legislations. Due to their economic strength, rich farmers and estates get water rights without community consent. Even

worse, once these water rights are issued other people are barred from using the resource. To resolve this conflict I recommend that the 1999 Land Act, which transfers all land and resource matters to the villages, be enforced.

The conflict between hydroelectric generators and other users can only be resolved if institutions like TANESCO realize that other users were there before them. They should also realize that proper management of the basin's water resources must include all stakeholders. However, long-term resolution of this conflict requires the introduction of alternative sources of energy. In addition, rural electrification programs would help people understand the importance of power stations.

Water conflicts between farmers and pastoralists will persist if the in-migration of farmers to former pastoral lands is not controlled. The squeezing of pastoralists into ecologically poor marginal lands has continued unabated since the 1930s, even as the population of pastoralists and their livestock has grown. The mixing of two incompatible livelihood systems has been the main cause of water conflict in the basin. The wetlands, which were reserved by the pastoralists for watering livestock, have been invaded by farmers growing rice. To resolve this problem, land for grazing livestock and farming should be separated, and the water rights of each group respected.

## Notes

1. This article is based on and adapted from "Migration and intensification of water conflicts in the Pangani basin, Tanzania." (2005). *Habitat International* 29, 41-67.

2. The number of livestock that exist in the Pangani River basin is uncertain, as the movement of livestock in and out of the basin, as well as within the area, makes an assessment difficult. Furthermore, most livestock are located in remote and almost inaccessible areas.

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