Water Scarcity and Conflicts: A Case Study of the Upper Ewaso Ng'iro North Basin

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Introduction

Growth in population, increased economic activity and improved standards of living have led to increased demand for freshwater resources in semiarid regions of Kenya. Consequently, local and regional water scarcity occurs in the dry seasons. It is induced mainly by low rainfall, low river flows, high demand for irrigation water and water pollution, and failure of water storage, delivery and distribution systems. With limited freshwater resources, competition for, and conflicts over, the resource use are increasing with increasing demand for water. The conflicts are further aggravated by high social inequity, economic marginalization and limited non-land-, non-water-dependent sources of livelihoods.

The purpose of this paper is to present a case study of water scarcity and associated problems in the Upper Ewaso Ng'iro North river basin in northern Kenya and to propose a research and action program through which the opportunities to alleviate water scarcity and associated conflicts can be exploited.

The Upper Ewaso Ng'iro North river basin is part of the Juba basin, which covers an area of 47,655 km^2 in Kenya, Ethiopia and Somali. The Juba basin has a low population density of 12 persons per km^2 and a high water scarcity, as 72 percent of the basin is in arid areas (WRI 1998). The Upper Ewaso Ng'iro North river basin is located to the north and west of Mt. Kenya (see figure 1) and extends between longitudes 36° 30′ and 37° 45′ east and latitudes 0° 15′ south and 1° 00′ north. The basin covers an area of 15,200 km^2, approximately 6 percent of the Ewaso Ng'iro North drainage basin and 2.8 percent of the total area of Kenya (587,900 km^2). The area falls under seven administrative districts (Nyandarua, Nyeri, Laikipia, Meru, Samburu, Isiolo and Nyambene) and three provinces (Rift valley, Central and Eastern).

The elevation gradient, climate and soil conditions give rise to ecological zones, ranging from humid to arid (see table 1). Approximately 60 percent of the area receives rainfall that is less than 50 percent of the potential evaporation.

The basin has been experiencing a high population growth arising mainly from immigration of small-scale farmers from the neighboring districts of Nyandarua, Nyeri and Meru and nomadic pastoralists from Baringo, Samburu and Turkana districts. In 1989, the population of the basin was estimated to be 270,000 (Karekia 1995). The population density varies with the ecological potential, access to water and available infrastructure. In 1989, population densities were estimated to be 875, 22 and 10 persons per km^2 for the Nyahururu division, a

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mainly urban area, the Rumuruti division, a mainly rural area with scattered smallholder settlements and the Mukogodo division, a rural area settled by pastoralists, respectively (Karekia 1995).

The Upper Ewaso Ng'iro basin is a rich wildlife ecosystem and is home to a large wildlife and livestock population as shown in table 2. Wildlife are generally found in national parks in Aberdare and Mt. Kenya, in private game ranches in the Laikipia plateau, in the game reserves in the lowlands, or in migratory areas as they move in search of water and grazing resources.

Figure 1. Location of the study area.

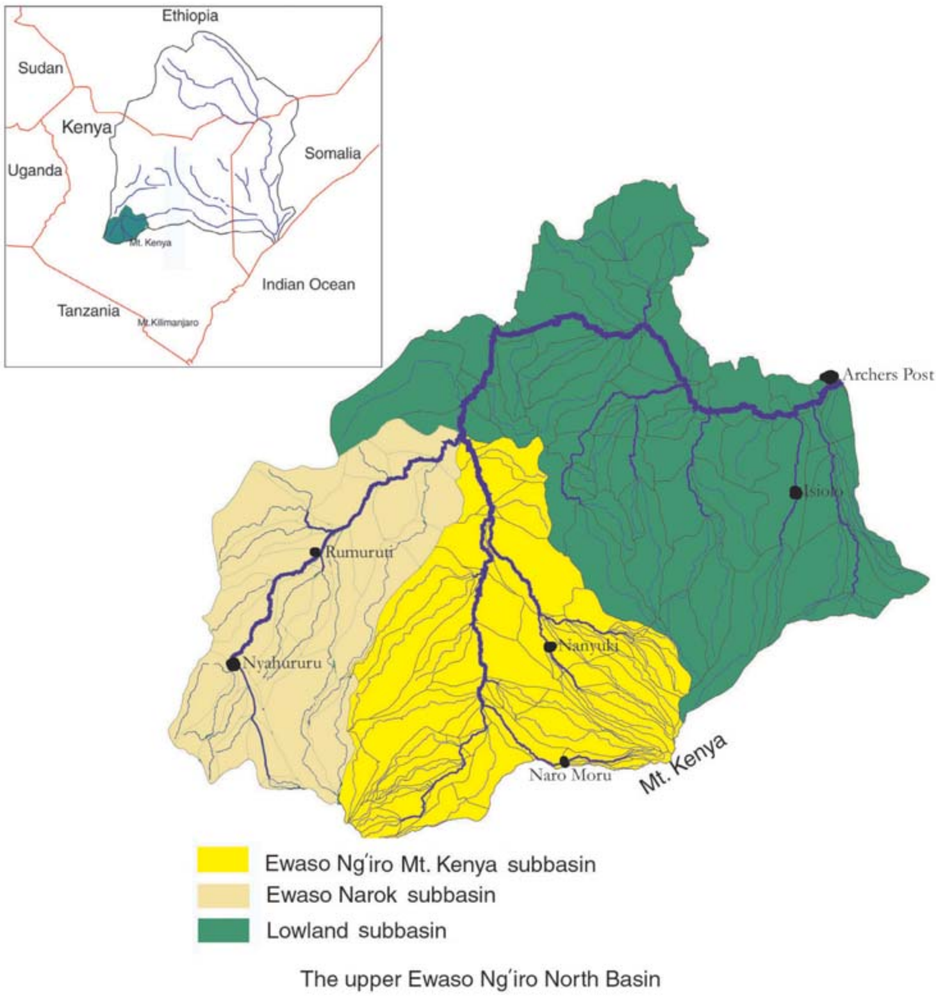


Table 1. Moisture availability zones.

Moisture Availability Zone	R/Eo	Classification	Natural Vegetation	Area (km^2)	Total Area (%)
I	>0.8	Humid	Moist forest	358	2
II	0.65-0.8	Subhumid	Moist and dry forest	1,316	8
III	0.5-0.65	Semihumid	Dry forest and moist woodland	3,043	20
IV	0.4-0.5	Semihumid to semiarid	Dry woodland and bushland	3,046	20
V	0.25-0.4	Semiarid	Bushland	4,666	30
VI	<0.25	Arid	Bushland and scrubland	3,066	20

R = Average annual rainfall (mm); Eo = Average annual potential evaporation (mm); R/Eo = Moisture availability ratio.

Table 2. Summary of the animal population.

	1997		1990		1994		1997	
Species	PE	SE	PE	SE	PE	SE	PE	SE
Livestock	793,964	222,219	717,644	77,061	493,519	62,187	521,196	63,358
Wildlife	132,435	66,808	88,461	29,625	81,127	42,996	121,082	22,704

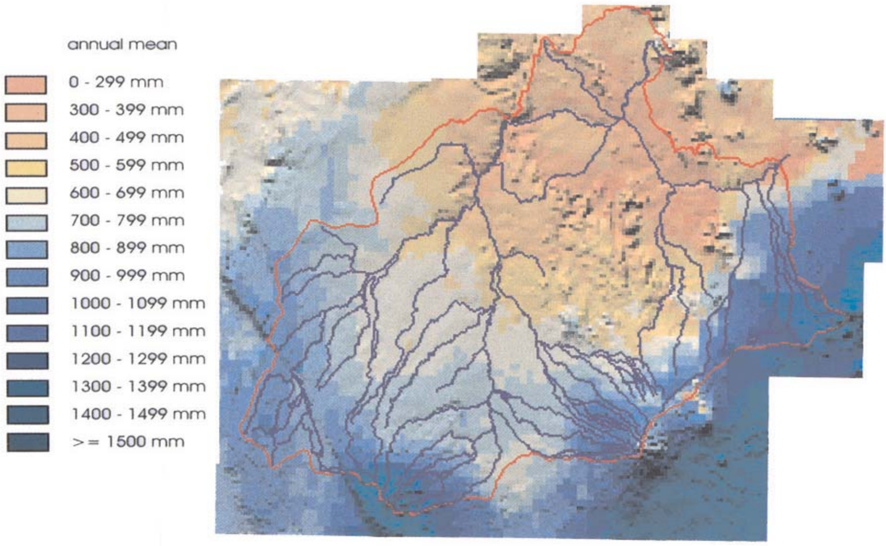
PE = Population estimate; SE = Standard error.
Source: Muchoki 1998.

Status of Water Resources

Rainfall. The mean annual rainfall in the basin ranges from 1,500 mm in the montane forest areas of Mt. Kenya and Nyandarua mountain ranges to 350 mm in the arid lowlands around Archer's Post. The elevation and orientation of the major topographical features (Mt. Kenya, Nyandarua and Nyambene hills, and Mathews, Lariak, Marmanet and Ndundori ridges) influence rainfall distribution over the basin (figure 2). There are four seasons, namely: long rains, continental rains, short rains and dry season. The long rains (mid-March to mid-June) provide the best rainfall (29–40% of annual rainfall) over the entire basin. Continental rains (mid-June to mid-September) are mainly confined to the western edge of the basin and their importance diminishes as one moves north and east. Short rains (October to December) penetrate the basin from the dry northern region and contribute 50–60% of the annual rainfall of the arid areas. The continental rains falling in the southwestern parts of the basin are mainly credited for maintaining flows at Archer's Post from July to September when the other parts of the basin are relatively dry.

Long-term analysis of rainfall data shows high variability from year to year, particularly for low rainfall stations and wet-dry cycles of 5–8 years.

Figure 2. Rainfall distribution (annual mean).



Source: Gichuki et al. 1998a.

Surface water. The Upper Ewaso Ng'iro North river basin can be divided into three main subbasins: the Ewaso Narok subbasin, the Ewaso Ng'iro-Mt. Kenya subbasin and the Ewaso Ng'iro Lowland subbasin. The common point of the three subbasins is the confluence of the Ewaso Narok and Ewaso Ng'iro rivers, called Junction. The relative contribution of the three subbasins to the river flow at Archer's Post varies with the rainfall regime (see table 3). An analysis of the relative contribution of the three subbasins shows the following (Gichuki et al. 1998b):

1. Ewaso Ng'iro-Mt. Kenya and Ewaso Narok subsystems with high rainfall and better ground cover (mainly the forested areas of Mt. Kenya and the Nyandarua mountain ranges) provide most of the water during the dry seasons.

2. The Mt. Kenya subbasin has the highest contribution during average rainfall and dry years[2] and for both wet and dry months.

3. The Ewaso-Narok subbasin sustains moderate flows at Archer's Post during the period of the continental rains (around June to September). Approximately 32 percent of the annual flow of the Ewaso Narok subbasin occurs during the months of June, July and August and an additional 36 percent occurs during the months of September, October and November.

[2]Glaciers of Mt. Kenya are important sources of water during the dry season.

4. The Ewaso Ng'iro Lowland subbasin has a major contribution during high rainfall periods (wet years and short-rain seasons) mainly attributed to the high runoff from the almost bare catchment at the beginning of the rains and the large area.

Table 3. Sources of flows at Archer's Post.

Period	Ewaso Narok Subbasin (5AC8) (3,380 km^2)	Ewaso Ng'iro-Mt. Kenya Subbasin (5D5) (4,640 km^2)	Ewaso Ng'iro-Lowland Catchment Subbasin* (7,180 km^2)
1951 (wet year)	22	22	56
1952 (dry year)	18	75	7
1960 (average rainfall year)	11	67	22
April (wet month)	11	40	49
September (dry month)	59	41	0
November (wet month)	23	36	42
February (dry month)	28	69	3
Annual mean	30	46	24

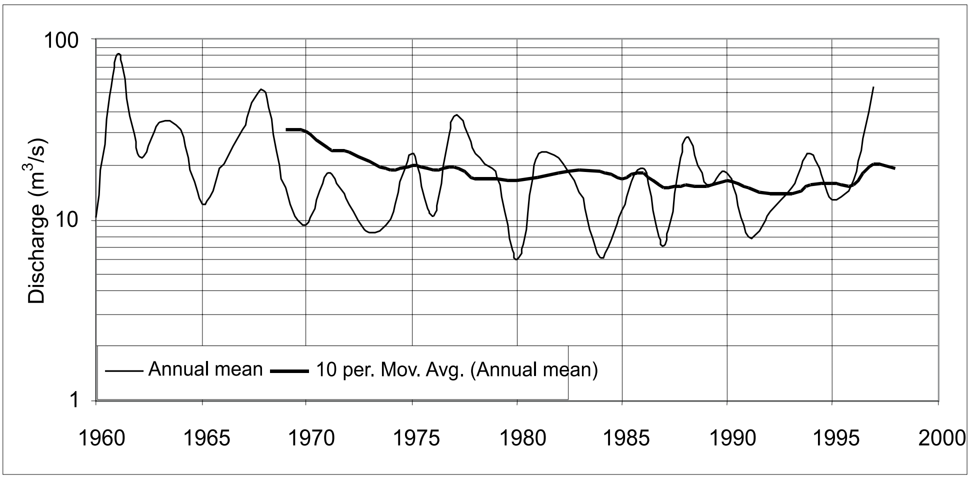
Sources: MoWD 1992 and NRM[3] database 2000.
*Catchment between Junction and Archer's Post.

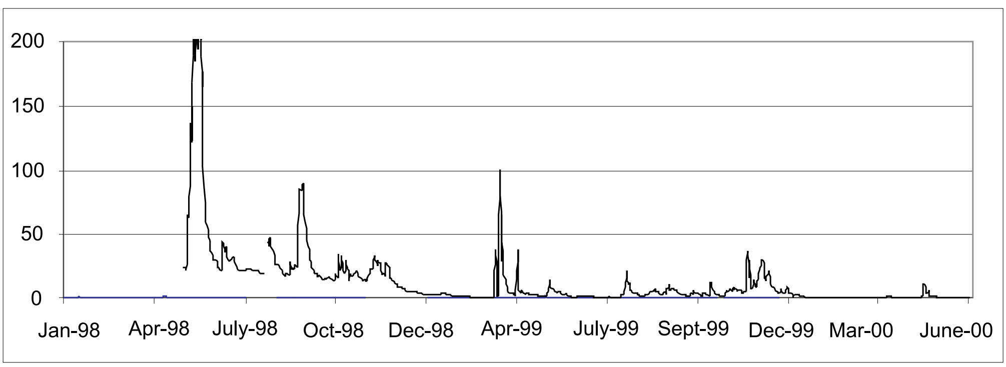
Monthly flow data show that there is a high variability in flows with February having the lowest mean flow and November recording the highest mean flow (table 4). The analysis of river flow at Archer's Post from 1960 shows a clear trend of decreasing dry-season flow (figure 3). During the period 1960–2000, the maximum mean annual flow recorded was 82.36 m^3s^{-1} in 1961 and the minimum was 6.8 m^3s^{-1} in 1980 with a mean of 20.8 m^3s^{-1}. The 10-year running mean indicates that the flow has been decreasing since 1970. From April 1998 to December 2000, the daily mean flow peaked at 354 m^3s^{-1} in May 1998 and dropped to zero in February 1999 (Gichuki et al. 1999). River flow at Archer's Post gauging station is lowest in February and the mean for this month has dropped from 9 m^3s^{-1} in the 1960s, to 4.59 m^3s^{-1} in the 1970s, to 1.29 m^3s^{-1} in the 1980s, and to 0.99 m^3s^{-1} in the 1990s (Liniger 1995). The river dried up for a stretch of up to 60 km upstream of Buffalo springs in 1984, 1986, 1991, 1994, 1997 and 2000 (Gichuki et al. 1995; Gichuki et al. 1998b). This reduction in flow is attributed mainly to increasing water abstraction upstream and drought cycles, as there is no corresponding decline in rainfall amounts over the same period.

Table 4. Monthly flow characteristics at Archer's Post.

	Monthly Flow Parameters 1960–2000 (m^3s^{-1})			
Month	Mean	Median	Standard Deviation	High Outlier Threshold
Jan.	11.82	4.25	17.76	181.73
Feb.	7.43	2.22	12.25	145.88
Mar.	10.28	5.59	13.40	142.06
Apr.	38.03	23.93	37.27	387.29
May	25.57	20.96	20.51	200.64
June	14.70	8.80	15.50	115.86
July	12.39	8.37	9.50	74.63
Aug.	16.95	13.13	13.53	141.85
Sept.	14.18	11.97	10.31	107.64
Oct.	17.65	12.82	15.74	212.96
Nov.	52.82	22.8	107.44	350.69
Dec.	28.12	12.16	36.47	273.67

Figure 3. Temporal variability of Ewaso Ng'iro river flow at Archer's Post.





Groundwater. The total amount of groundwater replenished in the upper catchment is estimated to range between 120 and 220 million m^3 per year (MoWD 1987). Springs discharging the water in the riverine areas of the Ewaso Ng'iro river near Archer's Post (Buffalo[3] and Shaba springs) are an important source of dry-season flow for wildlife around the game reserve areas and for pastoralists downstream. Groundwater yield at points in the basin is associated with the hydro-geological properties of a given area and is highly variable with a static water depth ranging from 5.3 m to 96 m and the discharge varying from 0.3 m^3/hr. to 13.7 m^3/hr.

The distribution of boreholes in the basin is influenced by the availability of alternative water resources, groundwater potential,[4] economic activities of the area, and purpose and ownership of the borehole. In communal grazing areas, most of the boreholes are owned by the government as part of the program to improve access to water resources in areas with good grazing resources and limited surface water.

Water quality. Surface water is considered to have an acceptable quality for irrigation, livestock and domestic use in most areas. Decurtins (1992) quoted in Gichuki et al. 1998b reported that the Ewaso Narok river had very high concentrations of sodium and high electrical conductivity whose effect is moderated when the Ewaso Ng'iro merges with it. Therefore, it can be concluded that Mt. Kenya is a very important source of river water both in quantity and quality.

The limited availability of data on water quality shows that there are reasons for concern in some places, particularly during the dry season when the concentration of pollutants increases beyond acceptable levels. The main concerns of water quality are sediment loads, salinity, sanitation and sewerage, industrial waste and agricultural chemicals. Sediment is the major form of physical pollution. The Ewaso Ng'iro North river is reported to have a high suspended sediment load (1,538 ppm), the second highest rate of suspended sediment load of the major rivers in Kenya[5] (MoWD 1992). Studies on the suspended sediment load in ephemeral catchments show that the sediment load can be as high as 200 kg s^{-1} at a flow rate of 4.4 m^3 s^{-1} (Gichuki et al. 1995). The main source of biological pollution of surface water is sewage from major urban centers, namely: Nyahururu, Rumuruti, Nanyuki and Isiolo. The incidences of waterborne diseases are reported among community members who use Nanyuki river water downstream of the Nanyuki town, indicating possibilities of high levels of bacteriological pollution of the river water.

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[3]Buffalo springs, on the southern bank of the river, yield approximately 0.20 m^3/s to the Ewaso Ng'iro North river during the dry season. This source of water maintains flows at Archer's Post even when the Ewaso Ng'iro North river dries up about 60 to 80 km upstream of Archer's Post during the dry season.

[4]A recent project involved in the development of groundwater resources in the semiarid areas of the Laikipia district has reported a 63.7-percent success rate in striking water and equipping the boreholes.

[5]Suspended sediment load was reported as 3,387, 1,538 and 1,328 ppm for Perkerra, Ewaso Ng'iro North and Tana rivers (at Garissa), respectively.

Factors Leading to Declining River Flows at Archers' Point

Natural Factors

The main natural factors contributing to the declining river flows at Archer's Post river-gauging station are seasonal rainfall pattern, low rainfall/high evaporation and drought cycles.

Since rainfall is the main source of streamflow, seasonal rainfall directly influences streamflow. The spatial variability of rainfall in the basin (see rainfall section) results in January and February being the months with no significant rainfall throughout the basin and hence with the lowest flow regime.

The average annual evaporation, rainfall and deficit (rainfall-evaporation) over the entire basin are 1,739 mm, 651 mm and 1,088 mm, respectively. Annual rainfall exceeds annual evaporation in only 1 percent of the basin area. A deficit of more than 1,000 mm per year is experienced, on average, on 51 percent of the basin area, whereas 11.5 percent of the area has a deficit exceeding 2,000 mm.

An analysis of data on rainfall and streamflow shows that extreme conditions of low flow are experienced during the dry seasons and in cycles of 2–8 years. A correlation analysis of rainfall and river discharges has shown that the decrease in low river flow is not a result of changes in rainfall patterns (Liniger and Gichuki 1994) but is due to a combination of low rainfall and high levels of water abstraction in the upper reaches. The drying up of the Ewaso Ng'iro North river upstream of Buffalo springs occurred following the low rainfall in 1983/84, 1985/86, 1991/92, 1994, 1997 and 1999/2000.

Human-Induced Factors

The main human-induced factors contributing to declining low flows at Archers' Post are land use and management, increasing water demand for human, wildlife and livestock use and inadequate management of water demand and supply.

Land use and management-induced water scarcity. Land use and management affect the partitioning of rainfall into runoff and infiltration that, in turn, affect the temporal and spatial availability of soil water, river water and groundwater resources. In forested areas, high rainfall, favorable soil drainage, and good canopy and ground cover result in high infiltration and groundwater recharge. Moderate evapotranspiration rates in these areas limit the amount of water lost to the atmosphere leaving most of the water to be released as dry-season river flow. Therefore, the forest belt is the most valuable water catchment area. In the semiarid highland plateau and arid lowlands, runoff induced by land degradation limits infiltration, groundwater recharge and dry-season river flows. Runoff losses as high as 60 percent have been recorded under poor ground cover conditions illustrating the importance of soil cover and topsoil management in water management (Liniger et al. 1998). Under these conditions, most of the rivers are ephemeral.

The main forms of land use changes experienced in the basin involve conversion from natural to plantation forest, from natural forest to cropland, from bushland to grazing land, from bushland to cropland, from grazing land to cropland, from grazing, forest or cropland to residential, commercial or transportation-infrastructural land and from swamps and marshes to cropland. The most dramatic land use change is the conversion of grazing land to cropland in the Laikipia plateau by smallholder farmers, which was reported to be 25 percent between 1984 and 1992 (Liniger 1995).

Land management changes are made to facilitate intensification of land use and include irrigation, conservation farming (in-situ moisture conservation, contour farming, mulching, construction of structures for soil conservation and the use of cover crops), agroforestry,[6] plantation forest and cultivation of cleared forestland during the period of the plantation-tree establishment. These management changes are mainly geared towards increasing the productivity per unit area and, in some cases, result in higher water use thereby reducing the catchment water yield, particularly in semiarid areas. In humid and semihumid areas, these land management practices may lead to increased groundwater recharge, which ultimately improves river flows during the dry season.

The area where land use and management changes lead to improved dry-season river flows is small compared to where runoff has increased and, therefore, the net effect of these land use and management changes on water scarcity has been the decrease of river flow during the dry season (mainly the degradation of grazing land and increased water use by irrigated agriculture).

Increasing water demand for human, wildlife and livestock use. The human population has been reported to increase at 2–8 percent per annum in different parts of the basin and by 1989, the estimated population of the area was 270,000 (Karekia 1995). The total wildlife population in the lowlands in 1997 was estimated at 121,082, consisting mainly of buffaloes, eland, elephants, gazelles, impala, gerenuk and giraffes. The elephant population grew from 1,156 in 1977 to 5,391 in 1997. The increase in elephant numbers has a significant effect on water resources because their vegetation consumption affects ground cover and hence runoff. The livestock population in 1997 was estimated at 521,196, consisting mainly of cattle, sheep, goats, camels and donkeys (Muchoki 1998).

The projection of water demand in the year 2010, assuming 9,000 hectares of irrigated agriculture and 3 percent growth in the human population and the 1997 animal population, shows that the basin will experience serious water constraints (table 5). The densely populated area at the foot of slopes and on the Laikipia plateau, where population pressure has been increasing and where there is a high irrigation potential, will experience the highest water deficit.

Inadequate management of water demand and supply. There is a high dependency on perennial river water resources. Wiesmann (1998) noted that 75 percent of the rapidly growing population in the basin was concentrated in small-scale settlement areas where the demand for perennial river water has been increasing rapidly. In a household survey of the smallholder farmers, Wiesman reported that since 1964, rain, groundwater and perennial river-based water supply systems had increased (in number but not in volume of water supplied) by 11, 34 and 60 percent, respectively. Towards the end of the dry season, 88 percent and 93 percent of the

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[6]Liniger et al. (1998) reported a fivefold increase in trees in cropland and a twofold increase in trees in grazing land within an 8-year period (1984–1992).

Table 5. Subbasin water balance for the year 2010.

		Potential (m^3/day)		Demand in 2010 (m^3/day)		Potential Demand in 2010 (m^3/day)	
Subbasin	Area (km^2)	Surface water	Ground-water	Domestic and livestock	Irrigation water requirement	Domestic and livestock	Domestic livestock and irrigation
5AA	560	1,728	1,321	14,601	35,000	-11,552	-46,552
5AB	482	2,592	455	15,434	65,000	-12,387	-77,387
5AC	1,879	3,802	1,744	24,525	59,000	-18,979	-77,979
5AD	517	1,037	907	5,731	35,000	-3,787	-38,787
5BA	269	12,960	125	4,144	80,000	8,941	-71,059
5BB	452	39,744	461	4,061	90,000	36,144	-53,856
5BC	1,636	45,792	2,824	16,800	120,000	31,816	-88,184
5BD	674	17,280	805	6,760	53,000	11,325	-41,675
5BE	1,238	4,320	2,636	10,456	150,000	-3,500	-153,500
5DA	2,240	108,000	8,306	20,102	90,000	96,204	6,204
5DB	1,176	132,192	3,579	2,921	25,000	132,850	107,850
5DC	1,268	175,392	2,894	8,419	14,000	169,867	155,867
5DD	1,883	134,784	5,553	18,392	16,000	121,945	105,945
5DE	926	3,900	450	5,289	70,000	-939	-70,939
Total	15,200	683,522	32,060	157,635	902,000	557,948	-344,052

households are dependent on river water in the semihumid and semiarid zones, respectively. These values underline the importance of perennial rivers as water sources and the growing pressure on these resources during the critical dry-flow conditions. The main reasons for the high dependency on the perennial river water resources are: a) reliability; b) accessibility; c) ease of capture and conveyance to the point of use, as they require the least technical and material input during construction and operation; and d) nonexistent or too expensive alternative sources of water.

There is also water scarcity induced by the abstraction of irrigation water. High levels of water abstraction in the upper reaches of the Ewaso Ng'iro have been blamed for decreasing water availability in the lower reaches. Overabstraction in the upper reaches of the river has been taking place since the introduction of irrigated agriculture in the area but it has increased at an exponential rate since 1984 when production of horticulture crops for the export market became very profitable. There is a higher level of abstraction in the upper reaches mainly due to the hydraulic and hydrologic advantage, suitability for irrigation development, access to the market and the settlement density. During the dry season, irrigation water demands and economic loss for not irrigating a water-stressed crop are highest. Consequently, as much as 60–80 percent of available water in the upper reaches is abstracted, 40–98 percent of it being unauthorized (Gikonyo 1997). Unauthorized abstractions are mainly attributed to a) lack of an effective abstraction-monitoring program, b) high financial returns from irrigated agriculture and low fines for illegal abstractions, c) lack of storage facilities for floodwater; and d) low water-use efficiency as evidenced by low irrigation efficiencies (25–40%) of smallholder irrigation schemes (Gichuki 2000).

There is potential for untapped water storage. Where there is inadequate ground cover most of the rainfall runs off whereas retaining only 30 percent of the current runoff can triple the available water supply (Gichuki et al. 1998b). Most parts of the basin have a high potential for water harvesting (surface or roof catchment) and storage (above and below ground tanks). Experience has shown that the use of underground water tanks, as a source of supplemental irrigation water, enables farmers to grow vegetables during the dry season and recover their investments in 2–4 years. The potential for small earth dams exists on many ephemeral and perennial springs. This potential if exploited would minimize the dry-season water abstraction from the perennial rivers. Suitable sites for large- and medium-scale reservoirs have also been identified but none has been developed (Gichuki 1999).

Conflicts Associated with Water Scarcity

Conflicts and Key Actors Associated with Water Scarcity

Conflicts in the basin have arisen due to a number of reasons: ethnicity, clanism, finance, gender, water scarcity, inequitable water allocation and distribution, election of representative water users, failure to observe water bylaws, imposition of values by outsiders, etc. In this paper, the focus is on conflicts induced by water scarcity. Water scarcity, particularly in the lower reaches of major rivers, has been increasing over the years and has resulted in conflicts. Box 1 presents a summary of some of the conflicts that have been reported in the basin. The effects of conflict vary from temporary reduction in water availability to complete collapse of water-supply projects. In some cases, conflicts have escalated into physical violence.

Water-related conflicts occur in the basin at the following levels: among water-project beneficiaries (project level); between different water-user groups (upstream v downstream); and between water users and environmentalists/resource managements (use v conservation). Project-level conflicts occur within a water project where the water-project beneficiaries are the key stakeholders. Conflicts at this level arise from inequitable water allocation and delivery, financial mismanagement, disputes over the unfair distribution of maintenance work, failure to observe bylaws, etc. Conflicts between upstream and downstream occur between irrigation and nonirrigation water users, mainly over very low dry-season river flows. Conflicts at this level arise from overabstraction of water by upstream water users, pollution of water, lack of cooperation between different user groups, disputes generated by jealousy related to growing wealth disparities, and conflicts between indigenous resource users and recent settlers. Use v conservation conflicts occur between those benefiting from direct use of water and those benefiting from environmental functions (e.g., tour operators/hoteliers operating in the basin). Conflicts at this level arise from environmental degradation associated with the drying up of the lower reaches of the river, migration of wildlife to upper reaches in search of water and grazing resources and associated loss of income.

The key actors in these conflicts fall into the categories of active or passive parties. They include environmentalists, small- and large-scale irrigators, nomadic pastoralists and commercial ranchers, downstream hoteliers and tour operators and downstream communities (living below the Archer's Post).

Box 1. Intensity of water conflicts.

Downstream Water Users Versus Conservationists Calling for Reduced Destruction of Forested Water Catchments

One of the main causes of water problems has been identified as destruction of water catchment areas. Newspapers are replete with statements on the effect of the wanton destruction of the water catchment. For example, on 26 February, 1999, the Managing Director of Tana and Athi Rivers Development Authority was quoted by a Daily Nation reporter as saying that “Kenya faces an imminent water deficit attributed to the massive destruction of water catchment areas. There is a lot of clearing of catchment areas that must be curbed.” On 3 December 1999, another Nation reporter said that 5 persons had died and many houses, household goods and crops washed away following flash floods in unprotected water catchments. On 15 March 2000, Namunane attributed water scarcity to massive felling of trees in water catchment areas. He quoted a former minister as saying “parts of his Nyeri district that were once wet and lush all year-round, have rapidly turned into semiarid areas requiring food relief.”

Sources: Daily Nation. Issues on 26 February and 23 December 1999, and 15 March 2000.

Conflicts between Smallholder Irrigators and Smallholder Farmers

On 21 February 2000, residents of the Kariminu village led by the Chairman of the Nyeri County Council barricaded the Nyeri-Nyahururu highway from 8.30 a.m. to 1.00 p.m. when the police arrived at the scene. They were protesting against the diversion of the Kariminu river by a group of individuals for irrigation and failure of the local District Officer and District Water Office to take any action to stop the illegal abstractors from draining the river. They claimed that their sub-location had gone without water for several months due to overabstraction by upstream irrigators resulting in increases in typhoid cases and near closure of a local boarding high school. They demanded audience with the area District Commissioner. As the riot police were restoring law and order, a riot erupted and several vehicles were damaged and old men and women who could not flee were injured.

Source: Wachira 2000.

Box 1. (Continued).

Conflicts between Irrigators and Pastoralists

Mathenge (2000a) reported that NGOs working with pastoralists were expressing concern over unbalanced exploitation of water resources, which cause serious conflicts. They argued that the benefits accruing from horticultural farming should not be allowed to continue at the expense of denying water resources for pastoralists. They blamed small- and large-scale irrigators for the drying of the Nanyuki river barely 20 km from the Nanyuki town. They criticized the government for failing to enforce the Water Act.

Conflicts between Irrigators and Fish Farmers

On 13 March 2000, a Daily Nation correspondent reported that a Nanyuki fish farmer had lost 30,000 trout following the diversion of the Likii river for irrigation upstream. The loss was estimated at KSh 4 million (US$53,000). This is an example of the water availability risks that are borne by downstream water users.

Source: Nation Correspondent 2000a.

Human-Wildlife Conflict

On 21 March 2000, a Daily Nation correspondent reported that 10 villagers of the Takaba Trading Centre, Mandera district, were hurt and 8 monkeys killed in a 2-hour battle between man and beast over water. The trouble started when monkeys attacked villagers, while the latter were drawing water from three relief water-delivery tankers. The clawing and biting monkeys sent villagers fleeing and then took to quenching their thirst. The villagers regrouped and counterattacked and killed eight monkeys. The villagers reported that water shortage in the area had forced gazelles, hares and monkeys out of the bush to roam through the villages. They feared that the more dangerous animals, such as elephants, lions and leopards would soon attack them in search of water.

On 23 March 2000, Mathenge (2000b) reported that elephants had left the wild to look for water in a village watering point in the Olborsoit location of the Laikipia district. Approximately 4,000 pastoralists and their cattle were experiencing water shortage and were forced to move upstream in search of water and grazing resources.

Source: Nation Correspondent 2000b.

Why Are Conflicts Interesting?

Conflicts over water resource use result from competition for water resources mainly during the dry season and the presence of deep-seated latent conflicts. Conflicts associated with water scarcity are attributed to overabstraction of water in the upper reaches, land use and management-induced changes in flow regimes resulting in decreased low flows, water pollution and to prolonged drought conditions. Latent conflicts are attributed to inequalities inherent in social, cultural, racial, economic and political disparities among the stakeholders. Latent conflicts include perceived inequitable access to water and land resources, economic and political elites supporting commercial interests over and above those of the local groups, and longstanding ethnic, cultural, racial, political and economic differences. Latent conflicts are generally dormant until "reawakened" by scarcity and/or inequitable allocation of the scarce resource, mainly during periods of drought. These conflicts are intensified by institutional failure to achieve fair and equitable water management and water users' perceptions and attitudes as illustrated below.

Weaknesses in water allocation. The current water allocation procedure lays a lot of emphasis on issuance of water use permits.[7] These permits may be acquired for domestic use, public water supply, minor irrigation (<0.8 ha), general irrigation (>0.8 ha), industrial use and power generation. They are issued by the Water Apportionment Board upon recommendations of the Ewaso Ng'iro North Catchment Board, District Water Boards and the Water Bailiff in charge of the river reach where water is to be abstracted. The current water allocation procedures have the following limitations that constrain the attainment of fair and equitable allocation of water resources:

1. Inadequate information on the availability of water resources, permitted abstraction and reserved flows for future applicants.
2. The concepts of flood and low flow are not generally applied in assessing water availability for the reach from which water will be abstracted.
3. There are no limits set on how much water can be abstracted in different reaches of the river system, or on district water abstraction quotas. This leads to overallocation of water resources in the upper reaches of the rivers.
4. It takes a long time (6 months to 2 years) between the application of a water permit and the award of the permit during which time applicants continue to abstract water.

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[7]The government owns the water resources of the country and the right to use them is vested in the relevant Minister but this right may be acquired in accordance with the stipulations of the Water Act.

Weaknesses in water abstraction policing. All water users abstract water illegally at one time or another. The main difference is in the nature and extent of the illegal abstraction. Illegal abstraction is considered to take place when the water is abstracted by a user without a permit[8] or when more than the authorized amount is abstracted at a particular time.[9] Weaknesses in water abstraction policing are attributed to a) inadequate budgetary and human resources allocated for this task, b) lack of clear guidelines and information on legal abstractors for when to and at what flow rate water is to be abstracted (water permits specify water to be abstracted in term of m^3/day rather than l/s), c) lenience to poor farmers, d) political patronage, and e) lack of complainants (most downstream water users raise concerns only during severe droughts).

Water users' practices, perceptions and attitudes. Over the years, water management has been greatly influenced by people's perceptions and attitudes. Illegal abstraction of water resources started in the 1940s and was influenced by the attitudes of European farmers.[10] They argued that water should be put into more productive use in the upper reaches rather than go to waste in the lower reaches. Ironically, after more than 50 years, practices and attitudes today have not changed due to the following perceptions of upstream abstractors:

1. They are only abstracting a small percentage of the flow, which has little or no impact on downstream water users.
2. Downstream water uses are of low economic benefit and, hence, generally, water goes to waste.
3. Changing the current water abstraction patterns calls for investments, which are costly and unjustifiable to upstream water users.

[8]This may take the form of abstracting water after submitting an application, or after getting approval to construct abstraction works or abstracting using the previous landowner's permit or abstracting pending approval or renewal of the water permit.

[9]This many take place in the form of abstracting water during low flow conditions whereas the permit is for abstracting water under flood and/or normal flow conditions.

[10]Many furrows have been made without permission of the Water Board (actually, they have been made in open defiance of it). They are not lined with cement (nor is the quantity measured) and, in many cases, the water is allowed to run waste in the bush instead of being returned to the river, as it should be, so that what remains of it can benefit the natives living down in the North Frontier Districts (NFD) (Ferson 1948, 279, qouted in Mathuva 1997).

A remark you hear from many of these settlers is "why the hell should the natives have it? (ibid.)

... in a place where water was supposed to be measured, (a farmer) was taking seventeen times the amount of water that was allowed to him: ... I mentioned this to Reece, who was fighting to bring down all the water that he could for the natives of the NFD. He smiled, albeit bitterly, and said that such men should be shot. My opinion is that those who deserve shooting are the people who permit it (Mathuva 1997).

Emerging Issues and Implications for Research

Emerging Issues

Water users' perceptions and their effect on water management. Water stakeholders have diverse perceptions of the availability of water resources, water scarcity and conflicts, and solutions (see box 2). Interventions that will strengthen the ability of different groups to engage in informed dialogues on the problems, the underlying causes, solutions and strategies to address the problems are very important in addressing water management problems at all levels. Therefore, there is a need to a) improve public access to key information on water resources, b) provide a framework for widespread public involvement in decision making in water management, and c) develop analytical and advocacy capacity, which can synthesize water data into information required for influencing informed water-management decision, and guide water-management initiatives.

Box 2. Commercial irrigators' views on water-resource conflicts.

There is a growing perception that irrigated horticultural enterprises are abstracting too much water and consequently having an adverse impact on smallholder irrigators and downstream pastoralists. Commercial irrigators operate under conditions of uncertainty of weather, water availability and market conditions. They also have to take into consideration that the Water Bailiff may ban irrigation altogether on short notice, which could result in huge financial losses arising from nonproduction of irrigated crops and consequently failure to honor delivery contracts. This discourages long-term investments in irrigated commercial agriculture.

Commercial irrigators have to maintain irrigation throughout the growing cycle irrespective of the conditions of the river flow. Provision of storage and, in some cases, exploitation of groundwater are both a statutory obligation and an economic necessity for them. Commercial irrigators view smallholder irrigators as inefficient irrigators. They use inefficient water delivery, distribution and application methods, use poor agronomic practices and consequently get a very low return per unit volume of water abstracted. They argue that substantial savings of water can be made if smallholder irrigators were to substantially improve their water-use efficiencies.

Source: *Gichuki and Njeru 2000; and Fox 1998.*

Need for better water allocation mechanisms. The system of allocation of water resources in the basin evolved in 1963 when a fixed allocation per unit length of river frontage was applied, to allocation on the basis of an application and availability of water resources. Downstream requirements are taken into consideration by estimating water requirements of the downstream water uses and by allocating only floodwater for irrigation, leaving the normal and low-flow water resources for domestic, livestock and industrial uses and for meeting environmental streamflow requirements. Although there is provision for local-level involvement in water allocation, the process is predominantly top-down with most of the decisions being made at the highest levels (Kiteme and Mathuva 1995; Mathuva 1997). This creates room for discontent and lays the foundation for conflicts as water scarcity bites.

In the past, downstream water uses were minimal and, hence, most of the water resources were allocated for use in the upper reaches. The situation is changing with the downstream users demanding a say in the way the water resources are shared (see box 1 for conflicts between pastoralist and upstream users). Therefore, there is a need for integration of views and interests of various sectoral and stakeholders, with due attention given to upstream-downstream relationships in the water allocation decision-making process.

Need to look at the bigger picture. Water scarcity and associated conflicts have been compounded by the lack of a good understanding of the nature and extent of water shortage, failure to take action required to address water-scarcity issues, inequity in resource access, poverty, lack of alternative sources of livelihood, high cost of water development and technologies that use water efficiently, political interference, diverse perception on water availability and entitlement to use, gap between the rich and the poor, etc. These perceptions bring out disagreements among the stakeholders on the causes and the course of action to be taken to address the problem. Hence the need to look at the bigger picture so as to be able to address political and economic disparity and social factors contributing to disputes and disagreements.

Need for better conflict-management mechanisms. As the conflicts continue to intensify there is a need to develop capacity in conflict management.[11] Conflict management strategies should build on the existing mechanisms, such as enforcement of the Water Act and relying on the self-regulating capacity of the stakeholders within the limits of the Water Act (GoK 1999). Capacity building would include training conflict management team members who would consist of trainers, facilitators, mediators or arbiters and developing guidelines on conflict management. Resolving conflicts requires that the issues related to factual disagreements, conflicting goals and relational aspects are addressed (Mostert 1998).

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[11]Conflict management is guiding conflicts towards constructive rather than destructive results. It is a process that promotes dialogue and negotiation by a) addressing issues of disagreements before they generate hostility, b) helping different actors to explore various options for minimizing conflicts and to select those that are widely acceptable and that everyone can live with, and c) identifying the underlying causes of conflict and addressing them with a view to preventing them in future (Babbit et al. 1994).

Getting the facts right. Disagreements on water resources are often attributed to the following:

1. The facts on any water resources situation are dynamic and the situations are hardly ever totally certain.
2. Uncertainties arising from imperfect knowledge of the functioning of water systems, limited representativeness and reliability of data and the use of assumptions as a substitute for knowledge and data.
3. The fact that different interest groups often have different data and information sources.
4. Limited capacity to process and use information in ways that will eliminate misunderstanding.
5. Distortion of facts as a tactic to oppose certain actions (Mostert 1998).

Disagreements over the availability of water resources, levels of water use and the impacts on downstream water users are the major causes of conflicts among upstream and downstream water users in the basin. These disagreements can be addressed by developing an effective communication mechanism to ensure that all the parties share the same data and information.[12] Efforts are under way to initiate collaborative monitoring of river water flows and abstractions with the WUAs. It is hypothesized that by involving the WUAs in streamflow monitoring, they will get a better appreciation of the flow regime and water scarcity.

Minimizing conflicting goals. Conflicting goals arise when the resources use is viewed from different users' perspectives. Conflicting goals in the basin manifest themselves in the use of water for irrigation in the upstream reaches versus using the water to support the wildlife ecosystem and pastoralism in the lower reaches. Even where the goals are not conflicting there may be conflicts over the approaches to use in arriving at the common goals. A case that is generally put forward is that the water resources should be used to alleviate poverty and promote food security. Upstream water users give high priority to using the resources in the upper reaches of the river where, they argue that, their water use efficiency is higher and results in producing food more efficiently, making it affordable to the downstream water users who are mainly engaged in less water-demanding sources of livelihoods.

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[12]For all the parties to agree on the data and information to be used in addressing the conflict, it is necessary that they develop confidence in the data sources. This can be achieved by a) active participation of all parties (in person or through their knowledgeable representative) in monitoring and research and in drawing conclusions, b) monitoring and research undertaken by a third party, acceptable to all parties, c) one party (or its representative) undertakes the monitoring and research and the other parties accept the results if they do not detect any biases or if they do not have the resources to question the results or if they can live with the negative aspects of the decisions arrived at using the results of the study.

Conflicting goals can be addressed by searching for "win-win" solutions in which all parties are better off than under the present situations. "Win-win" solutions can be created by means of compensation in kind and by financial or other management and/or policy interventions. For example, it may be worth exploring compensating upstream water users to improve their water use efficiency and consequently release more water for downstream users.

Addressing Issues of Distrust and Power Struggle

Relational aspects such as distrust and power struggles are important factors in resolution or escalation of water conflicts. Mostert (1998) argued that power struggles can start out of distrust and out of a feeling that the other party wants to increase its power or when the party starting the struggle thinks that it can increase its power. In the upper Ewaso Ng'iro North basin, distrust exists among the interest groups particularly when racial and tribal dimensions are taken into consideration. Power struggles among different communities and water users in the same water project have led to intensification of conflicts over water use (Gichuki 2000)

Research Implications

Research is required to provide answers to the following questions:

1. What are the economic and social losses arising from conflicts associated with water scarcity? What are the economic and social benefits of different technologies for improving water-use efficiencies? What mechanisms are needed to persuade upstream water users to invest in increasing their water use efficiencies thereby reducing the amount of abstraction of river water?

2. What is the value of the ecological functions performed by water and what is the minimum quantity and flow rate for this purpose? What are the benefits of environmental and ecological services of allocating land and water resources to fishing, grazing and forestry, and how can they be shared equitably?

3. How can water resources be allocated among different subbasins and districts? How should water resources be allocated among different water uses and users to ensure that we maximize productivity of water resources and equity, and reduce water-related conflicts?

4. How can policy and institutional constraints be alleviated? What water tariffs should be imposed on abstractors of irrigation water at different flow regimes? What is the optimal mix of direct regulation and self-regulation under different levels of water scarcity and different levels of conflict? What institutional arrangements are required at different levels?

This research calls for development of tools to address these questions and requires integration of social, economic, hydrologic and ecological principles and multidisciplinary research.

Conclusions

Water scarcity and associated conflicts arise because there is a) insufficient water, particularly during the dry seasons, b) inadequate water storage to reduce dependency on dry-season flows, c) inefficient use of water resources, d) diverse perceptions of water availability and inequity, e) inadequate enforcement of water laws, f) water user perceived gains and losses arising from use or nonuse of water, and g) lack of information on the downstream water situation and associated impacts. Under conditions of conflict, efficient water management is crucial to maximize benefits and spread them as widely as possible. An important prerequisite of this is availability of data to understand and interpret the hydrological characteristics of the area.

The government has played a key role in promoting sustainable water management through its policy on water-resources management, legislation and institutional roles. However, due to lack of political will and adequate budgetary provision for implementing policies and enforcing legislation, water scarcity continues to bite. During extreme drought years this translates into conflicts between upstream and downstream users. Consequently, the potential of water resources to alleviate poverty and to promote social and economic growth and prosperity has not been achieved.

The importance of creating an enabling framework for equitable, efficient and productive use of water resources in the basin cannot be overemphasized. It has, however, become evident that water stakeholders will have to play a key role in creating the enabling framework for action. Involvement of stakeholders, capacity building, a sound information base and conflict-resolution mechanisms are the key elements to addressing water scarcity and associated conflicts in the basin.

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