
International Research Workshop on 'Gender and Collective Action',

17-21 October 2005, Chiang Mai, Thailand

Water, women and local social organization in the Western Kenya Highlands

Elizabeth Were, Brent Swallow, and Jessica Roy

Safe water is widely recognized as both a fundamental human need and a key input into economic activity. Across the developing world, the typical approach to addressing these needs is to segregate supplies of water for domestic use from water for large-scale agricultural production. In that arrangement, the goal of domestic water supply is to provide small amounts of clean safe water for direct consumption, cleaning, bathing and sanitation, while the goal of agricultural water supply is to provide large amounts of lower quality water for irrigated agriculture. A new third use of water is now being given more attention by researchers: small amounts of water employed in selected household enterprises. This third use may be particularly important for women. There is a potential, therefore, that provision of modest amounts of water to smallholder farmers can enhance household economic production, save labor time for women and girls, and improve family health.

This paper adds to the merger literature on the multiple values of improved water supplies – improved health, time savings, and small-scale production for individual farmers and collectives – for the case of a rural community in the western highlands of Kenya. With minimum external support, two groups in this community have managed to install and operate systems of spring protection and piped water to their members' homesteads. A third group is in the process of replicating this success. The experience of this community also illustrates some of the challenges that must be faced for a community to effectively self-organize the investment and maintenance of a community-based water scheme. There are challenges of finance, gender relations, conflicts over scarce water supplies, group leadership, enforcement of community by-laws, and policy. Data from a census of springs in the same area show that successful collective action for water management is unusual, but certainly not unique, in this region of Kenya. Although women emerge as the main beneficiaries of improved water management in the community, their substantial contributions are largely hidden behind social norms regarding gender roles and relations. Research methods need to carefully triangulate information sources in order to clarify the very substantial and active roles performed by women.

Keywords: gender, Kenya, water, collective action, community organization, community-based organizations, women

Introduction

A major effort is required in this decade to fulfill (the MDG) commitments and extend access to these essential services to those who remain unserved, the majority of whom are poor people. As women play a central role in water provision and management, a special emphasis will be placed on ensuring the participation and involvement of women in these development efforts. (Kofi Annan, <http://www.un.org/waterforlifedecade/>)

Analysts studying Asian irrigation systems began to recognize the multiple-use nature of water supplies several years ago (Meinzen-Dick and Bakker, 1999). While domestic and multiple use of irrigation water may be seen as a problem by irrigation managers, it can also be seen as an important reality that must be considered by all those who design and manage irrigation systems. For example, it may be possible to organize irrigation channels and reservoirs to deliver safer supplies to household users before reaching fields that may have runoffs of phosphorus or pesticides¹. Accommodating multiple uses of water may be complicated by social relations that are systematically biased against groups such as women, landless people, pastoralists, small-scale industrialists, or downstream irrigators.

While irrigation dominates agriculture in much of South Asia, it is relatively unimportant in Africa. Across the vast parts of the landscape that depend mostly on rainfed agriculture, the potential for multiple use of water systems is through the use of rainwater harvesting and domestic water supplies for small-scale agricultural production (Rockstrom, Barron and Fox, 2003). Moriarty et al. (2004b) present an excellent case study of the value of water in smallscale agriculture for the Buckbridge community in South Africa. Drawing upon these and other case studies, Moriarty et al. (2004a) propose that quantities of water as small as 50 – 200 litres per capita per day can make big impacts on small-scale agricultural production, home industry and people's overall livelihoods. Moriarty et al. (2004a) therefore proscribe changes in policies and programs affecting water supply, relating particularly to the South Africa policy of guaranteeing access to a minimum of 20 litres per capita per day. Across East Africa, however, little research has been done on the actual or potential value of water supplies that go "beyond domestic" needs.

Across the global South, men's and women's divergent social positions lead to differences in water use, water rights, and access to water (e.g., Meinzen-Dick and Bakker, 1999; Zwarteveen and Meinzen-Dick, 2001; Crow and Sultana, 2002). In many societies, women have the primary responsibility for completing domestic work, including collecting water. Furthermore, in many societies, women's and girl's reproductive work and other unpaid labour are not considered 'real' work. Across the globe, particularly in non-industrialized countries, men control land, finances, industry and government and thus men tend to control access to water (Crow and Sultana, 2002). Legal or formal water rights (rights to control water) are typically vested in farmers or household heads, typically men. Water management structures – from the local to the basin level – tend to be dominated by men, particularly large-scale water users and administrative, political and economic elites (Guerquin et al., 2003, p. 56).

The East African country of Kenya is characterized by limited freshwater resources and high rainfall variability. It receives less than 650 square meters of freshwater per person per year, making it one of the most water scarce countries in Africa and the world (WRI Earthtrends, 2003). Water scarcity is further compounded by extensive degradation of existing water resources, increasing vulnerability of rainfall, and periodic droughts and floods. Much of the rain falls in less than 20% of the country; the rest of the country is arid and semi-arid.

¹ Personal communication with Susan Poates, describing traditional canal irrigation systems in the Andes region of northern Ecuador, September 2005.

Kenya's water resources have been mismanaged through unsustainable water and land use policies, growing pollution and increasing degradation of rivers, lakes, wetlands and catchments. The water sector is known for low levels of investment, with most infrastructure now old and dilapidated. National-level data show that about 12% of rural Kenyans have household water connections (WHO / UNICEF, 2004) and approximately two-thirds of poor rural households depend on unprotected sources of water (wells, rivers, lakes, ponds and rainwater) in all seasons (DOW II, 2002). Virtually no progress in reducing the proportion of people reliant on unprotected water sources has been made over the last 10 years (WHO / UNICEF, 2004).

In Kenya, women and children are generally responsible for domestic water-collection and management (Huggins 2000). Women make choices about the water they collect. Many women must decide between a water source that is distant providing higher quality water and one that is near but providing lower quality water (Nyong and Kanroglou 2001; Crow and Sultana 2002). The amount of time women spend collecting water affects the amount of time they have for education and paid work. In Kenya, as in many societies, women's and children's reproductive work and other domestic labor are not considered "real" work (Suda 1996). Suda posits that social and cultural norms have naturalized women's domestic roles. Cultural norms in much of the world most likely serve to undervalue domestic work. However, Whittington et al (1990) estimated the value of time spent collecting water for households in Ukanda, Kenya and found that time spent collecting water was nearly equal in value to the wage rate for unskilled labor.

One option for expanding the coverage of safe and productive water supplies is to empower individual households and community groups to undertake and operate appropriate water supply infrastructure. With most of its population living on the slopes of the country's five "water towers" (the Aberdares Range, Mount Kenya, the Mau Forest Complex, Cherangani Hills and Mount Elgon), there is great potential for communities to protect and harness water from natural springs. Research on gender, social relations and water has been initiated in the Nyando river basin, where it was known that springs are a major source of household water supplies. This paper reports results from the village of Kiptagen, a village in the Western Kenyan highlands. Kiptagen is a relative success story, a village where community groups are mobilizing for improving water supplies. The Kiptagen case was uncovered in the course of research on poverty and property rights dynamics recently undertaken across the Nyando basin (Swallow et al., 2005). Results presented in this paper focus on gender relations, social organization, gender-disaggregated impacts, and the challenges of uncovering the multiple contributions of women to local water management. The two objectives are to (i) identify institutions, processes and challenges that affect successful water supply to rural communities; and (ii) identify and quantify the role of water-based activities in improving livelihoods of the rural poor, in addition to hygiene and health benefits.

Background

Kenya's National Water Plan of 1974 committed the Government of Kenya to ensure availability of potable water, at reasonable distance, to all households by the year 2000 (Water Master Plan, 1974). In the 1980s the government began to experience more severe budget constraints and it became clear that, on its own, it could not fulfill this commitment. Attention therefore turned to finding ways of involving others in the provision of water services in place of the government, a process that came to be popularly known as "handing over".

In 1983, the government policy of district focus for rural development became operational, shifting increased responsibility to districts in order to encourage local initiative and improve local capacities. This, together with *harambee*, the local spirit of working together which was introduced at independence in 1963, gives the general framework for community management of water supply systems in Kenya (Oenga et al., 1997).

The Water Act of 2002 proscribes very different roles for the government. The revamped Ministry of Water and Irrigation has become mostly a policy-making and coordinating agency. Responsibility for management of water resources is now vested in the semi-autonomous Water Resources Management Authority, and responsibility for regulating water services is vested in the Water Service Regulatory Board. A new fund, the Water Services Trust Fund, has been established to channel external resources for water supply to disadvantaged communities.

In this new institutional setting, water provision is now seen as the role of private enterprises and non-governmental organizations. Under the Water Act of 2002 there is no clear recognition of the role of community-based organizations, despite evidence of their importance. Njonjo and Lane (2002) found that of eight million people who have access to improved water in the rural areas, 30% are served by community managed water supply schemes developed by self help groups. Njonjo (1997) found that community water associations are diverse in nature and capacity, ranging from fairly sophisticated systems with well structured tariffs to simple gravity schemes operated without any formal processes.

While Kenyan law requires self-help groups to be formally registered, there is no specific legislation governing how they work. For instance, non involvement of women as formal members in community water associations is a common denominator of water projects in the upper Nyando basin. Suda (2000) found women's participation in environmental conservation in Nyando and Kericho districts to be low. Part of the explanation was that women's farm work and household responsibilities divert their time from conservation activities. Also, activities performed by women were perceived as extensions of their domestic work and not as additional responsibilities.

Overview of study area

Kiptagan village is located in Ketutui sub-location, Ainamoi Division, Kericho District in the Western highlands of Kenya. The area is located in the upper catchment of the Nyando river basin, an area of about 3500 square kilometers that drains into Lake Victoria through the Winam Gulf. Rainfall in the Nyando basin varies from 700 to 2000 mm per year, and elevation varies between 1100 and 3000 meters above sea level. Population density in the basin ranges from less than 50 to over 1000 persons per square kilometer. The prevalence of absolute poverty ranges from over 70% percent poor to about 30% poor across the administrative locations in the basin. HIV / AIDS prevalence is very high, particularly in the areas occupied by Luo people on the flood plains near Lake Victoria. Patterns of land tenure, human settlement, and farming systems have been largely shaped by the pattern of colonial and post-colonial settlement that unfolded over the last century (Onyango, Swallow and Meinzen-Dick, 2005).

Relative to much of the Nyando basin, Kiptagen village is relatively well resourced. It is located at about 2000 meters above sea level, receives average annual rainfall of about 1500 mm, and is located near the large market town of Kericho in a major tea-growing area. By Kenyan national standards, poverty is relatively low: 30-40%; community groups describe an even lower rate of poverty accordingly to their own definitions (Swallow et al., 2005). The area is inhabited by people of the Kipsigis ethnic group, a Nilotic Kalenjin-speaking people. Major farming activities in the village are maize production for sale and consumption, livestock keeping, dairy farming and tea growing. Land tenure is freehold and adjudicated, indicating that the area was a native trust area during the colonial period. Improved water resource management is an important priority for communities throughout the basin (Swallow, 2005).

Water supply and water resources in the study area

Government involvement in improving water supply in Kericho district is limited to provision of technical advice to user groups. The Water Department issues the abstract permit after checking the quality and potential quantity of the discharge from the spring eye. As in many parts of Kenya, local authorities in Kericho are short of funds to invest in improving and expanding water systems, or even to maintain operating systems. The only government agency currently supplying water in Kericho district is

the National Water Conservation and Pipeline Corporation, which operates a pumping scheme that covers 20 square kilometers.

A census of springs in 5 administrative divisions of Kericho district was undertaken in early 2005 in order to better understand the importance of springs as sources of drinking water and the prevalence of different types of spring management. Springs were classified into three groups: unprotected springs had no obvious physical improvement and little social organization around spring use; protected and not piped springs had some obvious physical improvement and a minimum of social organization to maintain that investment; and protected and piped springs had constructed tanks and pipes that carried the water by gravity flow to downhill water taps. The census uncovered 135 springs, 85 (63%) of which were unprotected, 24 (18%) of which were protected and not piped, and 26 of which were protected and piped (19%). Of the 24 protected and not piped springs, 11 were mostly self-organized by community groups, while 13 were mostly organized by external agencies. Of the 26 protected and piped springs, 13 were mostly self-organized by community groups, while 11 were mostly organized by external agencies (D. Bondotich, unpublished results from spring census of Kericho district, 2005). The Water Act of 2002 implies less government support and more regulation of small community groups, further threatening the viability of community-based water supplies.

Evolving gender ideologies in Kipsigis society

In pre-colonial and early colonial Kipsigis society, men had a right to inherit and hold predominant control of land and livestock. Men's rights to property were circumscribed by the fact that women were regarded as heads of 'houses,' with residual rights of control, and the right to pass land on to their male heirs. Women's status and power were further sustained by their position as producers, processors and traders of food crops (Ochardson 1961; Peristiany 1939). By having sole control over harvested grain, women were vital in their husbands' prestige and wealth and possessed considerable influence over the ways that power and influence were consolidated in the community.

Colonization and commoditization led to the privatization of land and the introduction of new crops for exchange. The introduction of maize as the staple food changed the existing division of labor; women continued to cultivate millet on a small scale but maize production and trade with maize came to be regarded as men's 'business'. Since maize was for both consumption and trade, women were obliged to work on their husband's field as helpers. Thus women changed from being autonomous millet producers to being unpaid family laborers. In addition, women's customary rights to the means of production were limited when land adjudication registered land in the names of men. Today, men thus own and control the major means of production and economically significant resources. They acquire exclusive rights to productive and reproductive services of their wives through payment of bridal wealth. A man's responsibility is to raise money to cover major household expenses by engaging in income-generating activities and through wage labor. Women's fundamental roles in the household are to provide food, care for the children, carry water, tend cattle, keep the house clean and do whatever the husband wants her to do, e.g. help him in the tea field. (Sorensen 1990)

Research Methods

A study of poverty and property rights dynamics in the Nyando basin was conducted in 2004-5, including an intensive survey of 14 villages distributed across the basin. Villages were selected to be representative of 12 distinct zones in the basin, with zones defined by ethnicity (dominantly Luo, Kipsigis or Ogiek), land tenure (adjudicated – former native reserve, resettlement scheme, large-scale leasehold, undivided leasehold), water management (non-irrigated, irrigated private land, irrigated government land), land use (type of dominant cash crop, large-scale irrigation), and altitude (floodplain, mid-altitude, higher altitude). For each zone, a rural village was selected that had between 50-100 households.

Through this process, Kiptagen village was selected as a Kalenjin-speaking village located at high altitude, with adjudicated land tenure and rainfed agriculture. In the first months of 2004, a week-long survey was undertaken in Kiptagen by a 6-person survey team conducting in-depth interviews with a village representative group, village mapping and household surveys. Group interviews and household surveys revealed a surprisingly high level of social organization around water supplies, with three springs protected and piped, and plans for investment by other groups (Leah Onyango, unpublished data, 2005). Kiptagen was therefore identified for a follow-up study of local social organization, water impacts, and gender relations. The first phase of that study included comparison with a Safeguard village with virtually no collective action for water management. Preliminary results of that comparative study, mostly from key informant and focus group interviews conducted in June – August 2004, are presented in Roy et al. (2005). This paper focuses on more indepth studies conducted in Kiptagan village in March and April of 2005. The senior author of this paper led the implementation of those indepth studies.

Kiptagen village offers an interesting range of water management situations, with two groups successfully operating piped water systems, another group in the investment stage of their piped water system, and other groups still relying on unprotected springs. To investigate and clarify factors facilitating and hindering successful community organization, this study identified a pair of two groups facing similar opportunities and constraints; one group had succeeded in providing supplies of piped water to their members, one group relied on unprotected springs for their water. Key informant interviews were held with government agricultural, health and water officers at the district and divisional administrative units. At the community level, village elders, chiefs, water committee members, and other community leaders were interviewed. Results from those interviews were cross-checked against earlier interviews conducted in the June – August 2004 period.

The study also involved six focus group discussions following question guides adapted from the two earlier studies in Kiptagen. Focus group discussions were held with the all male Management Committees of the Chesilot, Kiptagen and Mairmur water projects, and with groups of women who currently use, or will use, piped water supplied through those projects. To better understand the role women played in improving water supply, semi structured interviews were held with individual members of the piped water project. Individual interviews were held with 30 adult women using protected and piped water and another 39 adult women using unprotected springs and streams. Field assistants accompanied respondents to and from open springs to countercheck respondents' estimates of the amount of time allocated for water collection.

Water Sources and Water Rights

In Ketitui sub location, springs are the main sources of water, with some households located far from springs relying on small streams originating from the springs. Streams are important for all households during dry periods, especially for watering livestock. Rooftop catchments and wells are alternative sources of water. Fifty-three percent of the households who reported using open springs also collected rain water into drums and small pots during the rainy season. Ten respondents indicated that they used water harvested rainwater from neighbours' roof tops since they themselves had grass thatched houses inappropriate for collecting rainwater. Wells provide an alternative source of water to a small number of community members who are unable to join gravity water-supply schemes because of being located above the spring heads. Well water is considered unsuitable for drinking and instead is used for watering cattle, cooking and irrigation.

Kiptagen village includes several significant springs, including Kiptegan, Tenduet, Cheribo, Mairmur, Chesilot and Asurur springs. Kiptegan and Chesilot springs have been protected and piped to members' homesteads, while Mairmur spring is in the process of being protected and piped. Non-members of these groups collect water at the springs and carry it to their homesteads for drinking, watering livestock, and irrigating nurseries for tea seedlings. Women and older children bear almost all of the responsibility for fetching water. Bathing and washing of clothes is mostly done at the springs.

Table 1 lists the various water sources used by people in the Kiptagen area, the location of those water sources, and the way that people obtain access rights to those sources. Springs are located on both individual and public land. In practice, there is very little difference in access between unprotected springs on private land and unprotected springs on public land. Kipsigis social norms hold that land owners must allow access to natural free-flowing water sources, including springs and streams. Previous research conducted across in the Nyando basin shows that farmers invariably provide access to unprotected springs via trails across their land, while many farmers cultivate or fence off the trails that provide access to rivers.

Table 1. Rights to sources of water

Source	Location	Rights
Open springs	Individual land	Agreement between land owner and community
	Public land	Open access/longstanding custom
Protected, not piped spring	Public land	General public access
Protected and piped spring	Individual land	Agreement between user group, land owner and user group
Stream and Rivers	Public land	Open access
Wells	Individual land	Maintenance fee by users
Rain water		Agreement between house owner and neighboring households

Source: Key informant and group interviews conducted by the authors, March – April 2005.

Variations from that norm occur for the case of wells and springs in which individual land owners or groups of water users make specific investments in the water point. Prior to the Water Law of 2002, group rights to protected springs could be formally registered with the District Office of the Ministry of Water, with land owners recognizing that right by signing “no objection” forms. Wells are generally considered to be private property and consent is obtained from the land owner before water can be drawn. While there are no fees incurred for drawing water from neighbours’ wells, an annual maintenance fee is charged for cleaning the well and replacing the drawing container.

In the case of springs that are protected and piped to households downhill from the spring, access rights are negotiated with the land owners and other local users of the springs, often through very protracted discussions. Parties involved in the negotiation, acquisition and use of Kiptegan, Chesilot and Maimur water projects include the owner of the land where the springs stand, group members, and the surrounding community (see Box 1).

Once protected (excavated and covered) and piped, management and exclusion rights are held by members of community water associations. During dry seasons water is rationed and irrigation is limited to kitchen gardens for members. Non-members who draw water at Chesilot spring during the wet season are forced to use alternative sources of water as overflow channels run dry during the dry season. Based on the group’s bylaws, non-members can only obtain water from a member’s homestead when one is sick or has visitors. Lack of access to spring water during the dry season has caused animosity between association members and the surrounding community.

BOX 1 – NEGOTIATIONS BETWEEN WATER GROUPS AND LANDOWNERS

Maimur water project.

Ten initial group members approached the landowner to use the spring and pipe water to their homesteads by gravity feed. The landowner agreed on condition that she would also benefit from the water supplied by the project, but has not yet signed a formal agreement. The landowner is recognized as a committee member and committee meetings are held at her home which makes it easier for her to attend. The landowner indicated that she is happy to participate in the committee in the capacity of a member and leave the higher offices to the men. Being on the committee will allow her easy access to decisions about water access and allocation when water supplies become scarce.

Kiptegan water project.

The initial members of the Kiptegan water project were denied access to the first spring that they identified for protection and piping to their downstream homes. The first spring had been protected during the colonial era and continues to provide water for a large number of neighbouring households. The group members settled for a second unused spring below the first. They consulted the landowner of the second spring, who already was a member of Chesilot water project and had water piped to his home. He was happy with the initiation of the Kiptegan water project as three of his sons would be members and would benefit from the project. The initial agreement was verbal but he later signed the “no objection” form from the Ministry of Water.

Chesilot water project

Members of the Chesilot water project were denied access to the first spring that they identified for protection and piping to their downstream homes. About 15 members approached the landowner of a second spring who agreed on the condition the group construct two outlets, one for her and one for the community, and a watering point for her cattle. The landowner signed the ‘no objection form’ provided by the Ministry of Water. The assistant chief also signed the form.

Activities around water sources

The 39 female survey respondents who relied on unprotected sources of water were asked questions about activities that occur around the water points that they use. These questions were designed to uncover explicit or implicit forms of water point management. Potential agents of water pollution as well as conservation measures have been identified.

Apart from being a primary source of water for animals and human beings, springs offer reliable locations for meetings, washing clothes and bathing. Land that abuts a spring is highly valued for agricultural activities due to its proximity to water for bucket irrigation.

Minimal conservation are undertaken in areas surrounding the ‘spring head’ of both protected and open springs. Excavation of spring head and laying of stones as filters are some of the activities carried out during spring protection. Cleaning of the water point is undertaken monthly at the Tenduet and Asurur unprotected springs. At the Kiptegan spring, cleaning is undertaken only at the point for drawing domestic water. Among the users of Asurur and Tenduet springs, cleaning is organized by the village elder. People who do not participate are barred from watering their cattle at those particular springs.

Efforts to plant trees by water users are hindered by lack of control over the use of the land around the spring. At Chesilot spring, cattle owned by the landowner destroyed trees planted by the group. The landowner, who had rejected the group request to fence the area around the spring, has dug trenches and cultivated the area above the spring. Respondents interviewed argued that it was the landowner’s responsibility to plant trees and cut them at his/her own discretion.

Lack of standards and enforcing institutions around open springs implies increased degradation of the source as users are free to do as they please. At the Kiptegan, Tenduet and Asurur springs, water is drawn using dirty containers. Poor hygiene standards around the springs reduce the amount of usable water available downstream and increase the waiting time for other users who have to wait for sediment to settle before drawing water.

Table 2. Activities reported to occur around unprotected springs

	Frequency N=39	Percent respondents reporting use
Washing clothes/bathing	27	69.2
Watering cows	27	69.2
Stone harvesting	14	35.9
Cutting of trees	12	30.8
Excavation	12	30.8
Farming	11	28.2
Collection of firewood	9	23.1
Planting of trees	4	10.3
Cleaning the spring	3	7.7
Meeting	2	5.1
Defecating	1	2.6
Charcoal burning	1	2.6

Source: Authors' survey of 39 women using unprotected springs, March – April 2005.

Impacts of improved water supplies

This section of the paper reports on the impacts of improved water supplies on water consumption, water allocation, and associated changes in livelihoods. Impacts of improved water supplies were calculated two ways: by comparing households currently with and without improved water supplies and by comparing before and after situations for households currently with improved water supplies.

Water allocation: time and uses

The 39 sample households who used an unprotected communal spring as their primary source of water reported using an average of 16.6 hours per week during the dry season and 6.5 hours per week during the rainy season to collect and carry water back and forth from the spring (see Table 3). The amount of time used during the dry season is almost triple that used in wet season. As indicated earlier, 53% of users harvest rainwater during the wet season, reducing the number of times they need to travel to the spring. Each trip to collect water during the dry season may also take longer, as there is a high concentration of users at the spring and less water running from the spring. Table 4 illustrates the amount of time taken to fill a 20 litre Jeri can at various sources during the wet and dry season. Besides a decrease in water volume during the dry season, the manner in which the container is filled influences the total time allocated for water collection. For example, at Chesilot during the wet season users take 5 seconds to fetch water from the existing overflow pipe / outlet; at Tenduet spring people use a smaller container to fill their Jeri cans, requiring up to 2 minutes to fill a Jeri can.

Table 3. Amount of time spent collecting water in the dry and wet seasons (n = 39)

Season	Minimum reported hours per week	Maximum reported hours per week	Average hours per week
Dry season	1.05	70	16.6
Wet season	0.47	28	6.5

Source: Survey of women who rely on water from unprotected springs

Table 4. Amount of time taken to fill a 20 litre Jeri can (n = 39)

Water source	Dry season	Wet season
Kiptegan Spring	2 minutes	1 minutes
Tenduet Spring	3 minutes	2 minutes
Tenduet stream	3 minutes	2 minutes
Asurur spring	5 minutes	25 sec
Chesilot spring	not available	5 sec

Source: Survey of 39 women who rely on water from unprotected springs

Because of the high variation in the amount of time that households reporting taking to collect water, field assistants were tasked to stay by the springs, then walk home with some of the women who came to collect water. The results suggested some clear over-estimates by the women respondents. One woman indicated that it would take 30 minutes to walk home, when in fact it took only 5 minutes. Another women indicated that it would take 60 minutes to walk home, when in fact it took 20 minutes. Several factors may explain this discrepancy. On one hand, the women do not wear watches and may not have a clear sense of time. On the other hand, drawing water from the spring provides one of the only chances that most women have for meeting friends, washing clothes and bathing. The extra time may also be tacitly used to monitor and sanction use of the spring. Overall these results call for a detailed longitudinal study and the use of more appropriate techniques for measuring time allocation.

On average during the dry season, households with piped water reported spending 69 minutes per day collecting water, 33 minutes less than the amount before improved supply and 73 minutes less than the amount used by non members in search of water. The 30 respondents with improved water supply reported that they used the time savings to work in the farm (28 respondents), attend women's meetings (7 respondents), trade in the market (7 respondents), clean themselves and the compound (2 respondents), water cattle (2 respondents), prepare meals (1 respondent) and collect firewood (1 respondent).

Increased water use

Table 5 provides results on the total amounts of water reported to be used by 30 households before and after they had piped water available in their compounds, and compares those amounts to the amounts reported by the 39 sample households that did not have access to piped water. The average amount reported for households without piped water (100.5 litres per day) is fairly similar to the average amount reported for piped water households before they obtained the piped water sources (84.5 litres per day). Households with piped water reported using 2.8 times more water after piped water was available than they did before they had piped water and 2.4 times more water than households without piped water.

Table 5. Daily water use before and after improved supply due to piped water

	N	Minimum number of litres per day	Maximum number of litres per day	Mean number of litres per day
Current users of piped water after improved supply	30	40.0	600.0	236.2
Current users of piped water before improved supply	30	0	200.0	84.5
Current users of unprotected springs communal springs	39	5.0	280.0	100.5

Source: Calculations based on household surveys of 30 women using water from protected and piped sources and 39 women using water from unprotected springs

Table 6 provides data on the major uses of water for the 30 households with piped water and the 39 households without piped water. Note that the sum of these individual uses of water is much higher than the total water collection in those households reported in Table 6, with the the aggregate over-estimate almost 100 litres per day for households with piped water and 80 litres per day for households without piped water. We consider the estimates of total water use from Table 6 to be much more reliable than the quantitative estimates of water allocation to the different uses. We therefore focus on the percentages of water reported for the different uses (columns 3 and 5) to be more reliable than the amounts of water reported for each individual use.

The five major uses of water in houses with piped water are livestock, kitchen gardens, bathing, washing clothes and tea seedlings. In households without piped water, livestock again was the highest water consumer followed by watering tea seedlings, cooking, washing utensils, and watering kitchen gardens. Households with piped water use a much higher proportion of their water for washing clothes and a much lower proportion for human consumption. The largest proportionate increases in water use for households with piped water were washing clothes, watering kitchen gardens, and bathing.

The total amount of water allocated for productive uses is higher than the amount utilized for domestic purposes for both households with piped water and households without piped water. Households with piped water reported using 52.9% of their daily water use for watering livestock, watering kitchen garden and watering tea seedlings (productive purposes), and 47.1% of their daily water use for drinking, cooking, washing clothes and bathing (reproductive purposes). Households without piped water reported using 56.5% of their daily water use for productive purposes and 43.5% for reproductive purposes.

The indicated total amount of water used by households without piped water is not exhaustive as activities such as bathing; washing of clothes and watering of the cattle are undertaken at the stream, making it difficult to quantify the amount of water used.

Table 6. Average daily water consumption for households with and without piped water

Household use of water	Average liters used per day reported by households with piped water	% of water by use reported by households with piped water	Average liters used per day in households without piped water	% of water by use reported by households without piped water	Average higher consumption in households with piped water	% higher consumption in households with piped water
Livestock consumption	94.0	28.1	64.4	35.5	29.6	46
Kitchen garden irrigation	45.7	13.7	15.7	8.7	29.9	190
Bathing	41.8	12.5	15.1	8.3	26.8	178

Washing clothes	37.8	11.3	3.6	2.0	34.2	937
Tea seedlings irrigation	37.0	11.1	22.4	12.3	14.6	65
Washing utensils	32.8	9.8	20.6	11.4	12.2	59
Cooking	26.7	8.0	21.2	11.7	5.5	26
Human consumption	15.8	4.7	15.1	8.3	0.8	5
Resurfacing floor	2.6	0.8	3.4	1.8	-0.8	-24
Total	334.2		181.4		152.8	84

Source: Calculations based on household surveys of 30 women using water from protected and piped sources and 39 women using water from unprotected springs

Health benefits of improved water supply

Households with piped water were also asked to provide their perceptions of the benefits of the improved water supply. Of 30 households with improved water supply, reduced incidences of waterborne diseases were reported by 25 respondents, and frequent clothes washing and bathing were reported in 24 and 23 households, respectively. Other health benefits included reduction in skin infection and washing of utensil after every meal (previously utensils were washed once a day, after lunch) (see Table 7).

Table 7. Health benefits associated with piped water supplies

Advantage associated with piped water among households gaining piped water (n = 30)	Number of households noting this advantage (n =30)
Less water borne diseases	25
Clothes washed more	24
Bathing more	23
Smear floors each week	6
Less rush	4
Utensils washed more	3
No need to boil water	2
No discoloured clothes	2
Less fatigue	1

Source: Survey of 30 women with improved water supplies

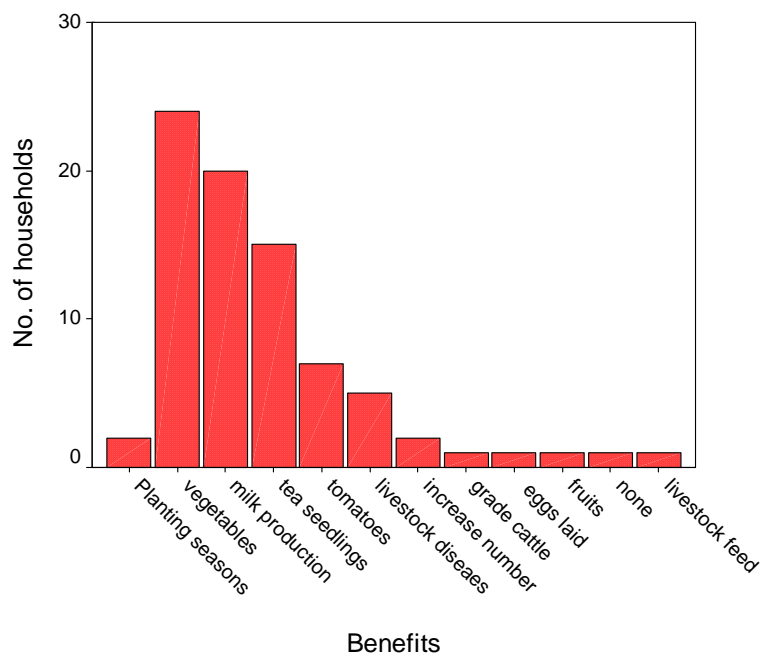
Impacts of improved water supply on agricultural production and sale

The 30 households with improved water supply were also asked a series of questions about the impacts on agriculture. The results are displayed in Figure 1. Increased supply of indigenous vegetables was reported by 24 households, increased milk production was reported by 20 households, increased production of tea seedlings was reported by 15 households, and increased production of tomatoes was reported by 8 households. The 15 households reporting increased production of tea seedlings produced between 100 and 7000 tea seedlings. These products were important sources of monetary income for the households with

improved water supply: 76% of them sold milk, 76% sold indigenous vegetables, 66% sold tea leaves, and 30% sold tomatoes.

Other impacts noted by a few households were less livestock disease – due to more frequent spraying of livestock at the homestead and less interaction with other cattle, increase in the number of livestock, introduction of improved cattle breeds, increase in eggs laid, planting of napier grass and cultivation of fruits. Also, two households indicated planting and harvesting maize twice a year compared to only once before improved water supply. Livestock, fruit and chickens were sold by small numbers of households.

Figure 1 – Effects on agriculture of improved water supply, reported by households with piped water



Source: Survey of 30 women with improved water supplies

Households with improved water supply were also asked questions about who controlled different sources of household income (Table 8). Joint control of income by husbands and wives is relatively uncommon. Husbands tend to control income from the sale of tea leaves and tomatoes, while wives tend to control income from indigenous vegetables. Milk is a special case. In most households, women are in charge of evening milk sales and men in charge of morning sales. Evening produce is often sold in bottles to neighbouring homesteads while morning milk tends to be sold at the outlet of the cooperative society. It was noted that women would continue to control evening sales provided that the milk produced was limited to a few bottles. A larger increase in the quantity of evening milk would require delivery of milk to cooperative societies. This would lead to the involvement of men, who are the registered members of the cooperative societies, rather than their wives.

Table 8. Control of income from various activities

Income source	CONTROL of				
	husband & wife	husband	wife	father in law	n/a
Tea leaves	5	13	2		
Vegetables	2	2	19		
Milk	4	7	11	1	
Tomatoes	2	5	2		
Livestock		1			
Fruits			1		
None					1
Chicken		1	1		

Source: Survey of 30 women with improved water supplies

Other benefits of improved water supply

Other benefits noted during the group interviews include: time for relaxation, visiting friends and relatives, men spending more time doing casual work as they no longer have to hurry home to bathe at the river before dusk, and increased cohesion between wives and husbands as cattle are watered and meals are prepared on time. Children, notably girls, are arriving promptly at school as they are no longer required to fetch water before and after school.

A significant outcome of the water projects has been the formation of Chesilot and Kiptegan women's groups which raised funds for implementation of the water projects on one hand and purchased household goods and /or paid school fees on the other.

Noted from the survey was the increased collaboration between members and wives of Chesilot and Kiptegan water project. The men with the help of local chief and local authority spearheaded the construction of Kiptegan primary school which has benefited the entire community. In the past, the nearest primary school was in Kapsoit, 10 kilometers away.

Other noted benefits include opportunities to relax, travel and visit friends/relatives; men spending more time undertaking casual work as they no longer have to hurry home to bathe at the river before dusk and; increased cohesion between wives and husbands as cattle are watered and meals are prepared on time. Children, notably girls, are arriving promptly at school as they are no longer required to fetch water before and after school.

A significant outcome of the water projects has been the formation of Chesilot and Kiptegan women's groups which raised funds for implementation of the water projects on one hand and purchasing household goods and /or paid school fees on the other. Women in the Chesilot and Kiptegan women's groups have also formed the Mothers of Hope Group which provides care to orphans.

Social organization for improving water supplies

In this section we examine factors facilitating instigation and successful operation of water associations in the study area. The following three paragraphs provide short descriptions of how the Maimur, Chesilot and Kiptegan water projects were established.

The Chesilot water project was the first water association in the administrative sub-location. It was initiated by a farming group, consisting of 10 men in a self-help group focused on tea and dairy farming. In the face of severe drought and resultant poor yields, the group considered investing in a hydram that would use the force of gravity to pump water uphill from their normal water point, but abandoned the idea after three of its members on a field visit to Sociot, a nearby village, observed people drinking water at their homes without the use of a generator, simply by gravity. They decided to replicate what they had observed. Back at home, the three members – the village elder, the current treasurer (village elder's son) and the current secretary -- informed other members about the new technology. The group recruited 30 more members, all of whom live in a line downstream from their source spring. All members are from Chesilot village. As we report below, women's roles in the initiation of the Chesilot project have largely been hidden in the narrative told by the committee members. By all accounts, the Chesilot water project continues to be a strong social institution that enhanced social cohesion among men and women and improved livelihoods for its members.

The Kiptegan water project was initiated soon after the Chesilot project succeeded in installing water stand pipes in all the homesteads of all 40 members. Members of the Kiptegan group decided to replicate the success of Chesilot and another nearby water project, Kipkabur. The Kiptegan group has 17 male members that receive water at household taps and provides piped water to a church. Providing water to dairy cattle appears to be the main impetus for the project. The research revealed that the Kiptegan water project is not a strong social institution. The water project has strained social relations and there is mistrust among members and between men and women.

The Maimur water project was at the initial stage of spring protection at the time of this study —excavation and laying of stones to construct the water reservoir. The group is made up of 40 households from Ketitui village. Unlike Chesilot and Kiptegan water projects, all the members live upstream and will use a hydraulic pump, or hydram, to pipe water into their homestead. The women of Maimur have consistently lobbied for improving water supply, first by separating the water points of livestock and humans, and thereafter by urging their husbands to protect the spring head and find a way to pipe water to their homesteads. The impetus for initiation emanated from women who progressively advocated for improvement of water supply, first by mobilizing the users to separate watering points for livestock and humans and thereafter, urging their husbands to protect the spring head and pump water into their homesteads. Women often have informal meetings at the spring where they discuss ways of improving water supply.

Registration of the community water projects

Once a suitable spring was identified, group members approached the landowner who is the de facto owner of the spring as it is situated on his/her land. He/she then stipulated conditions (see box 2) to be fulfilled before he/she approved allocation of the spring for protection and piping.

For Kiptegan and Chesilot water projects, once a verbal agreement was reached, the landowner was presented with a 'no objection form' to sign from the Ministry of Water. It was then given to the assistant chief for confirmation and approval. Subsequently, the groups registered with the Ministry of Social Services but only after electing officials and writing project constitution/bylaws. Maimur water project is yet to be formalized and is currently operating on a verbal agreement.

Conflicts affecting the community water projects

With diminishing water during the dry season, a result of persistent droughts and poor land uses, conflicts (though not violent) range from vandalism to quarrels between women waiting to fetch water, to increased tension between landowner and user groups as well as non members and user groups.

At Chesilot spring, when the group approached the spring 'owner', a verbal agreement between the man and the group was reached on the need to protect the spring, plant trees and fence the catchment area. When he passed away, his wife did not honor the agreement and began cultivating and digging trenches above the spring. The group's effort at protecting the catchment area was thwarted when her cattle destroyed young

trees planted. Attempts to resolve the conflict hit a snag when the landowner failed to attend a meeting convened by the chief.

At Kiptegan spring, members of Kiptegan water project were obstructed from protecting the source by the owner of the land and the surrounding community, both claiming long standing traditional right to the spring. Current users claim the group commenced protecting the spring without consulting existing users and landowner. This claim was corroborated by a member of the project.

The most cost efficient approach to improving water supply is by gravity scheme; this is however limited to those living downstream from the location of the spring, excluding upstream users. To this end, upstream users often object to the protection of springs and piping of water.

For community members unable to join a water association, spring protection poses a threat to water security. Protection of the Chesilot spring reduced the amount of water available to the surrounding community during the dry season. As a result, tension is high and several cases of vandalism have been reported.

Participation by women and men

Operations and daily deliberations of activities in the water projects are coordinated by committee and group members. Group meetings of the committee are held once per week in Chesilot water project, once per month in Kiptegan water project and twice per week in Maimur water project. Committee meetings are held either late in the afternoon (Maimur water project) or in the evening (Chesilot water project) making it very difficult for women, who are responsible for preparing evening meals and childcare, to participate. In the existing water associations at Chesilot and Kiptagen, committee membership is now indeed exclusive to men. The only female member of Chesilot water project committee was the widow landowner, who recently relinquished her position to her son. As described in the following section, some women do attend the semi-annual general meetings of the projects and participate actively in women's groups associated with the projects.

From the group discussions in Chesilot and Kiptagen, men do appear to have taken lead roles in initiation and implementation phases of the project. In a key informant interview, the Chesilot village elder acknowledges the role played by women in the initiation of the project, and noted their wise decision to raise money through the sale of tea seedlings. Another male member admitted joining the group out of his wife's initiative. His wife sold two chickens for about Ksh.500 to pay the initial registration fee. Individual interviews with group members and wives of group members further revealed the active participation of women. During project implementation, men harvested stones, excavated the spring head and protected it, and dug trenches and laid pipes. Figure 2 illustrates that women prepared meals, an activity primarily considered to be a woman's task, but they also went a step further and paid registration fees, ferried stones to the implementation site, and undertook duties (digging trenches, constructing the source and tank) assigned to their husbands when the latter were absent.

At Maimur water project, separate group discussions held with women and men plainly identified women who met informally at the spring as project initiators. In discussions held with non members, initiation of projects is seen as women's responsibility as they bear the brunt of fetching water from distant sources and undertake most if not all domestic and farm work. Once they have identified an appropriate technology and passed on information to their spouses, it is upon the men to implement the project. To raise funds, women are expected to raise a smaller proportion compared to the men.

From Table 9, there is a shift in activities undertaken by women once water has reached the homestead. Worth noting is the increase in the number of women attending meetings from 4 during construction phase of projects to 16 after completion of construction. They continue to prepare meals when meetings are held in their homes. A few women however were not involved in any activities.

Table 9. Water management activities undertaken by women before and after construction of protected and piped water systems (n = 30)

Activity	Before completion of construction	After completion of construction
Preparing meals	16	6
Source construction	6	0
Tank construction	0	13
Not involved	4	6
Attending semi-annual general meetings	4	16
Purchase of sand	1	1
Carrying stones	4	2
Digging trenches	7	0
Registration fee	6	0
Pipes	2	0
Urging defaulters to pay	0	1
Maintenance fee/fine	0	5

Source: Household survey of 30 women involved in the Chesilot and Kiptagen water projects

Womens' groups and water management

As earlier indicated, women are not members of the Water Project committees, although some women are recognized as members of the projects and the wives of many male members do participate in general meetings of the membership. Women have instead opted to form separate groups, with their own committees. The Kiptegan women's group was initiated after women felt marginalized in the water project. In the words of Leah Mosoin, a villager drawing water from communal springs:

'After members meet and agree on those to be given official positions women are mostly left out. The only option for women is to form their own group within the project and elect their own officials. For the group (women) they intend to finance part of the project costs. The women can contribute an amount decided by them in order to aid in the financing of the project'.

The Chesilot women's group (previously called *anyiny bei* (sweet waters)) was formed when wives of members of the Chesilot water project organized a festival to express their appreciation of their husband's role in improving water supply. To raise funds they engaged in informal labor groups, harvesting and weeding farms for payment. Money obtained was invested in planting of tea seedlings which were later sold for a total amount of ksh. 25,000. Part of the proceeds was distributed amongst members and the balance used to purchase maize to be put aside and sold at a higher price during the dry season. Each member also contributed Ksh. 500 for repaying loans which had been obtained by men for constructing the reservoir tank.

In addition to informal harvesting groups, women's groups have revolving funds where part of the money is contributed to the water project. The Kiptegan women's group has a revolving fund made up of 16 members, each of whom contributing Ksh.100 towards the kitty. From monthly collection of Ksh 1600, the

women donated Ksh.500 towards the spring protection and purchase of pipes. The balance was given to the host to be used to purchase household items.

Factors influencing effective collective action

Members of Kiptegan and Chesilot water projects have collectively initiated and managed water projects and are currently enjoying improved economic, physical and social wellbeing. A section of the community has been unable both individually and collectively to improve water supply. They in turn face numerous challenges ranging from contaminated water, long distances to fetch water, steep slopes, and long queues to uncertain access to water resources. The success of the water projects can be credited to several factors including:

- Members understood the value of pooling efforts and resources to solve a shared problem. The initial 10 members of Chesilot water project recruited more members to raise funds for the construction and protection of the spring head. During the second phase of the project, ‘laying pipes to individual homesteads’, members agreed to collectively contribute money to purchase pipes in view of the fact that the number of pipes required to reach one’s homestead depended on the distance of the homestead from the ‘source’.

‘If we constructed the main pipe and asked everyone to get own pipes, some would not have afforded, so we decided that all members should work for all. Other members required only 5 pipes (20 ft each) while others needed 30 pipes’ (interview with Mr. Kiget, chairman of Chesilot water project. March, 11 2005.)

- Membership was limited to individuals from the same village, i.e. Chesilot, two church organizations and all members belonged to one clan. This provided enhanced cohesion amongst members. Special emphasis was put on conduct of members during and after meetings. High discipline amongst members meant high attendance at weekly meetings, payment of dues on time and conflicts deliberated upon and resolved at meetings.
- Awareness and enforcement of written and unwritten bylaws: all the members interviewed and a section of their wives were aware of the group’s bylaws. Sanctions are also in place to deal with defaulters. For example, failure to pay maintenance resulted in the amount being doubled and water disconnected until payment was finalized. One member was kicked out of the group for not participating in group activities for two consecutive days without offering an explanation while at the same time refusing to pay a fine amounting to Ksh. 200.
- The group is composed of educated members and officials with good writing and record keeping skills. The chairman is a health official at the district hospital. The secretary, treasurer and village elder are widely traveled with the latter having been a soldier during the Second World War. Thus, they appreciate the role of water in promoting good health, agricultural and economic activities.
- A combination of good governance and transparency is enshrined in the management of the project; records are easily available for inspection by members during the weekly meetings and by members and their wives during the annual general meeting held once every six months. Moreover, officials were elected based on their generosity, determination and on their geographic location within the village. The latter would enable them to monitor how members use water.

Why do you think your committee has been able to manage money and maintenance issues (management generally) so well?

“Yes, we have a general meeting twice a year. At these meetings, we give the financial records to the whole group. People are reminded of the payments they owe. And they are shown how the money was spent and how much money is remaining. We have a bank account. At least two people

have to withdraw money from the account.” Reuben Tanui, treasurer of Chesilot water project, august, 2004. (Source: Field notes of the late Jessica Roy)

- Division of labor is characterized by reciprocity and complementarity. Men raise a larger proportion of project funds, women raise a smaller proportion; women report vandalism, men take care of vandalism; women guard against breakages in the home, while men do the plumbing work. Men appreciate the importance of time spent by women in search of water and acknowledge that the time saved by improving the water supply can be used productively. Consequently, they initiated water projects which benefited the entire household, particularly the women. Women on their part prepared meals for the men during construction. They also formed women groups, in which they raised funds by planting and selling tea seedlings, engaging in casual labor and revolving funds. Women organized themselves into *morik* (informal harvesting groups) to raise fund. They also capitalized on the premise that through their initiative, by working together as women, it becomes easy for their spouses and the entire community to do the same.
- Membership is small and closed to new members. Members argue that the fewer they are the more water will be available in each household and for the officials; it is easier to monitor and coordinate activities when the group is small.

Conclusions

The case studies presented in this paper illustrate that rural communities can successfully mobilized local investment in water systems in an environment where most groups have failed to do so. Safe and easily accessible water has brought a range of benefits to those households, especially through activities where women have special responsibilities. Households with improved water access report time savings, improved health, cleaner clothes, increased production of tea seedlings, milk and vegetables, with the net result of significant increases in income controlled by women. This case study thus provides solid support for the proposition that access to small amounts of water beyond domestic needs can lead to substantial improvements in welfare, especially for women (Moriarty, Butterworth, and van Koppen, 2003).

Also from Chesilot water project, collective action is seen to achieve greater impact when the division of labor is characterized by reciprocity; men and women negotiate their rights deliberately and undertake activities complementing each other and; trust and social cohesion is strong between men and women. In contrast, discussions with users of communal springs suggest collective action will fail when trust relations are breeched, especially when funds are misappropriated, when there is a lack of information flow between the men who attend meetings and their wives who are the chief direct users of the water, and when there is a lack of trust between women and men. Men must trust that women will use their enhanced time and water resources to the good of all household members.

Despite the obvious obstacles, a significant number of community groups in this part of Kenya have mobilized themselves to protect and pipe water to their members' homesteads. Policy makers and planners must see community groups as important water service suppliers and adjust policies and programmes accordingly. Kenya's current Water Policy appears to be more biased toward the regulation of larger-scale private and non-governmental suppliers of water, rather than the facilitation of small community groups. Community groups would benefit greatly from reliable technical input into water system design, institutional support for group formation and conflict resolution, and cost sharing of infrastructure investments.

References

- Crow, Ben and Farhana Sultana. (2002) "Gender, Class, and Access to Water: Three Cases in a Poor and Crowded Delta." *Society and Natural Resources* 15: 709-724.
- Government of Kenya, 2003. *Public expenditure Review*, 2003 <http://www.planning.go.ke/>
- Government of Kenya. 1999. *National Policy on Water Resources Management and Development*, Sessional Paper No 1 of 1999, Government Printer, Nairobi.
- Guerquin, F., T. Ahmed, M. Hua, T. Ikeda, V. Ozbilen and M. Schuttelaar, 2003. *World Water Actions: Making Water Flow for All*. Water Action Unit, World Water Council: Marseille, France.
- Katui-Katua, M, 2002 *Drawers of Water II 2002: Kenya country Report* International Institute for Environment and Development, UK
<http://www.eldis.org/static/DOC16232.htm>
- Meinzen-Dick R. and M. Bakker, 1999. Irrigation systems as multiple-use commons: water use in Kirindi Oya, Sri Lanka. *Agriculture and Human Values*, 16: 281-293
- Moriarty, P., J. Butterworth, and B. van Koppen (eds.) 2004a, *Beyond Domestic: Case studies on poverty and productive uses of water at the household level*. IRC Technical Paper 41. IRC International Water and Sanitation Centre: Delft, The Netherlands.
- Moriarty, P., J. Butterworth, B. van Koppen and J. Soussan, 2004b. "Productive uses of water at the household level: evidence from Bushbuckridge, South Africa." In P. Moriarty, J. Butterworth, and B. van Koppen (eds.), *Beyond Domestic: Case studies on poverty and productive uses of water at the household level*. IRC Technical Paper 41. IRC International Water and Sanitation Centre: Delft, The Netherlands.
- Njonjo, A. 1997. Study of Community Managed Water Supplies – Final Report on Case Studies and Experience Exchange, in World Bank RWSG-EA, *Survey of Community Water Supply Schemes*, Republic of Kenya / JICA, Nairobi.
- Njonjo, A., and J. Lane. 2002 Rural Piped Water Supplies in Ethiopia, Malawi and Kenya Community management and Sustainability. Field note:13. www.wsp.org/publications/FN-13%20eth_mala_ken_eng.pdf
- Nyong, A.O. and P.S. Kanaroglou. (2001) "A Survey of Household Domestic Water-Use Patterns In Rural Semi-arid Nigeria." *Journal of Arid Environments*. 49: 387-400.
- Onyango, L., B. Swallow and R. Meinzen-Dick, 2005. Hydronomics and terranomics in the Nyando basin of Western Kenya. Paper presented at the International Workshop on Africa Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa, 26-28 January 2005, Gauteng, South Africa.
- Rockstrom, J., J. Barron and P. Fox, 2003. Water productivity in rain-fed agriculture: challenges and opportunities for smallholder farmers in drought-prone tropical agro-ecosystems. In: J.W. Kijne, R. Barker and D. Molden (eds.), *Water Productivity in Agriculture: Limits and Opportunities for Improvement*. CABI Publishing: Wallingford, UK, pp. 145-162.
- Roy, J., B. Crow and B. Swallow, 2005. "Getting access to adequate water: community organizing, women and social change in Western Kenya." Paper presented at the International Workshop on African Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa, 26-28 January 2005, Johannesburg, South Africa www.nri.waterlaw.

Suda, Collette. (1996) "The Political Economy of Women's Work in Kenya: Chronic Constraints and Broken Barriers" in *Women, Work and Gender Relations: A Global Perspective*. Parvin Ghorayshi and Claire Belanger, eds. Greenwood Press, Westport, Connecticut.

Suda, Collette, 2000. Gender, Culture and Environmental Conservation in Western Kenya: Contextualizing Community Participation and the Choice of Techniques. *Nordic Journal of African Studies* 9(1): 31-48.

Swallow, B., 2005. Potential for poverty reduction strategies to address community priorities: case study of Kenya. *World Development* 33(2): 301-321.

Swallow et al., Improved land management in the Lake Victoria basin: Annual technical report. July 2001 to June 2002. *Natural Resource Problems, Priorities and Policies Program: Working Paper Series 2002-2*. World Agroforestry Centre.

Swallow, B, L. Onyango, R. Meinzen-Dick and N. Holl, 2005. Dynamics of poverty, livelihoods and property rights in the lower Nyando basin of Kenya." Paper presented at the International Workshop on Africa Water Laws: Pluralistic Frameworks for Rural Water Management in Africa, 26-28 January 2005, Gautang, South Africa.

Water Supplies Managed by Rural Communities; Country reports and case studies from Cameroon, Colombia, Guatemala, Kenya, Nepal and Pakistan 1997 Chapter 4 <http://www.irc.nl/page/1870>

WHO / UNICEF, 2004. Coverage Estimates, Improved Drinking Water, Kenya. World Health Organization / United Nations Children's Fund, Joint Monitoring Program for Water Supply and Sanitation, Geneva, Switzerland www.wssinfo.org.

World Resources Institute, 2003. EarthTrends – Country Profiles. Water Resources and Freshwater Ecosystems – Kenya. http://earthtrends.wri.org/pdf_library/country_profiles/wat_cou_404.pdf

Whittington, D; X. Mu et al. (1990) "Calculating the Value of Time Spent Collecting Water: Some Estimates for Ukunda, Kenya." *World Development* 18(2): 269-281.

Zwarteveen, M. and R. Meinzen-Dick. (2001) 'Gender and Property Rights in the Commons: Examples of Water Rights in South Asia.' *Agriculture and Human Values*. 18: 11-25.

Acknowledgements and dedication

Brent Swallow and Elizabeth Were acknowledge financial support from the European Union and USAID, contributions of Ben Crow and Ruth Meinzen-Dick who helped to shape these studies, the Roy family who approved the publication of Jessica's work, and our many colleagues who assisted with the field studies, particularly Daniel Bundotich, Leah Onyango, Kenneth Bii and Rosemary Chemeli. We also acknowledge the members of the Chesilot group who generously provided information about their inspired efforts at water management, especially Reuben Tanui and Joseph Keter. Juan Camilo-Cardenas provided very useful comments on a previous draft of this paper, most of which have been incorporated into this version of the paper.

This paper is dedicated to the memory of our close friend and colleague, Jessica L. Roy.