The Springs of Nyando: Water, Social Organization and Livelihoods in Western Kenya

Ben Crow, Brent Swallow, Isabella Asamba

The Springs of Nyando:

Water, Social Organization and Livelihoods in Western Kenya

Ben Crow, Brent Swallow, Isabella Asamba

Correct citation:

Crow B, Swallow B, Asamba I. 2009. *The Springs of Nyando: Water, Social Organization and Livelihoods in Western Kenya*. ICRAF Working Paper 90. Nairobi: World Agroforestry Centre.

Titles in the Working Paper Series aim to disseminate interim results on agroforestry research and practices and stimulate feedback from the scientific community. Other publication series from the World Agroforestry Centre include: Agroforestry Perspectives, Technical Manuals and Occasional Papers.

Published by the World Agroforestry Centre
United Nations Avenue
PO Box 30677, GPO 00100
Nairobi, Kenya
Tel: +254(0)20 7224000, via USA +1 650 833 6645
Fax: +254(0)20 7224001, via USA +1 650 833 6646
Email: icraf@cgiar.org
Internet: www.worldagroforestry.org

© World Agroforestry Centre 2009
Working Paper no. 90

The views expressed in this publication are those of the author(s) and not necessarily those of the World Agroforestry Centre.

Articles appearing in this publication may be quoted or reproduced without charge, provided the source is acknowledged.

All images remain the sole property of their source and may not be used for any purpose without written permission of the source.

Contributors

Ben CROW

Ben Crow is a professor of Sociology at the University of California, Santa Cruz. He is the author of *Markets, Class and Social Change: Trading Networks and Poverty in Rural South Asia*. Before working at UC Santa Cruz, he taught at Stanford University, UC Berkeley and the Open University in the UK. His email is bencrow@ucsc.edu

Brent SWALLOW

Brent Swallow is Professor of Environmental Economics and Chair of the Department of Rural Economy at the University of Alberta in Edmonton, Canada. Brent is also a Distinguished Associate of the World Agroforestry Centre. The research reported in the report was conducted while Brent was the Theme Leader for Environmental Services at the World Agroforestry Centre in Nairobi, Kenya. His email contact is brent.swallow@ualberta.ca

Isabella ASAMBA

Isabella is a development consultant with extensive experience in both the government and the NGO sector. A graduate of University of Nairobi, she served in a research and training capacity with the Government of Kenya's National Environment Secretariat prior to moving onto The Kenya/Netherlands Bilateral Programme as the Training/M&E Advisor. In this capacity she worked with the Lake Basin Development Authority on the implementation of the water, sanitation, and health program in Nyanza Province in western Kenya using participatory and gender-sensitive approaches. She conducted this research while a masters student at Maseno University. Her email contact is lutzilih@yahoo.com

Abstract

The provision of improved access to safe water supplies appears to be an obvious goal for external development assistance. This study of 7 villages in the Upper Nyando basin of Western Kenya shows that the provision of piped water into rural households can dramatically alter people's lives, particularly by alleviating labor and time burdens generally born by women and girls, and by providing a key input into home garden and intensive livestock production. Yet this study also shows that community self-organization for water provision is a difficult collective action problem, requiring high levels of finance, commitment to collective processes, formalized structures of governance, and some way of surmounting gender disparities. Looking across the seven villages included in this study, no clear pattern emerged regarding the preconditions for collective action, although ethnic heterogeneity and conflict are obvious obstacles to collective action. There is no evidence that income, wealth or connections to the outside world were important. This is both good news and bad: good in that any community with a relatively homogeneous population might be capable, bad in that we've not identified easy ways for external agencies to identify villages most likely to be successful.

Keywords

gender, collective action, water management, Lake Victoria, impact assessment, Kenya, social organization

Acknowledgements

The research reported here was designed and initiated by Jessica L. Roy, a PhD student at the University of California-Santa Cruz and Graduate Fellow at the World Agroforestry Centre, Nairobi, Kenya. Jessica passed away on August 28th, 2004, following a tragic auto accident in Nairobi Kenya. The authors humbly acknowledge Jessica's many contributions to this work.

The authors gratefully acknowledge the contributions that the following persons made to the study: Ric Coe, Katie Roy, Wilson Nindo, J. Bore, Daniel Bundotitch, Joseph Sang, Leah Onyango, Hiroshi Fukurai and George Mark Onyango.

This research has been supported by the United States Agency for International Development through the United States Department of Agriculture, the European Union, the University of California at Santa Cruz, Maseno University, and the World Agroforestry Centre. The views expressed are those of the authors and cannot be associated with the sponsoring organizations.

Contents

1 Introduction	7
2 Study area and design	8
2.1 Study context	8
2.2 Population and sampling of springs in the upper Nyando basin	9
2.3 Household Selection	12
3 Comparing the contexts of collective action	14
3.1 A brief comparison of the seven springs	15
3.2 The Contexts of Collective Action	17
4 Good Governance and Local Organizing for Potable Water	28
4.1 Participation	28
4.2 Constitutions and representation	31
4.3 Transparency and accountability	31
5. Water use and the benefits of piped water	33
5.1 Water Collection and Use	33
5.2 The labor of getting water each day	37
5.3 Incomes of piped and non-piped households in Simotwet and Borowet	38
6 The influence of piped water on women's activities and time allocation	42
6.1 Women's participation in project committees	42
6.2 Focus group discussions on gender analysis and changes in work	43
6.3 Time allocation of women and men	45
6.4 Implications of work changes	46
7 Conclusions	47
References	49

List of Tables

Table 2.1 Distribution and protection status of springs in Upper Nyando Basin	11
Table 2.2 Agencies protecting springs in the area	11
Table 2.3 Springs selected for study	12
Table 2.4 Household sampling method	13
Table 2.5 Numbers of households sampled in each spring community	13
Table 3.1 Comparison of spring histories	15
Table 3.2 Mean land holding and numbers of households renting land	18
Table 3.3 Distribution of households (%) by land ownership and rental categories, not protected springs	18
Table 3.4 Distribution of households (%) by land ownership and rental categories, protected but not piped springs	18
Table 3.5 Distribution of households (%) by land ownership and rental categories, protected and piped springs	18
Table 3.6 Mean total household incomes by spring community	19
Table 3.7 Gini Coefficients for Household Income and Land Ownership	23
Table 3.8 Gender of interviewee and perception of who made spending decisions	23
Table 3.9 Proportion of men taking spending decisions	24
Table 3.10 Number of households and their relation to spring geography	27
Table 4.1 Spring connections and numbers of potential households	28
Table 4.2 Participation and decision making by spring community	30
Table 4.3 Constitution and representation by spring community	31
Table 4.4 Transparency in water committee activities	31
Table 6.1 Committee composition by gender	42
Table 6.2 Participants in gender analysis focus group discussions	43
Table 6.3 Gender Analysis Matrix showing the current overall impact of a successful spring project	44
Table 6.4 Typical woman's daily schedule	45
Table 6.5 Typical man's daily schedule	46

List of Figures

Figure 3.1 Mean income by activity in each spring community.	20
Figure 3.2 Mean income by activity, households in 80-100% income percentile.	21
Figure 3.3. Mean income by activity, households in 0-20% income percentile.	22
Figure 3.4 Gender of interviewee and perception of spending decisions.	24
Figure 3.5 Education levels in each spring community.	25
Figure 5.1 Quantity of water used by purpose, non-protected springs, wet season.	33
Figure 5.2 Quantity of water used by purpose, protected but not piped springs, wet season.	34
Figure 5.3 Quantity of water used by purpose, piped households only, wet season.	34
Figure 5.4 Quantity of water used by source, protected but not piped springs. 35	
Figure 5.5 Quantity of water use by source, protected and piped springs, dry season.	36
Figure 5.6 Quantity of water use by source, protected and piped springs, wet season.	36
Figure 5.7 Distribution of times to collect water by numbers of households (source: household interviews).	37
Figure 5.8 Time collecting water by spring community (source: household interviews).	38
Figure 5.9 shows that households with pipes have 35% higher incomes than those without.	39
Figure 5.10 Mean income of households by activity, piped and non-piped households, Simotwet.	40
Figure 5.11 Mean households incomes by activity, piped and non-piped households, Borowet.	40
Figure 5.12 Additional income reported by piped households, Simotwet and Borowet.	41

1 Introduction

Some 1 billion people worldwide lack access to safe drinking water. In rural Kenya, only 10% of people have access to household connections and 45% have improved access¹ to water (WHO/UNICEF Joint Monitoring Program 2004). Household or domestic water in rural areas serves the needs of livestock and kitchen gardens as well as drinking, cooking, washing and cleaning (Were et al., 2008). Improved access to safe drinking water, and in particular household water connections, brings wide-ranging benefits for the household and may provide a significant step toward poverty reduction (e.g. Moriarty, Butterworth and van Koppen, 2004).

Kenya's National Water Master Plan of 1974 set a target of ensuring the availability of potable water, at reasonable distances, to all households by the year 2000. By the year 2000, the National Water Conservation and Pipeline Corporation operated piped water systems in 21 urban centers serving 2.3 million people and 14 large rural water supply systems serving 1.5 million people. This left a gap of over 23 million rural Kenyans reliant on less safe water sources. About ten percent of those reliant on other sources of water received some level of service from small water systems operated by self-help community groups, sometimes with financial support from external agencies. Despite significant investments by government agencies, donors and communities, the benefits of household water supply are still eluding the majority of the rural population (Mumma, 2007, pp. 158-159).

The Nyando basin of western Kenya illustrates the challenges and potential benefits of improving domestic water supplies in rural Africa. The basin, which covers approximately 3,500 square kilometers is home to approximately 611,000 people, for an average population density of 174 persons per square kilometer. The vast majority of people live in rural areas, with only a few small market centers found in the basin. The most common sources of domestic water are rivers / streams, piped water systems, wells, springs, boreholes and ponds. Where they are available, springs are a preferred water source and are generally regarded as sources of relatively safe water. Springs are relatively common in the upper part of the catchment and uncommon in the lower part (Onyango et al., 2007).

Participatory planning activities undertaken in the Nyando basin between 2000 and 2003 showed that improved water and sanitation is a key priority for many rural communities. In Nyando district, in the lower part of the basin, 7 of 10 communities identified water management as one of their top 5 development priorities, with 2 of those communities identifying water management as their top priority. In Kericho district, in the higher part of the basin, 6 of 10 communities identified water management as one of their top 5 priorities, with 3 communities identifying water management as their second highest priority (further analysis of data used in Swallow, 2005).

Recognizing the importance and continued need for improved domestic water supplies, a series of studies were undertaken in the Nyando basin on domestic water management, rural livelihoods and collective action. A study of poverty-water dynamics in 14 communities from across the Nyando basin identified a community (Kiptagen) in which two separate groups had self-organized for improved spring protection, piping and household water connections. A follow-up case study of water management was undertaken in that community. The results, reported in Roy et al. (2005) and Were et al. (2008), suggest large positive impacts of improved water supply through gravity-fed water systems, as well as substantial challenges to the collective action necessary for protection and piping to be effective (Were et al., 2008). The results further showed strong gender differentiation in roles, with women bearing most responsibility for household water supply, but having limited ability to mobilize collective action for protection or piping. It is clear that the technology of spring protection is simple but requires significant investments of labor, money and collective decision making.

¹ Improved access is defined as one of the following: household connection; public standpipe; borehole; protected dug well; protected spring; and rainwater collection.

A geo-referenced census of springs was undertaken in the upper Nyando area of Kericho district to ascertain the prevalence of different types of management, including self-organized piped water systems similar to the one found in Kiptagen. Results from the census are presented in section 2 of this paper. The census results were then used as a sampling frame to select 7 spring management groups for more detailed analysis. Three of the seven groups studied have not protected their springs, two have protected their springs and two have both protected their spring and built storage and pipe networks to deliver spring water to the homesteads of group members. A small number of communities have been able to undertake the collective work required to build spring protection and household water delivery. Most have not. Therein lies the problem of collective action that motivates this paper. Why are some communities able to build institutions, accumulate money and undertake the work of building better water supply systems, while others endure the hardships of walking long distances to unprotected springs that are often shared with livestock.

This paper explores two questions. First, what are the characteristics and histories of the communities in the three groups i) unprotected springs, ii) protected springs and iii) protected and piped springs? Second, what benefits are associated with spring protection and piping of water supply?

Section Two of the paper describes the origins and organization of the study on which this paper is based. Section Three examines the history of the springs under study and the contexts of collective action in the seven communities: are there systematic differences in community conditions, capacities and networks associated with more effective collective action? Section Four compares the elements of water governance associated with different levels of collective action (unprotected; protected but not piped; protected and piped). Section Five examines changes in water use which have followed from spring protection and piping of water in some of the springs. Section Six examines the gender impacts of different levels of water access. Section Seven presents conclusions from the study.

2 Study area and design

2.1 Study context

The upper Nyando basin in Kericho district is primarily populated by people of the Kipsigis Kalenjin ethnic group. Population density varies from about 100 to 400 persons per square kilometer. During the colonial period (circa 1900 -1965), land in the area was divided between Trust Lands occupied by local populations and leaseholds occupied by European settlers. After independence in 1964, the trust land was adjudicated to individual families, while the leasehold land became settlement schemes or sub-divided leaseholds purchased by land-buying companies. Areas sub-divided by land-buying companies tend to have clusters of particular ethnic groups located next to each other, and to have high levels of inter-ethnic conflict between those clusters (Onyango et al., 2007).

All springs in the adjudicated area are located on private land, with no formal public access routes to the springs. By Kalenjin custom no one prohibits other community members from obtaining water from springs located on their land. In practice, however, access to springs is becoming more restricted as farms are subdivided and more fences are erected to protect the boundaries of fields and farms (Onyango et al., 2007). Spring management in the former leasehold areas is generally more variable than in the adjudicated areas. Some of the colonial farmers who previously occupied those lands invested significant amounts of resources into spring protection, assets which are still relatively intact in some cases. In settlement scheme areas, government planners sometimes set aside spring areas for use and management by the local communities. In areas purchased and sub-divided by land-buying companies, there was little or no planning for springs and thus most are located on private plots.

Agriculture is a primary source of livelihood in the study area, with most households cultivating maize and rearing livestock, and fewer households cultivating tea, other cash crops, and horticultural crops. Other important sources of income are casual labor and small business (analysis of unpublished data from 6 villages in the study area). As of 2006, the major land cover types in the study area were grazing land, forest and bush land, maize production, sugar cane, tea, and woodlots (Swallow et al., 2009). Poverty levels in the study area are about average for rural Kenya, with between 30% and 70% of the rural population living below the national poverty line as of 1999 (World Resources Institute et al., 2007).

2.2 Population and sampling of springs in the upper Nyando basin

As described in the introduction to this paper, this study was undertaken as part of a series of studies of poverty, environment and collective action being undertaken in the Nyando basin of western Kenya. The motivation for this study arose from early discovery by Jessica Roy (Roy et al, 2005) that some communities in the upper Nyando had obtained piped homestead water through self-organized work and investment. Subsequent work (Were et al, 2006, 2008) documented the impacts and challenges of self-organized piped water systems in Kiptagen village. The most notable gains were in reduced labor time spent collecting water, increased water used for smallholder dairy and garden production, and increased income to women's groups. The most notable challenges were raising the necessary finances, obtaining permission to tap into an upstream spring, and enforcing rules on use of the spring water.

The study described in this paper was designed to expand upon the results from Kiptagen through a comparative study of the circumstances in three groups of spring communities: Group 1 Non-protected springs; Group 2 Protected but not piped springs; and Group 3 Protected and piped springs.

The sampling frame for the study was a census of community water springs in a 650 square kilometer area of the upper Nyando basin. The census was conducted between December 2004 and March 2005, by Daniel Bundotitch, working as a consultant to the World Agroforestry Centre and in collaboration with officials from the Kenya government agencies responsible for agriculture and water. All of the springs were visited, located with portable Global Positioning System units (GPS), and a short questionnaire used to identify the number of users, protection status, water quality and management of the spring (Bundotitch 2005, unpublished report). To be included in the census, the spring had to run throughout the year and to be the water source for at least one household.

The census found 137 springs that were the primary source of water for about 100,000 people in 15,920 households, 25 schools, 10 health facilities, 7 churches, 13 businesses, 8 cattle dips, a monastery, a college and a railway station. Each spring was used by an average of 112 households, with the number of households per spring ranging from 1 to 1500. The distribution of the springs is shown in Figure 1.

Only 10 of the springs were registered with the Ministry of Water. Apparently hidden to the Ministry of Water are 133 springs providing water to some 85,000 people.

Map: Distribution of the surveyed water points – We need a new version of this that shows the location of the springs with the boundary of the Nyando basin and the district and division boundaries [Need map or insert to show where Nyando is in Kenya as a whole]

Most of the 137 springs (91 of 137 – Table 2.1) are currently unprotected, yielding water supplies considered to be unsafe for human consumption. Thirty-two of the springs have been protected through assistance from external organizations, with notable support from projects funded by the Swedish International Development Agency (Table 2.2). Of the 32 springs that have been protected with external support, 18 have been designed to carry piped water directly to people's homesteads. In addition, 19 groups have – on their own initiative, with their own finance, and with their own management systems – made the investments necessary to protect their springs. Eight of these groups have protected the springs and piped the water to their members, a total of 912 individual homesteads with perhaps 5928 people (Bundotitch unpublished report, 2005).

Table 2.1 Distribution and protection status of springs in Upper Nyando Basin

Division	Open	Protected, not piped	Protected and piped	Total springs in division
Ainamoi	22	6	8	36
Belgut*	0	1	0	1
Chilchila	10	0	5	15
Kipkelion	37	4	9	50
Londiani	4	3	2	9
Sigowet	11	6	1	18
Soin	7	1	0	8
Total	91	21	25	137

Source: Bundotitch unpublished report, 2005. * incomplete Census.

Table 2.2: Agencies protecting springs in the area

Protection by	Protected and piped	Protected, not piped
Community groups	13	11
Churches	2	0
Canadian International Development Agency	1	0
Environmental Health Programme	4	10
International Centre for Research in Agroforestry	0	3
Kenya Railways	1	0
Local Authority	2	0
Lake Victoria Environmental Management Programme	0	2
Ministry of Water	2	0
National Agriculture and Livestock Extension Programme	1	0
Total	26	26

Seven spring communities were purposively selected for this follow-up study. These springs were selected from a restricted list of springs, not including springs that had received substantial assistance from external agencies or springs serving very large or very small numbers of households. To reduce the field study costs, we concentrated the study in the two divisions that had the largest numbers of springs, Ainamoi and Kipkelion. In both divisions, we selected one non-protected spring, one protected-not piped spring, and one spring with protection and piping. In Kipkelion, we added an additional spring, Borowet, which was the only spring of the 137 that had been protected and piped mostly through the initiative of female residents of the village.

Table 2.3: Springs selected for study

Spring selection criteria	Kipkelion Division	Ainamoi Division
Not protected	Kipsotet spring, Kasheen village, Kapkures sub-location, Kipsegi location Serves 20 households who are permanent members	Moiyowet spring, Moiyowet village, Maso Sub-location, Kapsaos Location Serves 140 households All live upstream
Protected, not piped	Togombe spring, Central village, Chesinende sub-location, Chipseon location Serves 70 households All live upstream except 5	Nyinyitiet spring, Chemorir village, Ainamoi Sub-location, Ainamoi Location Serves 200 households
Protected, piped, managed mainly by men	Kasheen spring, Kasheen village, Lelu sub-location, Kipsegi location Serves 200 households All live downstream	Simotwet spring, Koikaron village, Maso Sub-location, Kapsaos location Serves 35 households All live downstream
Protected, piped, managed mainly by women	Borowet water project, Borowet village, Kapkures sub-location, Kipsegi location Serves 35 households, All live downstream	None selected

During the data analysis phase of the project, the team found that Nyinyitiet Spring was not effectively protected, while Kasheen was protected, but not piped. This reassessment has shifted the category of two springs (Nyinyitiet and Kasheen), so that the final spring groups include the following groups:

Group 1 Non-protected springs (Kipsotet, Moiyowet, Nyinyitiet)

Group 2 Protected but not piped springs (Togombe, Kasheen)

Group 3 Protected and piped springs (Simotwet and Borowet)

2.3 Household Selection

Household and key informant interviews were undertaken by a team with local knowledge, including speakers of Kipsigis, the most common language of the area. For each of the seven selected springs, the team mobilized community members to help draw a map of the community, locating all households and water sources and characterizing the livelihood strategies of all households. A sample of 15 households was selected as shown in table 2.4.

Table 2.4 Household sampling method

	Female Headed	Male Headed	Female in male headed	Widow	Widower	Committee member	Group member	Non-group member	Opinion leader
FEMALE	*	*	*	*		*	*	*	*
MALE		*	*		*	*	*	*	*

In those communities (Simotwet and Borowet) with piped water supply to some households, an additional five non-piped households were sampled. Where institutions, a schools and a monastery, also received piped water, those institutions were included as additional households. This led to the sample numbers shown in Figure 2.3.

Table 2.5 Numbers of households sampled in each spring community

Spring group (initial)	Spring name	# of households sampled
1 Non-protected	Moiyowet spring, Moiyowet village	15
1 Non-protected	Kipsotet Spring, Kasheen village	15
2 Protected but not piped	Nyinyitiet spring, Chemorir village	15
2 Protected but not piped	Togombei Spring, Central village, Chesinende	15
2 Protected but not piped	Kasheen Spring, Kasheen village	18
3 Protected and piped	Simotwet spring, Koikaran village	20
3 Protected and piped	Borowet Spring, Borowet village	22

In addition to the 122 household interviews, thirty seven key informants were interviewed. These included ten heads of government departments from District Social Services, District Agriculture Office, Divisional Water Office (Kipkelion), Divisional Agriculture Office (Ainamoi and Kipkelion), District Environment Office (NEMA), the Area Chiefs for Maso, Lelu, Kapkures and Ainamoi sub-locations, and the chairpersons, secretaries and treasurers of the water points and two head teachers of Kasheen Secondary School and Morao secondary School.

The next section summarizes the historical and social characteristics of each of these spring groups and seeks to compare the characteristics of members of the spring communities: landholding, incomes, inequality, education, diversity of activities, whether men or women take decisions, and the histories of conflict. Surprisingly, it does not appear that high income or large landholding predispose communities to act to achieve access to water.

3 Comparing the contexts of collective action

Collective action at the seven Nyando springs has achieved three levels of accomplishment. All seven springs have water committees. Five springs have spring protection – a small tank constructed around the water source to store water and protect the source from contamination. Two spring groups have accomplished more than protecting their springs, they have built a water storage tank and installed piped water connections to the homesteads of their members. All three levels of action – establishing a committee, protecting the water source, and laying pipes for water supply – constitute significant levels of social action. The question we explore in this section is this: are there identifiable social characteristics that predispose the community to achieve the third, most desirable, level of homestead water supply? If we can identify these characteristics, then it may be possible to provide support that enables other spring communities to self-organize.

Studies of collective action have established a general consensus about the conditions for successful management of common property resources (Baland and Plateau 1996: 298). Among the conditions on which there is agreement are the following: user groups must be small, crucial decisions must be taken publicly, and there must be record-keeping and accountability (Baland and Plateau 1996: 298). We will deal with questions of transparency and accountability in section 4. A parallel literature on community owned water supply in towns (Bakker 2008) suggests a comparable consensus. Common pool water management systems are more successful when: they cover a small geographic area with defined boundaries, there are low levels of mobility, there is a small community with high social capital, and the water is used for both economic and domestic purposes (Bakker 2008: 241).

Table 3.1 Comparison of spring histories

Name	Category	Spring action	Land ownership	Ethnicity/ language groups	Geographic
Moiyowet	Not protected	1953 spring protected by white settler	Spring land privately held	Kipsigis, Kalenjin	Most homesteads upstream of spring
Kipsotet	Not protected	Land was owned by single white settler	Spring privately owned	Kipsigis, Kalenjin	
Nyinyitiet	Not protected	1984 spring protection now ineffective		Kipsigis, Kalenjin	
Togombei	Protected not piped	1981 externally-funded project	Spring private but communal access negotiated	Kipsigis, Kalenjin	Large catchment, 5 households downstream, 65 upstream of spring
Kasheen	Protected not piped	Spring protected in early 1960s before white settler left. Recent external funding	Spring ownership contested by school and community.	Kikuyu, Kisii, & Kipsigis – community torn apart by ethnic clashes of 1992, 1997 and 2002.	All members downstream
Simotwet	Protected and piped	2002 project started	Spring on private land	Kipsigis, Kalenjin	
Borowet	Protected and piped	2002 protect started	Spring on private land	Kipsigis, Kalenjin	Only downstream households have piped water

Source: Authors and fieldwork by Kericho Team.

3.1 A brief comparison of the seven springs

In this section we provide a narrative description of the spring communities based on interviews with community members.

The spring communities occupy terrain once occupied by European settler farms. The settlers established farms on land with access to spring water. When they left, the land was subdivided and redistributed. Access to water and topographic features helped to reinforce these borders as the boundaries of the communities that emerged after resettlement.

Moiyowet spring: The white settler who owned this land protected the spring in 1953. His concern was to provide water for his cattle. By 2000, the wall around the spring had completely collapsed. In 2007, the fact that the spring was once protected was not common knowledge.

The committee has collected some money from its members, but has not collected enough money to protect the spring. Most homesteads are upstream of the spring. Providing piped supplies to these homesteads would require a storage tank and a pump. An application has been made for Local Authority Transfer Funds to meet the high costs.

The ethnically homogeneous, Kipsigis community around the spring formed the committee to protect the spring. Officials of the committee were handpicked by the local administration. The community appears to have conservative views about gender relations. Women separate themselves in meetings. There is a strong division of labor between men and women, and women keep a distance from their in-laws.

Kipsotet spring: When the European settler left, a single family purchased much of his land. It has been subdivided into relatively large landholdings for members of that family. The spring is privately owned and is well maintained with a barbed wire fence keeping out cattle. Water is scooped from the pool at the spring, and the pool is periodically cleared. People drawing water from the spring are relatively affluent with larger landholdings, compared to those at the other springs, and generally have external, often professional, employment.

There is a small water committee. The spring currently provides water for 20 households, but there are another 200 who would like to get access to the water. Most of the households are Kipsigis, Kalenjin.

Kasheen spring: The European owner of the land protected this spring in the 1960s. In 1970, a project committee took over the running of the spring. The spring itself is in a forest. A pipeline brings water to a communal tap on a rise above most of the homesteads. In 1970, water was also piped to the market place and three cattle troughs.

This community was disrupted by a sequence of violent ethnic battles which led to members of two groups leaving. Until the early 1990s, this was an ethnically mixed community with members from Kikuyu, Kisii and Kipsigis tribes. The community was caught up in country-wide ethnic clashes in 1992, 1997 and to a lesser extent 2002. At that time, many of the Kikuyu and Kisii moved away. Some sold their land to the Kipsigis who were more comfortable staying in the area. In the 1997 battles, pipes were uprooted, cattle troughs dismantled, and a pipe to the market place was disconnected. Even before then, in 1992, maintenance of the collection tank had broken down and the supply of water to the market had become insufficient.

Cattle are now brought up the hill to the communal tap, where they get precedence over people collecting water. Many people, and the local dispensary, use donkeys to collect water.

The European settler's farm building is now a secondary school. There has been controversy, between the school and the community, over who owns the land on which the spring emerges.

Togombe spring: The spring was protected in 1981. The spring is privately owned but access to the land was negotiated by the water committee. The land around the spring and an access road have been demarcated by the Ministry of Lands, Survey Department, and the two landowners, on their own initiative, moved their fences to reflect this change of use.

The committee is enthusiastic and the spring has a large capacity, 2000 gallons/day. Most households, however live upstream of the spring and it has not yet been possible to obtain and install a holding tank, pump and pipe network which would be required to bring water to upstream homesteads.

Nyinyitiet spring: The name given to this spring, translated to ‘coming out in small quantities’, indicates its inadequacy. The spring was, nonetheless, protected by the Ministry of Health in 1984 with funding from the Swedish International Development Agency (SIDA). The spring community has 100 households spread across a large catchment area. Many households are employed as tea pickers. The spring has deteriorated, suffering from siltation and lack of repair. Storm water draining from a nearby road brings gravel into the spring. There is conflict at the spring because of the shortage of water. Women struggle to be first in line to collect water.

Borowet spring: In 2002, a group of three women, in this coffee growing valley, initiated a committee to improve the local water supply. 73 households use water from the spring and 24 of 30 registered members of the water project have water piped to their homestead.

The initial group of 3 women grew to 20 women when the initial group shared their ideas with others. Negotiations to use an initial site failed because the landowner said there was not enough water. The landowner of a second spring, higher than the first, gave the group permanent use of the water. In return, the water project paid school fees for the landowner’s child to the local secondary school, built a water trough for the landowner’s cattle and provided a standpipe for the family (Bundotitch and Sang 2005).

The women’s group started the protection and piping of the spring, without male help, but ran out of money. They turned to their husbands and they ‘were now willing to be part of this success story’ (Bundotitch and Sang 2005). They provided additional finance and joined the committee of the project, though women retained key positions. The local primary school and the church also joined the project.

Simotwet spring: In 2001, an initial group negotiated an agreement with the owner of the spring land. He agreed to let the community improve the spring, and provided some of the materials, and supervised construction, for protecting the spring. In return, the committee built him a water trough for his livestock. The committee also put a fence around the spring, and planted trees recommended by the Ministry of Agriculture for this purpose. 27 households have water piped to their homesteads. Upstream users do not yet have piped water. But they may be able to get water supply from another nearby spring. There has been some conflict. The trough built for the owner of the land around the spring was fouled. He interpreted this as sabotage and broke the trough. Nonetheless, he is interested in joining the project in order to get water supplied to his upstream homestead.

3.2 The Contexts of Collective Action

We turn now to consider what characteristics of the spring and the spring community might predispose the community to take collective action. We consider (i) landholding and renting, (ii) economic activities, income and inequality, (iii) the proportion of spending decisions taken by men and women, (iv) education levels, (v) the history of conflict and (vi) the size of the community and its topographic relation to the spring.

(i) Landholding and renting

We found no simple relationship between average landholding in a spring community and collective action (Table 3.2). The unprotected spring communities, Kipsotet and Moiyowet, have the largest landholdings. The two piped and protected springs, Borowet and Simotwet are variable and in the middle and at the bottom, respectively of the landholding range. The prevalence of land renting is surprisingly high, ranging from 20% in Moiyowet to 75% in Simotwet. Despite this variation from village to village in the prevalence of renting, however, there was no obvious contrast in the pattern of land renting for the three categories of protection. Also, the results show that the pattern of land renting, both in area rented in, and prevalence, was about the same in all size classes of land ownership. Land renting does not stand out as a response to landlessness or a means of excessive concentration of land control by the wealthy.

Table 3.2 Mean land holding and numbers of households renting land

	Mean land owned (acres)	Max land owned (acres)	% Renters	Mean rented land area (acres)
Group 1 Non-protected springs				
Kipsotet	7.5	70	60	1.3
Moiyowet	7	30	20	1.5
Nyinyitiet	2.9	8	33	0.8
Group 2 Protected but not piped springs				
Togombei	5.8	40	40	1.4
Kasheen	3.6	20	61	2.0
Group 3 Protected and piped springs				
Borowet	3.8	18	59	1.6
Simotwet	2.5	10	75	0.5

Tables 3.3, 3.4 and 3.5 indicate that the addition of rented in land does not reveal marked differences between the patterns of ownership.

Table 3.3 Distribution of households (%) by land ownership and rental categories, not protected springs

	Land rented (acres)			
Land owned (acres)	0	> 0 -2.5	2.5-5	5-7.5
0-2.5	22.2	20.0	2.2	0
2.5-5	20.0	12.1	0	0
5-7.5	6.7	6.0	3.0	0
7.5-10	2.2	0	0	0
>20	4.4	3.0	0	0

Table 3.4 Distribution of households (%) by land ownership and rental categories, protected but not piped springs

	Land rented (acres)			
Land owned (acres)	0	> 0 -2.5	2.5-5	5-7.5
0-2.5	12.1	27.3	6.1	0
2.5-5	24.2	9.1	0	3.0
5-7.5	9.1	0	0	0
7.5-10	0	0	0	0
>20	3.0	3.0	0	0

Table 3.5 Distribution of households (%) by land ownership and rental categories, protected and piped springs

	Land rented (acres)			
Land owned (acres)	0	> 0 -2.5	2.5-5	5-7.5
0-2.5	23.8	28.1	0	0
2.5-5	16.7	9.5	2.4	0
5-7.5	7.1	0	0	0
7.5-10	4.8	0	0	0
>20	0	2.4	0	0

(ii) Economic activities, income and inequality

High incomes do not make spring communities more likely to undertake collective action to protect their water supply.

Table 3.6 shows that one of the unprotected springs, Kipsotet, has the highest average incomes in this group of seven springs. Kipsotet, as noted in section three, has larger landholdings and substantial external incomes than the other communities under study. The two springs with piped water have mean incomes in the low end of the range for these seven communities.

Table 3.6 Mean total household incomes by spring community

Spring Group	Spring	Household income per year Mean K Sh
Group1 Not protected	Moiyowet	24,986
	Kipsotet	142,613
	Nyinyitiet	20,880
Group 2 Protected not piped	Togombei	45,398
	Kasheen	78,953
Group 3 Protected and piped	Simotwet	33,965
	Borowet	42,857

Most households in this area of Kenya obtain their incomes from a range of 2, 3 or 4 activities. Almost all engage in staple crop farming, for both sale and own consumption. Many have some other income source, including casual labor, trade, coffee or tea farming or working in a profession.

Figure 3.1 below shows the median income for the main types of activity found in all seven communities. Incomes from crop farming are present in all seven, but their (estimated) contribution to incomes is small. Farming is overshadowed by activities which, for some households, bring in much larger incomes: teaching, government and other professional jobs, and casual labor.

Figure 3.1 Mean income by activity in each spring community.

Since the household sample in each village is a stratified random sample, a more reliable picture of household incomes can be obtained by exploring activities in each income stratum. Figure 3.2 shows mean household incomes for the wealthiest quintile (80-100%). Figure 3.3 shows mean household incomes for the lowest quintile.

Figure 3.2 Mean income by activity, households in 80-100% income percentile.

The most important activities of the top quintile of households, Figure 3.2, are casual labor, particularly in Kipsotet and Kasheen, dairy and livestock production, and professional employment (government, teaching and other professions), particularly in Togombe, Kipsotet, and Borrowet. Tea and coffee farming is significant in two villages, Nyinyitiet and Borrowet, and present in two others. Trade, dairy and livestock farming contribute to incomes in most villages. Annual crop farming provides only a small contribution, except in Simotwet. Moyowet has no households in this top income quintile.

Figure 3.3. Mean income by activity, households in 0-20% income percentile.

The poorest quintile of households in most communities, as shown on Figure 3.3, depends more on annual crop farming, than the richest quintile. Dairy and livestock farming contributes half or more of mean incomes in two communities, and casual labor contributes a major portion of incomes in two communities.

We can conclude from this exploration of mean incomes by income quintiles that there is great diversity of income activities at all levels of income. Farming of all kinds (arable, tea and livestock) is particularly important for the poorest households. Professional employment and casual labor are the main sources of income for the richest quintile of households.

When it comes to inequality, Simotwet and Borowet, the two spring communities that have been able to organize to provide homestead piped water, are at the low end of the range of inequality. So, too, is one of the non-protected communities, Moyowet. Table 3.7 shows Gini Coefficients for the distribution of household income and land ownership. Baland and Plateau's (1996: 302-312) survey of the common property literature suggests that inequality and heterogeneity do not necessarily reduce the likelihood of collective action on a common property resource.

Table 3.7 Gini Coefficients for Household Income and Land Ownership

Spring Group	Spring	Income Gini	Owned land Gini
Not protected	Moiyowet	0.34	0.49
	Kipsotet	0.61	0.68
	Nyinyitiet	0.47	0.43
	Average	0.47	0.53
Protected but not piped	Togombe	0.66	0.61
	Kasheen	0.53	0.47
	Average	0.60	0.54
Protected and piped	Simotwet	0.39	0.48
	Borowet	0.39	0.40
	Average	0.39	0.44

What about occupational networks and collective action? Government, teaching and professional activities could be associated with collective action both because those occupations are likely to build networks and provide the capacity to organize. While this occupation group is important, particularly in the richest quintile of households, in one of the protected and piped communities (Borowet), it is not present in the other (Simotwet) and both non protected (Kipsotet) and protected spring communities (Kasheen, Togombe) have significant incomes from those occupations.

(iii) Who decides about income?

An initial hypothesis of the study was that gender relations might influence collective action on access to water. Women do most of the work of collecting water but men are much better represented in decision making bodies at all levels including the water committees undertaking community water improvements. If women have greater influence or autonomy within the household, it might be expected that women's work of water collection would be given higher priority for action.

The extent of women's decision making in households can be taken as a proxy for women's influence and autonomy in the household. In our household questions, we asked our interviewees to identify who decided how the income from each activity (tea farming, casual labor, arable farming and so on) would be spent. This could provide an indication of differences in women's autonomy in the three groups of villages.

When this information is analyzed according to the gender of the interviewee, there are striking differences (Table 3.8 and Figure 3.4) between the perceptions of men and women about who takes decisions. Women report that women generally make spending decisions. Men report that women rarely make spending decisions, that most decisions are made jointly or by the man alone.

Table 3.8 Gender of interviewee and perception of who made spending decisions

Gender of Interviewee	Who makes spending decisions %			Total
	Both or household	Man / husband	Woman / wife	
Female	26	25	49	100
Male	55	44	1	100

Figure 3.4 Gender of interviewee and perception of spending decisions.

When the decisions are broken down by spring group and by the gender of the interviewee, the distribution of decision making is difficult to discern. Table 3.9 documents the percentage of decisions taken by men for each community, according to both women and men. There are marked differences between communities, but there is no obvious pattern of male or female decision making characteristic of the different spring groups. In one community the gender distribution of decisions is nonetheless worth noting. In Borowet, the community where women took the lead in organizing the water project, the men's responses fit with a community where women have a larger role: men say they take only 13% of spending decisions. This suggests that nearly 90% of decisions are taken jointly or by the women alone. Strangely, however, the women of Borowet say that men make 38% of spending decisions, the highest of any community.

Table 3.9 Proportion of men taking spending decisions

Spring group	Spring	% of men taking spending decisions	
		Gender of respondent Men	Women
Non protected springs	Moiyowet	67	29
	Kipsotet	36	15
Protected but not piped	Togombe	50	20
	Nyinyitiet	77	7
	Kasheen	44	28
Protected and piped	Simotwet	71	19
	Borowet	13	38

(iv) Education levels by spring

There is some limited correspondence between education and collective action. Figure 3.5 shows in percentages the highest levels of education attained for respondents in each spring community. Kipsotet, a non-protected spring community, has the highest level of post-secondary education, and no respondents without any education. This community, as we have noted earlier, is an outlier in the seven communities with higher landholding, incomes and professional employment. If this community can be set aside, then the two Group 3 piped communities have higher education levels.

The two piped communities, Simotwet and Borowet, have high levels of secondary education and low proportions of households with no education. Nyinyitiet and Togombel, two of the three springs, which are protected but not piped, have the highest proportion of households with no education. If we ignore the case of Kipsotet, an anomaly in education as in most respects, then high levels of secondary education are associated with collective action.

Figure 3.5 Education levels in each spring community.

(v) History of conflict

The accounts of interviewees in one spring community suggest that ethnic conflict can set back the prospects of collective action for water provision.

Ethnic conflict in the community of Kasheen is the clearest example of conflict in the springs. This is the most ethnically diverse of the communities, with people Kikuyu, Kisii, and Kipsigis ethnic groups. Countrywide ethnic clashes in 1992 and 1997 led to many people leaving. Many Kikuyu and Kisii moved away. Some sold their land to Kipsigis who were more comfortable staying in the area. In the words of a teacher, “The whole settlement was disrupted, cattle trough members, dispensary members and others left. . The old establishment moved, a new one was coming in. It takes time to settle, interact well, and reach an amicable understanding with the people already here. Suspicion remains for those who were beaten. It took time before the newcomers were understood.’ (Mabera 2007).

In Kasheen there had been a communal cattle trough. It was destroyed during the clashes because ‘Animals were stolen, others were sold for fear that they would be stolen. So there was no need for the cattle trough. There was a lot of fear.’ (Mabera 2007)

There has been conflict, sometimes expressed through sabotage, at other springs. At Nyinyitiet, there is conflict among women over who can obtain the limited supplies of water. In Borowet, there has been some tension around the fouling of the spring landowners’ water trough. Elsewhere, there are indications of some tensions between members and non-members.

(vi) Numbers of households and their topographic relation to the spring

The two communities with piped water seem to be distinguished by the small size of their membership and the fact that the homesteads are downstream of the spring. Borowet and Simotwet are relatively small communities – determined largely by the number of households within the catchment. There is a consensus that smaller groups organize collective action more readily (Baland and Plateau 1996: 298-9). They also have fewer households upstream of the spring (Table 3.10).

The task of providing piped water is easier for spring communities, such as Simotwet and Borowet, with smaller catchments and downstream households. Nonetheless, not all small catchments (see Kipsotet), nor all catchments with downstream households (see Kasheen), manage to arrange piped water.

A committee having a large proportion of its households upstream of the spring has additional technology to acquire and install. A pump is required and a larger storage tank to store water for pumping. A larger community of households has the more difficult task of organizing a larger group.

Table 3.10 Number of households and their relation to spring geography

Spring group	Spring/ community	Number of households	Upstream
Not protected	Moiyowet	600	All live upstream
	Kipsotet	200	
	Nyitnyitiet	200	
Protected but not piped	Togombeï	140	All live upstream except 5
	Kasheen	150	All live downstream
Protected and piped	Simotwet	56	All live downstream
	Borowet	73	All live downstream

Summary: comparison of 7 springs

This section provides a series of interesting findings, many of them counterintuitive. Accumulated wealth in the form of landholding is not correlated with better access to water. High incomes do not enable spring communities to improve their water access. It is two communities at the low end of the income range which have been able to provide piped water to homesteads. Higher levels of secondary education, with one exception, are associated with collective action. Catchments with smaller numbers of households, and those with all members downstream of the spring, appear more likely to undertake spring improvement. Finally, and not surprisingly, the experience of Kasheen, the spring with the highest level of ethnic conflict, suggests that severe conflict sets back the process of spring improvement.

We turn in the next section to a focus on participation, transparency and accountability in local governance of water activities.

4 Good Governance and Local Organizing for Potable Water

International development agencies stress the importance of ‘good governance’ in development institutions. What does good governance mean: ‘participation, accountability, transparency, effectiveness, efficiency and adherence to the rule of law’ (Lund and True 2008: 11). Does such ‘good governance’ influence the success of self-organized domestic water improvement? The Nyando Springs case suggests that it does. Those water projects able to improve their water supply have more formal and active project committees that more closely resemble the ideals of good governance.

As noted in section 3, there is also a more specific, and evidence-based consensus on the conditions for successful collective action on common property resources. This suggests that user groups should ‘be free to set access and management rules in their own way....crucial decisions must be taken publicly; and some record-keeping and accountability must be provided for.’ (Baland and Plateau 1994: 289).

This section examines three areas of governance in the water committees of these spring communities: i) participation, ii) rule of law (formality and frequency of meetings) and iii) transparency and accountability. We discuss these in relation to the three groups of projects. The findings reported in this chapter come from the analysis of interviews with groups of people living in the communities.

4.1 Participation

For each of the committees, we assessed the intensity of participation according to the following categories: i) Information: one-way flow of information; ii) Consultation: two-way flow of information; iii) Collaboration: shared control over decision making; iv) Empowerment: transfer of control over decisions and resources.

Table 4.1 lists the numbers of water committee members for each spring and the number of households that could be supplied by water from that spring.

Table 4.1 Spring connections and numbers of potential households

Spring Status	Spring Name	Potential target households	Number of registered Members	Number of household connections
Group 1	Moiyowet	600	50	0
Unprotected	Kipsotet	200	20	0
	Nyinyitiet	200	200	0
Group 2 Protected not piped	Kasheen	150	69	5
	Togom-mbei	140	70	2
Group 3 Protected and piped	Simotwet	56	35	35
	Borowet	73	36	36

The sites with protected and piped household connections, that is Group 3, have committees which not only act as representatives of members but also provide direction to the members. Members have continuously been in touch with project action from identification of key issues affecting their interests, determination of priorities, and enacting solutions to meet emerging needs. Similar levels of participation have also taken place in springs that are protected but not piped.

Members described participation as contributing to renovation both in cash and unskilled labor. In Kasheen (Group 2 protected but not piped), for example, women have been at the forefront in collecting building supplies while men contribute labour for the construction of the water holding tank at the spring. Members are encouraged to make decisions and to take action and not merely respond passively to initiatives proposed by the committee.

“In the beginning I was not sure if I wanted to join but my wife asked me to go and see what the meeting was all about. Since we began, the leaders we elected have called us to meetings and to also work on the trenches”
Langat, Simotwet spring

Participation in Group 3 protected and piped sites, Borowet and Simotwet, has been accompanied by information sharing and has led to active involvement of members in decision making. In Borowet focus group discussions suggested that a discernable and subtle process of handing over is leading to the community taking greater responsibility.

The story of group mobilization in Borowet is clear and particular. It started as the initiative of one woman talking to her clinical officer husband on the effects of contaminated water. She followed this by sharing with friends and they later incorporated others to make a group of nine that met with the area Assistant Chief for advice on registration and getting external support to develop their own safe water point (Bundotitch and Sang 2005). Over time more households got involved and even men were incorporated as work got underway. This included members being directly involved in approving of new applications for those who wish to get a household connection; members developed criteria which they use to vet potential members prior to approval. Focus group discussions suggest that members' needs and wishes were used to underpin the key decisions and actions relating to their livelihoods.

Apart from the unprotected sites in Group 1, all the projects in the study, that is, Groups 2 and 3, have sought, and managed, to build some level of links with the government departments based at the district head quarters.

Table 4.2 Participation and decision making by spring community

Spring	Group	Physical status	Ownership	Legality and Self organization	Taking part	Decision making
Kipsotet	Group 1 Unprotected	Has never been protected	Privately owned	Not registered but has a committee	Meet when required	Committee and land owner
Moiyowet		Initially protected in 1953 Wall now has collapsed	Private Majority of users live upstream	Not registered Officials selected by Provincial Administration Money households insufficient	Meet every 2 months Have applied for LATF support Poverty high	Mainly men
Nyinyitiet		Initiated in 1984 Has broken down over the years	Public	Not registered No constitution	Meet when necessary Initial committee still in office	Mainly by the committee
Togombei	Group 2 Protected not piped	Initiated in 1981	Public	Registered by Ministry of Water in 1985	Land acquired by contributing funds and purchasing. Attend meetings Work on clearing bush	By members
Kasheen		Initially protected in 1960 by European settler Has had maintenance done by community since taking over in 1970	Public	Registered committee elected in 2005 Have constitution	Labor & Cash contribution Attendance of meetings CDF has pledged Sh 600k for pipeline extension	By members
Borowet	Group 3 Protected and piped	Initiated in 2002 by women	On Private land but owned by the members	Registered by Ministry of Water with a constitution in place	In works identified by the committee In cash contribution Attendance of meetings	By members
Simotwet		Initiated in 2002	On private land owned by members	Registered by Ministry of Culture & Social Services	Labor In cash contribution Attendance of meetings	By members

4.2 Constitutions and representation

The three unprotected spring communities do not have committee constitutions. Both protected and piped and both protected but not piped springs have constitutions. The constitutions of these spring committees seem to have helped ensure a fair framework of policies and by-laws that protect members and support growth.

Table 4.3 Constitution and representation by spring community

Spring	Status	Constitution	Last election	Reference to constitution in project operations
Kipsotet	Unprotected	None	Have a committee in place elected in 2000	None
Moiyowet		None		None
Nyinyitiet		None	Last elections in 1985	No
Togombei	Protected not piped	Have constitution	Committee was elected in 2000	Yes
Kasheen		Have constitution	Not known	Yes
Borowet	Protected and piped	Have constitution	Committee has been in office since 2002	Yes very regularly Yes,
Simotwet		Have constitution	Committee elected	Yes regularly

All sites have a committee in place, it is the formality and the level of interactions in these committees that differentiates them. Focus group discussions in communities with piped springs (Group 3) attributed their success to the ability to operate democratically. In these communities, the water committees meet the community regularly, brief them on latest developments and also share the budget and work-plan.

4.3 Transparency and accountability

In the unprotected and non-piped spring projects, focus group discussions suggested that committee members were viewed as those in privileged positions who volunteered information when needs arose. In these cases, the committees did not appear accountable. Little progress toward water supply has taken place for these springs.

Table 4.4 Transparency in water committee activities

	Status	Record keeping	Community meetings	Community meetings
Kipsotet	Unprotected	No records	Rare	When need arises
Moiyowet		Had records but not shared	When need arises	When need arises
Nyinyitiet		No records seen	Rare	Rarely
Togombei	Protected not piped	Had records that are shared with community	When need arises	Monthly
Kasheen		Had records that are shared with community selectively	When need arises	At least once a month or when need arises
Borowet	Protected and piped	Had records that are shared with community at each meeting	Every two to three months	Monthly
Simotwet		Had records that are shared with community if necessary	When needed but at least 3 times a year	Monthly

All project sites with household connections have continuously shared information, held regular meetings to deliberate the way forward, and given opportunities for members to influence the development processes. These spring committees had clear records of financial transactions, which have helped in the management of funds at their disposal.

Use of funds is agreed on and minuted prior to expenditure and all records kept and made available to members. The fact that members have been allowed to question and hold the committee accountable has improved relations and enriched the group. The spring committees have managed to make information not only freely accessible to those who are affected but in a manner that it is useful and understandable. Information accessed by members has led to a high level of trust among members and with the committee. The spring committees that were highly rated in transparency were also more accountable. These sites had evidence of keeping records, which were to a large extent complete, valid, correct and up-to-date.

In piped spring projects, the spring committees have managed to effectively engage the government and lobby for resources in the form of technical expertise, materials (cement, wire mesh etc) and finances.

Summary

Good governance appears to matter. The two communities with piped water, Borowet and Simotwet, have higher levels of participation, more frequent meetings and more active water committees. A detailed study of decentralized forest management in Tanzania (Lund and True 2008) suggests that local management of resources creates a new arena for political struggle between interest groups at the village level. There are hints of such tensions in this study, for example in the conflict between the owner of spring land and water users in Simotwet (Section 3). Despite such tensions, participation, a constitution, transparency and accountability do seem to be associated with more successful outcomes.

At this point in the paper we have concluded our exploration of the first question posed in the introduction: What characteristics and histories of the communities are associated with spring protection and the provision of piped homestead water? We can add good governance to the points listed at the end of Section 3 (higher education levels and smaller communities matter, but high landholding and incomes do not).

We turn now to examine the second question addressed in this paper: what benefits are associated with spring protection and piping of water supply?

5. Water use and the benefits of piped water

There is little systematic and reliable data on rural sources of water, how much water is used for different purposes and how long it takes to collect water (Blackden and Woden 2006; Thompson 2001 is a notable exception that focuses on urban areas). There is, however, a growing literature on the multiple uses and diverse benefits of improved access to household water (Were et al 2008; Andujar 2005; Moriarty et al 2004; James et al 2002; Bakker et al 1999). The consensus of this literature is that improved access generates a range of benefits besides those associated with health. These include time savings, expenditure savings, well-being (reduced stress from pressure of work), education, environmental sanitation, community capacity, productivity and income, investment, food security and nutrition (Moriarty et al 2004: Box 1).

In this section we explore changes in water use, changes in the time spent collecting water, and income changes which may be associated with access to piped water. Section 6 examines changes in women's allocation of time to different tasks associated with access to piped water.

5.1 Water Collection and Use

Quantities used for different activities

Household water needs are often conceptualized as basic needs for drinking, washing and cooking of 25 to 50 liters/capita/day (United Nations 2003 World Water Development Report; World Water Council 2006: 3). Moriarty et al (2004: 16) argue that the needs of rural households for water for productive uses mean that 100 to 200 liters/capita/day are required. Our study results are consistent with this recommendation. Households without access to piped water use in excess of 200 litres per household per day (60l/c/d), while those with piped water to the homestead use about 300 litres per household per day (75l/c/d). The additional water is used particularly in kitchen gardens and for livestock. Note that the average household size is 6.3 persons per household in the study area.

Figures 5.1 and 5.2 show the main uses for water in the two spring groups without piped water, and Figure 5.3 shows the larger use of water in the households with piped water. In the spring communities without piped water, the largest amount of water, about 100l/hh/d, is used for livestock (goats and cattle), followed by washing of clothes and utensils, bathing, cooking and finally drinking. (Livestock use here excludes cattle watered at spring or other water point). Figure 5.1 illustrates this pattern for the communities with non-protected springs during the wet season. A similar pattern of wet season water use emerges in Figure 5.2 for the protected but not piped springs.

Figure 5.1 Quantity of water used by purpose, non-protected springs, wet season.

Figure 5.2 Quantity of water used by purpose, protected but not piped springs, wet season.

For households in Borowet and Simotwet, with piped water, shown in Figure 5.3, kitchen garden use exceeds livestock use. This is a substantial increase on kitchen garden water use in the other spring groups. Water quantities used in these households for bathing, washing and cooking are comparable to the quantities used by households in other spring groups. This conforms in almost all respects with the household water use pattern found in a detailed study (Were et al 2006) of the village of Kiptagan where piped water had been organized by the community.

Figure 5.3 Quantity of water used by purpose, piped households only, wet season.

Sources of water and how they change with access to piped water

Water is obtained from a range of sources in these communities including rivers, boreholes, roof collection and springs. The main source in both wet and dry seasons is the spring. The pattern of wet and dry season sources for the three protected but not piped communities is shown in Figure 5.4 below. In both wet and dry season, protected or non-protected springs provide the main source of water. Roof collection provides an additional source of water in the wet season, and one village has a borehole.

Figure 5.4 Quantity of water used by source, protected but not piped springs.

Reliance on particular water sources is changed by the introduction of piped water. A comparison, in Figure 5.5, of the quantities of water used before and after introduction of piped water suggests that piped water is treated as an additional source of water, nearly doubling the amount of water used by the household, but existing sources continue to be used. Figure 5.5 shows the volume of water taken in the wet season from different sources before and after access to piped water. Figure 5.6 provides a comparable picture for the dry season.

Figure 5.5 Quantity of water use by source, protected and piped springs, dry season.

Figure 5.6 Quantity of water use by source, protected and piped springs, wet season.

For both wet and dry seasons, the use of river water is significantly reduced. Previous spring and borehole sources change only slightly. The diverse needs of households for water, particularly for livestock watering, may explain why use of these sources remains.

5.2 The labor of getting water each day

Most households in these seven communities spend one hour or less collecting water each day. Some households, however, spend four or more hours per day collecting water. Figure 5.7 shows the number of households spending up to one, two, three, four, five and six hours collecting water each day. These data come from interviewee's estimates of total time taken per day to collect water. Interviewees were asked (at the end of the dry season) how much time do you spend collecting water each day? These figures are somewhat lower than interviewee's estimates based on the time per trip and the number of trips taken per day. We consider the estimates of total time to be more reliable.

Figure 5.7 Distribution of times to collect water by numbers of households (source: household interviews).

The villages with piped water have significantly reduced the time taken to collect water. Figure 5.8 shows the range of times collecting water. The two piped communities (Simotwet and Borowet) clearly have much lower median times and lower ranges than the six communities without piped supply. On average, households with piped water supply spent about 85 minutes less per day collecting water.

Figure 5.8 Time collecting water by spring community (source: household interviews).

5.3 Incomes of piped and non-piped households in Simotwet and Borowet

James et al (2002) argue that time saved in water collection can be converted into income generating activities. They describe the organization of micro-enterprise activities in the wake of a large state-backed domestic water supply project in rural Gujarat, India. They conclude that ‘when water supply improvements are coupled with opportunity to create income through micro-enterprises, time released from water collection is converted into income earned’ (James et al 2002:205).

The evidence from the Nyando springs is not conclusive, but does suggest that additional household water and time saved from water collection are associated with additional household incomes, particularly from fruit and vegetable and livestock production. We have two types of evidence. First, there is evidence on income in households with and without pipes from the two communities which have achieved piped household connections. Second, there are estimates from the households with piped water of the additional incomes which they attribute to having piped water.

In the following figures, we contrast the incomes of piped and non-piped households and examine the additional incomes that piped households attribute to having piped water. The direction of causation in these figures is difficult to establish without successive years of household data. Did more affluent households get piped connections? Or did piped connections make households more affluent. Either might be the case. The source of the additional incomes, kitchen garden production, however, gives credence to the idea that piped water led to the increased incomes.

Mean income of households with and without homestead pipe in Simotwet and Borowet

Figure 5.9 shows that households with pipes have 35% higher incomes than those without.

Figures 5.10 and 5.11 show the breakdown of this income by type of activity for each of the two springs, Simotwet and Borowet. In both communities, vegetable and fruit farming activities generate more income for the piped households than those without homestead connections. In Borowet, dairy and livestock activities also generate more income for the piped households. These two activities, vegetable and fruit farming and dairy and livestock production, are likely to have been improved by the ready availability of water at the homestead.

Figure 5.10 Mean income of households by activity, piped and non-piped households, Simotwet.

Figure 5.11 Mean households incomes by activity, piped and non-piped households, Borowet.

Figure 5.12 shows the additional income reported by households with piped water 'due to changes in the water source'. These households estimate that they have been able to increase their dairy and livestock incomes substantially (35% of income from that activity in Simotwet and 9% in Borowet) as a result of piped water. Simotwet households report a 20% increase in income from vegetable and fruit production. Borowet households report a 3% increase in vegetable and fruit and an 8% increase in tea and coffee income. These are all activities that are carried out mostly within the homestead and could plausibly have benefited from additional quantities of water.

Figure 5.12 Additional income reported by piped households, Simotwet and Borowet.

Summary

Households with piped water reduce the time collecting water from between 2 hours to half of one hour. They increase the amount of water used, particularly for kitchen gardens. Households with piped water have higher incomes in vegetable and fruit and dairy and livestock activities. It is plausible, but not certain, that these higher incomes arise from the additional water available for homestead production.

In the next section, we examine changes in women's activities and time allocation as a result of having piped water.

6 The influence of piped water on women's activities and time allocation

Women do the work of collecting water in Kenya, as elsewhere in Africa. Recent research on women's time allocation in sub-Saharan Africa (Blackden and Woden 2006) has identified 'time poverty' as a constraint to development, with 'women working especially long hours due in part to a lack of access to basic infrastructure services such as water and electricity, but also due to the rising demands of the "care economy" (Bardasi and Woden 2006: 91-2 in Blackden and Woden). Time poverty is the idea that individuals do not have enough time for rest after completing their work tasks. Several studies have shown that women work longer hours than men (Ilahi 2000).

One of the key advantages of access to piped water in the homestead is that women are liberated from the time-consuming drudgery of collecting water. We provide data in this chapter on the impact of this time-saving. We examine first, in Section 6.1, women's participation in project committees. Then, in Section 6.2 we describe the organization and findings of focus group discussions on changes in women's work. In Section 6.3 we examine time allocation in the three groups of communities – non-protected, protected but not piped and protected and piped. Findings are summarized in Section 6.4.

6.1 Women's participation in project committees

Within each spring community, few women make decisions even though 92% of the women interviewed had primary level education.

All the committees have women members (Table 6.1). The average proportion of women on the committees was 33.3%. Borowet set a high of 75% and Kasheen a low of 15%. In all the projects apart from Borowet, men are reported to be the main decision makers. In Borowet, by contrast, women have become an effective social force. The leadership of one charismatic woman combined with significant determination of the women's group appears to have been a strong force backing the Borowet water project.

Table 6.1: Committee composition by gender

Spring group	Spring	Committee composition				
		Total	Females	%	Males	%
Group 1	Moiyowet	25	5	20	20	80
Not-protected	Kipsotet	12	3	25	9	75
	Nyinyitiet	25	9	36	16	64
Group 2	Togom-mbei	17	7	41	10	59
Protected but not piped	Kasheen	15	2	13	13	87
Group 3	Simotwet	17	6	35	11	65
Protected and piped	Borowet	12	9	75	3	25
	Total	123	41	33	82	67

Source: Focus Group Discussions

The average percentage of women in water project committees for each of Group 1 and Group 2 is 27%. For Group 3, it is 55%. The small sample size and variation within each group mean that this is not a strong finding. Nonetheless it suggests there is at least a weak association between greater participation by women in the work of water committees and the ability to take action to improve access to water.

6.2 Focus group discussions on gender analysis and changes in work

To generate information on the work and time allocation of men and women, a series of focus group discussions were held. Four groups of 6 to 8 persons were selected as follows: women only, men only, youth (boys and girls below 15 years), and a mixed group. The numbers of participants in each community are shown in Table 6.2.

Table 6.2 Participants in gender analysis focus group discussions

Name of spring	Number of participants in discussion		
	Women	Men	Youth/children
Borowet	12	6	5
Simotwet	8	9	0
Moiyowet	16	9	7
Kipsotet	5	8	0
Nyinyitiet	12	11	14
Togombe	4	8	0
Kasheen	7	12	6

The groups were told we were interested in the effects of water projects on men and women. The question asked was 'how does access to safe water impact your lives?'

Each group was asked to describe changes in labor, time, resources and culture and to rate them as negative or positive. The consensus of the groups was noted. This information was then consolidated into one table/matrix and used for discussion in a plenary/general group meeting that brought everyone together to share and agree. Table 6.3 is drawn from that discussion.

Table 6.3 Gender Analysis Matrix showing the current overall impact of a successful spring project

	Labor: Changes in tasks	Time: Changes in amount of time taken by tasks	Resources: Changes in access to capital	Culture: Changes in the social aspect of the lives of those involved
Men – all ages	(-) New task of taking home water for livestock (+) New skills gained in development and management of spring	(-) More time taken up with the development of the spring	(+) More access to income from milk and vegetables (+) Cows produce more milk as access more water	(-) Taking on roles considered as female
Women – all ages	(+) Reduced workload fetching water (+) Reduced walking distances to fetch water (+) New skills gained in development and management of spring (+) Reduced stress on the back	(+) Time saved (+) Time invested in income generating activities (+) Reduced conflict with spouse as less time spent fetching water (+) Cleaner houses (+) Girls have time to attend to school work	(+) More access to income from milk and vegetables (+) Improve nutrition	(-) Social time when fetching water reduced (+) Increase in exposure as water managers (+) Men support them in bringing water into the house
Households – men, women and children (residing together even if they are not part one nuclear family)	(+) Reduced workload	(+) Time saved	(+) More access to income from milk and vegetables	(+) Male and female members involved in watering livestock and fetching water for household use

Source: Focus Group Discussions.

Note: + Positively viewed by interviewee

-Negatively viewed by interviewee

Several intuitive points emerge from these discussions. Women with access to homestead water appreciate the reduction in their work and the time saved, girls have time for school work, and the stress on women's backs from carrying water is reduced. Women also report the opportunity to increase their income, particularly by selling milk and vegetables. (We have looked at this increased income in Section 5.3.) The value of improved health was also noted in discussions not reported in Table 6.3. Reduced illness resulted in both improved productivity and more regular school attendance by children. In another study of a western Kenyan community that has organized to obtain homestead water access (Were, Swallow and Roy 2006), interviewees stressed the benefits that household members got from having clean clothes. Children were happy to go to school and men were more comfortable attending meetings because their clothes could be washed more regularly.

Three less obvious points, not previously widely-reported, are highlighted by the discussion. Women report reduced conflict with their husbands, the capacity to maintain cleaner homes, and the increase of their skills.

Men also appreciate new skills learned from the management of the water project and the new income from milk and vegetables, but they dislike the extra time they spend on water tasks, working on the spring, and that they have to work on tasks previously deemed to be women's responsibilities.

6.3 Time allocation of women and men

Women in general bear a heavier burden of work; they contribute a major share to the family income, and in addition are responsible for child-rearing and most household chores including fetching water and fuel wood. The daily activity profiles (Tables 6.4 and 6.5) indicated that an average woman's day is 6½hours longer than that of an average man, which reduces their opportunities for rest, leisure and self-development. Women work, on average, for about 16½hours daily while men in the same area put in some 10 hours of productive work.

Table 6.4: Typical woman's daily schedule - hours

	Group 1	Group 2	Group 3
	Non-protected	Protected but not piped	Protected and piped
	Mean hours/day	Mean hours/day	Mean hours/day
Prepare breakfast & children for school	1.83	2.00	2.00
Fetching water for the day	3.50	4.00	2.00
Prepare meals -looking for vegetables & cooking	2.83	2.50	2.75
Farming	2.67	3.50	3.50
Fetching firewood	2.33	2.00	3.00
Washing, cleaning and child care	3.17	3.00	2.75
Milking	1.00	-	-
Sleep	7.33	7.00	8.00
Leisure	-	-	-
Hours of productive work	16.67	17.00	16.00

Source: Focus Group Discussions

Access to homestead water allows women in Group 3 communities to spend rather less time collecting water and more time sleeping, compared with women in Groups 1 and 2. (Note that these time allocations are derived from group interviews. Estimates of the time spent collecting water are greater than the average times reported by households as shown in section 5.2).

Table 6.5: Typical man's daily schedule

	Group 1	Group 2	Group 3
	Non-protected	Protected but not piped	Protected and piped
	Mean hours/day	Mean hours/day	Mean hours/day
Milking	0.38	0.83	0.63
Transportation of milk/sale	1.25	1.33	2.5
Cutting Napier grass/grazing	0.5	2.17	0.75
Feeding cows	0.25	0	0.5
Cleaning cow shed	0.5	0	0.83
Plucking tea	0	2	1.5
Watering cows	1	1	1
Socializing/project work	0	1.3	4
Farming/fencing	4.5	4.67	2
Sleep	10.6	7.17	9.4
Leisure/meals	5	1.5	3
Hours of productive work	8.4	13.3	11.75

Source: Focus Group Discussions

Men in Group 3 spend more time selling milk and more time socializing and working on the water project. In this group, men spent less time farming and fencing. This may reflect a change of emphasis toward livestock from cultivation. Even in this group with homestead water access, men have more time for leisure and sleeping.

6.4 Implications of work changes

Women's time poverty is reduced by access to homestead water. Women in communities with piped water report that time saved from collecting water enables more time to be devoted to milk and vegetable production, and girls to spend more time on school work. Women also report reduced conflict with their husbands, increased household cleanliness and increased skills arising from the water project. Women's time allocation adds to this picture that women with homestead water access were able to sleep longer.

There were changes in work and time allocation patterns for both women and men in communities with homestead water access. Men in these communities reported working longer hours on the sale of milk and on socializing and project work, and they did not like their increased involvement in women's tasks. Nonetheless, increased income from milk and vegetable production was a positive change for men in communities with homestead water.

Participation of women in decision making within their households and communities is also important. While women did voice their ability to make decisions at the household level, at community level the tendency was towards them agreeing with the men. Communities able to act collectively to increase household water access had a higher level of women's participation in water committees.

7 Conclusions

Case study analysis in Kiptagen Village conducted in 2005-6 suggested that protection and piping of water to individual homesteads can have dramatic impacts on several dimensions of household well-being (Were et al., 2006). The spring census that was undertaken following that case study found that there are other groups in the upper Nyando basin who have been able to protect their springs, with a minority of those able to install piped water systems. If protected and piped water systems generate such large benefits, why were they the exception rather than the rule? We posited two obvious hypotheses: 1. the Kiptagen case was an exception in terms of the types and level of benefits that resulted or 2. the obstacles to collective action are so daunting that very few communities are able to surmount them.

This study does not support the first hypothesis, but does support the second. That is, the evidence reviewed in this study is consistent with the Kiptagen study in showing that households with household water connections are able to save a great deal of time (about 1.5 hours per day of time savings for women and girls) which they are able to allocate to more beneficial uses: education for girls, garden production for women, and rest for women and girls. The extra water available to the household is useful for intensive dairy production and for watering home gardens. There is evidence of a 35% increase in income for households with home water access mostly from dairy and home garden production. The percentage increase may have been larger in some of the poorer households that were able to obtain household water supplies.

But there certainly are many constraints to the collective action necessary for establishing protected and piped water supply systems. Ethnic heterogeneity and conflict, such as seen in this area of Kenya as recently as January 2008, can certainly serve to reduce or stop collective water management. Formalized and efficient systems of water governance appear to be key. The two community groups that were able to establish a constitution, generate good participation from members, and ensure some level of accountability and transparency in the governance systems, built and maintained piped water systems.

The study did not show any particular factors that might pre-condition some villages for collective action, against the backdrop of general failure of collective action. Neither income nor wealth were important; education may have played a minor role.

Gender relations are clearly important for water management, with women and girls bearing most of the costs of collecting water and men generally needing to be involved in mobilizing the necessary finance and access to land. Focus groups note a large number of benefits of piped water for women, it is perceived that some of the impacts for men can be negative. Questions about gender responsibilities over resource control generated the curious result that both men and women claim to be in charge, with an interesting contrast that men in Borowet (where women led the water project) acknowledged a greater decision-making role for women than in other villages.

We started this research with a hypothesis that differences in men's valuation of women's work collecting water could lie behind the ability of some communities to organize to improve household water access. Early results from fieldwork by Jessica Roy (Roy, Crow and Swallow 2005) provided some anecdotal support for this idea. We were not able to provide further evidence of such differences (see Section 3.2, (iii)). We suggest that more sophisticated exploration of perceptions of women's work could illuminate this idea.

Given the very large potential benefit, improving household access to piped spring water must be a major investment priority in the upper Nyando basin. Close to 90,000 people stand to benefit. The best way to

target external intervention is not obvious, however, given the importance of community self organization and internal governance structures. A study of externally-supported systems would be an appropriate follow-up to this study.

References

- Andujar A. 2005. When women say enough is enough: the struggle for drinking water in Villa Jardin, Argentina. Paper presented at International Research Workshop on Gender and Collective Action (17-21 October 2005). Chiang Mai, Thailand.
- Asamba I. 2007. Spring Management and Local Social Organization in Kericho District (Kenya). Masters Thesis. Maseno, Kenya: Maseno University.
- Bakker K. 2008. The ambiguity of community: debating alternatives to private-sector provision of urban water supply. *Water Alternatives* 1(2): 236-252.
- Bakker M, Barker R, Meinzen-Dick R, Konradsen F. 1999. *Multiple Uses of Water in Irrigated Areas: A Case Study from Sri Lanka*. SWIM Paper 8. IFPRI-IWMI System-Wide Initiative on Water Management.
- Blackden M, Wodon Q eds . 2006. *Gender, Time Use, and Poverty in Sub-Saharan Africa*. World Bank Working Paper 73. Washington DC: World Bank.
- Bundotitch D. 2005. Report on survey of springs in Kericho district. Unpublished report. Nairobi: World Agroforestry Centre.
- Bundotitch D, Sang J. 2005. Report on survey of springs in Kericho District. Appendix: Borowet Water Project.
- Ilahi N. 2000. The Intra-Household Allocation of Time and Tasks : What have we learned from the empirical literature? Policy Research Report on Gender and Development, Working Paper 13. Washington, D.C.: World Bank.
- James A, Verhagen J, et al. 2002. Transforming time into money using water: A participatory study of economics and gender in rural India. *Natural Resources Forum* 26(3): 205-217.
- Kenya, Republic of. 2004. Pulling Apart the Facts.
- Langat. Interview. Simotwet.
- Lund J, Treue T .2008. Are we getting there? Evidence of decentralized forest management from the Tanzanian Miombo woodlands. *World Development* 36 (12):2780-2800.
- Mabera 2007. Interview. Kasheen.
- Moriarty P, Butterworth J, van Koppen B. 2004. Beyond Domestic: Case studies on poverty and productive uses of water at the household level. Delft, The Netherlands: IRC International Water and Sanitation Center.
- Roy J, Crow B, Swallow B. 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).
- Swallow, B. 2005. Potential for Poverty Reduction Strategies to Address Community Priorities: Case Study of Kenya. *World Development* 33(2): 301-321.

- Swallow BM, Sang JK, Nyabenge M, Bondotich DK, Duraiappah AK and Yatich T. 2009. Tradeoffs, synergies and traps among ecosystem services in the Lake Victoria basin of East Africa. *Environmental Science and Policy* 12(4):504-519.
- Thompson J, Porras IT, Tumwine JK, Mujwahuzi MR, Katui-Katua M, Johnstone N and Wood L. 2001. *Drawers of Water II*. London, UK: IIED.
- Were E, Swallow B, Roy J. 2006. Water, women and local social organization in the Western Kenya highlands. ICRAF Working Paper 12. Nairobi: World Agroforestry Centre.
- Were E, Roy J, Swallow, B. 2008. Local Organization and Gender in Water Management: A Case Study from the Kenya Highlands. *Journal of International Development*. 20: 69–81.
- WHO/UNICEF Joint Monitoring Program. 2004. Coverage Estimates Improved Drinking Water – Kenya. Wssinfo.org.
- World Resources Institute, Department of Resource Surveys and Remote Sensing, Ministry of Environmental and Natural Resources, Kenya, Central Bureau of Statistics, Ministry of Planning and National Development, Kenya and International Livestock Research Institute. 2007. *Nature's Benefits in Kenya. An Atlas of Ecosystems and Human Well-Being*. Washington DC and Nairobi: World Resources Institute.
- World Water Council (2006). *The Right to Water: From concept to implementation*. Marseilles, France: World Water Council.

WORKING PAPERS IN THIS SERIES

1. Agroforestry in the drylands of eastern Africa: a call to action.
2. Biodiversity conservation through agroforestry: managing tree species diversity within a network of community-based, nongovernmental, governmental and research organizations in western Kenya.
3. Invasion of *prosopis juliflora* and local livelihoods: Case study from the Lake Baringo area of Kenya.
4. Leadership for change in farmers organizations: Training report: Ridar Hotel, Kampala, 29th March to 2nd April 2005.
5. Domestication des espèces agroforestières au Sahel : situation actuelle et perspectives.
6. Relevé des données de biodiversité ligneuse: Manuel du projet biodiversité des parcs agroforestiers au Sahel.
7. Improved land management in the Lake Victoria Basin: TransVic Project's draft report.
8. Livelihood capital, strategies and outcomes in the Taita hills of Kenya.
9. Les espèces ligneuses et leurs usages: Les préférences des paysans dans le Cercle de Ségou, au Mali.
10. La biodiversité des espèces ligneuses: Diversité arborée et unités de gestion du terroir dans le Cercle de Ségou, au Mali.
11. Bird diversity and land use on the slopes of Mt. Kilimanjaro and the adjacent plains, Tanzania.
12. Water, women and local social organization in the Western Kenya Highlands.
13. Highlights of ongoing research of the World Agroforestry Centre in Indonesia.
14. Prospects of adoption of tree-based systems in a rural landscape and its likely impacts on carbon stocks and farmers' welfare: The FALLOW Model Application in Muara Sungkai, Lampung, Sumatra, in a 'Clean Development Mechanism' context.
15. Equipping integrated natural resource managers for healthy Agroforestry landscapes.
17. Agro-biodiversity and CGIAR tree and forest science: approaches and examples from Sumatra.
18. Improving land management in eastern and southern Africa: A review of policies.
19. Farm and household economic study of Kecamatan Nanggung, Kabupaten Bogor, Indonesia: A socio-economic base line study of Agroforestry innovations and livelihood enhancement.
20. Lessons from eastern Africa's unsustainable charcoal business.
21. Evolution of RELMA's approaches to land management: Lessons from two decades of research and development in eastern and southern Africa.
22. Participatory watershed management: Lessons from RELMA's work with farmers in eastern Africa.
23. Strengthening farmers' organizations: The experience of RELMA and ULAMP.
24. Promoting rainwater harvesting in eastern and southern Africa.
25. The role of livestock in integrated land management.
26. Status of carbon sequestration projects in Africa: Potential benefits and challenges to scaling up.
27. Social and Environmental Trade-Offs in Tree Species Selection: A Methodology for Identifying Nich Incompatibilities in Agroforestry [Appears as AHI Working Paper no. 9].
28. Managing tradeoffs in agroforestry: From conflict to collaboration in natural resource management. [Appears as AHI Working Paper no. 10].
29. Essai d'analyse de la prise en compte des systemes agroforestiers pa les legislations forestieres au Sahel: Cas du Burkina Faso, du Mali, du Niger et du Senegal.

30. Etat de la recherche agroforestière au Rwanda etude bibliographique, période 1987-2003.
31. Science and technological innovations for improving soil fertility and management in Africa: A report for NEPAD's Science and Technology Forum.
32. Compensation and rewards for environmental services.
33. Latin American regional workshop report compensation.
34. Asia regional workshop on compensation ecosystem services.
35. Report of African regional workshop on compensation ecosystem services.
36. Exploring the inter-linkages among and between compensation and rewards for ecosystem services CRES and human well-being.
37. Criteria and indicators for environmental service compensation and reward mechanisms: realistic, voluntary, conditional and pro-poor.
38. The conditions for effective mechanisms of compensation and rewards for environmental services.
39. Organization and governance for fostering Pro-Poor Compensation for Environmental Services.
40. How important are different types of compensation and reward mechanisms shaping poverty and ecosystem services across Africa, Asia & Latin America over the Next two decades?
41. Risk mitigation in contract farming: The case of poultry, cotton, woodfuel and cereals in East Africa.
42. The RELMA savings and credit experiences: Sowing the seed of sustainability.
43. Policy and institutional context for NRM in Kenya: Challenges and opportunities for Landcare.
44. Nina-Nina Adoung Nasional di So! Field test of rapid land tenure assessment (RATA) in the Batang Toru Watershed, North Sumatera.
45. Is Hutan Tanaman Rakyat a new paradigm in community based tree planting in Indonesia?
46. Socio-Economic aspects of brackish water aquaculture (Tambak) production in Nanggroe Aceh Darussalam.
47. Farmer livelihoods in the humid forest and moist savannah zones of Cameroon.
48. Domestication, genre et vulnérabilité : Participation des femmes, des Jeunes et des catégories les plus pauvres à la domestication des arbres agroforestiers au Cameroun.
49. Land tenure and management in the districts around Mt Elgon: An assessment presented to the Mt Elgon ecosystem conservation programme.
50. The production and marketing of leaf meal from fodder shrubs in Tanga, Tanzania: A pro-poor enterprise for improving livestock productivity.
51. Buyers Perspective on Environmental Services (ES) and Commoditization as an approach to liberate ES markets in the Philippines.
52. Towards community-driven conservation in southwest China: Reconciling state and local perceptions.
53. Biofuels in China: An Analysis of the Opportunities and Challenges of *Jatropha curcas* in Southwest China.
54. *Jatropha curcas* biodiesel production in Kenya: Economics and potential value chain development for smallholder farmers.
55. Livelihoods and Forest Resources in Aceh and Nias for a Sustainable Forest Resource Management and Economic Progress.
56. Agroforestry on the interface of Orangutan Conservation and Sustainable Livelihoods in Batang Toru, North Sumatra.
57. Assessing Hydrological Situation of Kapuas Hulu Basin, Kapuas Hulu Regency, West Kalimantan.
58. Assessing the Hydrological Situation of Talau Watershed, Belu Regency, East Nusa Tenggara.

59. Kajian Kondisi Hidrologis DAS Talau, Kabupaten Belu, Nusa Tenggara Timur.
60. Kajian Kondisi Hidrologis DAS Kapuas Hulu, Kabupaten Kapuas Hulu, Kalimantan Barat.
61. Lessons learned from community capacity building activities to support agroforest as sustainable economic alternatives in Batang Toru orang utan habitat conservation program (Martini, Endri et al.)
62. Mainstreaming Climate Change in the Philippines.
63. A Conjoint Analysis of Farmer Preferences for Community Forestry Contracts in the Sumber Jaya Watershed, Indonesia.
64. The highlands: a shared water tower in a changing climate and changing Asia.
65. Eco-Certification: Can It Deliver Conservation and Development in the Tropics.
66. Designing ecological and biodiversity sampling strategies. Towards mainstreaming climate change in grassland management.
67. Towards mainstreaming climate change in grassland management policies and practices on the Tibetan Plateau.
68. An Assessment of the Potential for Carbon Finance in Rangelands.
69. ECA Trade-offs Among Ecosystem Services in the Lake Victoria Basin.
69. The last remnants of mega biodiversity in West Java and Banten: an in-depth exploration of RaTA (Rapid Land Tenure Assessment) in Mount Halimun-Salak National Park Indonesia.
70. Le business plan d'une petite entreprise rurale de production et de commercialisation des plants des arbres locaux. Cas de quatre pépinières rurales au Cameroun.
71. Les unités de transformation des produits forestiers non ligneux alimentaires au Cameroun. Diagnostic technique et stratégie de développement Honoré Tabuna et Ingratia Kayitavu.
72. Les exportateurs camerounais de safou (*Dacryodes edulis*) sur le marché sous régional et international. Profil, fonctionnement et stratégies de développement.
73. Impact of the Southeast Asian Network for Agroforestry Education (SEANAFE) on agroforestry education capacity.
74. Setting landscape conservation targets and promoting them through compatible land use in the Philippines.
75. Review of methods for researching multistrata systems.
76. Study on economical viability of *Jatropha curcas* L. plantations in Northern Tanzania Assessing farmers' prospects via cost-benefit analysis.
77. Cooperation in Agroforestry between Ministry of Forestry of Indonesia and International Center for Research in Agroforestry.
78. "China's bioenergy future. an analysis through the Lens if Yunnan Province.
79. Land tenure and agricultural productivity in Africa: A comparative analysis of the economics literature and recent policy strategies and reforms.
80. Boundary organizations, objects and agents: linking knowledge with action in agroforestry watersheds.
81. Reducing emissions from deforestation and forest degradation (REDD) in Indonesia: options and challenges for fair and efficient payment distribution mechanisms.
82. Mainstreaming Climate Change into Agricultural Education: Challenges and Perspectives.
83. Challenging Conventional mindsets and disconnects in Conservation: the emerging role of eco-agriculture in Kenya's Landscape Mosaics.
84. Lesson learned RATA garut dan bengkuntat: suatu upaya membedah kebijakan pelepasan kawasan hutan dan redistribusi tanah bekas kawasan hutan.
85. The emergence of forest land redistribution in Indonesia.

86. Commercial Opportunities for Fruit in Malawi.
87. Status of fruit production processing and marketing in Malawi.
88. Fraud in tree science.
89. Trees on Farm: Analysis of Global Extent and Geographical Patterns of Agroforestry.
90. The Springs of Nyando: Water, Social organization and livelihoods in Western Kenya.

The World Agroforestry Centre is an autonomous, non-profit research organization whose vision is a rural transformation in the developing world where smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability. The Centre generates science-base knowledge about the diverse role that trees play in agricultural landscapes, and uses its research to advance policies and practices that benefit the poor and the environment.

United Nations Avenue, Gigiri - PO Box 30677 - 00100 Nairobi, Kenya
Tel: +254 20 7224000 or via USA +1 650 833 6645
Fax: +254 20 7224001 or via USA +1 650 833 6646
www.worldagroforestry.org