

Dynamics of poverty, livelihoods and property rights in the Lower Nyando basin of Kenya

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Data from 14 villages representing contrasting circumstances around the Lower Nyando basin in Kenya indicate that the incidence of poverty is higher in the flood plain than in the other parts of the basin. Over the last ten years, poverty has risen significantly in an area controlled by the National Irrigation Board (NIB), increased slowly in smallholder mixed farming areas, and remained relatively stable in areas supported by the Provincial Irrigation Unit (PIU). Reasons for these trends are discussed, and are linked to factors including land tenure and forms of external support. Customary gender biases against women are also exacerbated in the irrigation schemes. As it plans a revitalization of the irrigation sector under the new Water Act of 2002, the government should consider organizational arrangements that will provide women and men farmers with suitable services without compromising their discretion over land and water use.

Key words: poverty, livelihood strategies, irrigation, Kenya, property rights, land tenure

Introduction

Rural Africa is an area of ingrained poverty, stagnant economic growth, and enduring customs. Yet over the last 10-20 years, Africa’s rural populace has been buffeted by a number of strong dynamic processes: population growth means greater pressure on limited land and water resources; changing world and domestic markets have translated into lower prices for traditional commodity exports and higher prices for purchased inputs such as fertilizer; structural adjustment means less involvement of central government agencies in provision of infrastructure and public services, and greater involvement by a plethora of non-governmental organizations and private firms. While some of these trends may lead to improved economic performance and more equitable access to resources, there is great cause for concern. Over the last 10-20 years, much of sub-Saharan Africa has experienced stagnant growth, increased concentration of land ownership (Jayne et al., 2001), more scarce and polluted water resources, greater numbers of people suffering poverty and malnutrition, and increased incidence of human diseases, especially HIV / AIDS, malaria and water-borne diseases (Benson, 2004). Distinct declines in human security and economic growth have been reported in Central Africa and several countries of East and Southern Africa (Benson, 2004). Between 1970 and 2002, life expectancy at birth declined across most of southern and eastern Africa (Benson, 2004, p.38).

The Nyando basin in western Kenya is an interesting case in point. Previous research has shown the 3500 km² Nyando basin to be an area of high and increasing poverty, recurrent flooding, stagnant agricultural production, increasing prevalence of HIV / AIDS, malaria and diarrhea, and a major contributor of sediment and nutrients into the eutrophying Lake Victoria (Swallow et al., 2002). It is also an area given particular attention by the Kenya government in ongoing reforms of the environment, land, domestic water and irrigation sectors. There were a number of important gaps in knowledge: what are the characteristics of poor and vulnerable people? Is lack of access to land, water and tree resources a defining or incidental characteristic of the poor? Are there groups of poor and vulnerable people who are particularly susceptible to losing rights with planned changes in resource management institutions?

The Safeguard project was initiated by the World Agroforestry Centre (ICRAF), Maseno University and the International Food Policy Research Institute (IFPRI) to address these questions in the context of the Nyando basin. Safeguard is short for *Safeguarding the rights of poor and vulnerable people to critical land, water and tree resources in the Nyando basin of Western Kenya*. Safeguard is part of the The Safeguard project has illuminated the remarkable diversity of conditions that prevail across this basin of 3500km², which is home to about 750,000 people. This paper reports results from Safeguard pertaining to poverty and property rights

dynamics in the lower floodplain area of the Nyando river adjacent to Lake Victoria. The results demonstrate how three different types of irrigation development have shaped poverty and livelihood dynamics in the area.

Methods

The Safeguard project employs a package of research methods grounded on the following principles:

- nested scales – collection of data at multiple, nested scales in recognition of the “fractal” nature of poverty processes
- representing the range of circumstances – use the multi-scale approach to identify the range of circumstances in the basin, then sample villages to represent that range
- dynamic – focus on processes that have effect over the last 10-25 years
- diverse livelihood strategies – it is important to recognize and explicitly collect data on the full range of options that people employ to earn a livelihood (e.g. Ellis 2000)
- multiple facets of poverty – explicitly considering the consumption, vulnerability, and agency aspects of poverty (Narayan et al., 2000)
- inclusive and participatory – the population under consideration should provide their own definitions of poverty, livelihood strategies and their own assessment of poverty and livelihood trends (Krishna, 2004; Kristjanson et al., 2004)
- legal pluralism approach to property rights – recognizing that there often are multiple and overlapping sources of sanction for property rights (Meinzen-Dick and Pradhan, 2002).

The following methods satisfy these principles:

Characterization of hydronomic and terranomic zones – The accompanying paper by Onyango et al. (2005) presents the approach used and results of this analysis.

Selection of villages to represent the range of circumstances in the basin – Villages were chosen to represent 12 distinct zones in the basin. A total of 14 villages were selected, one village for each of ten zones and two villages for each of two zones. These results therefore represent the variation found across the basin, but cannot be simply aggregated to represent the whole basin. Table 1 shows comparative data for the 14 villages.

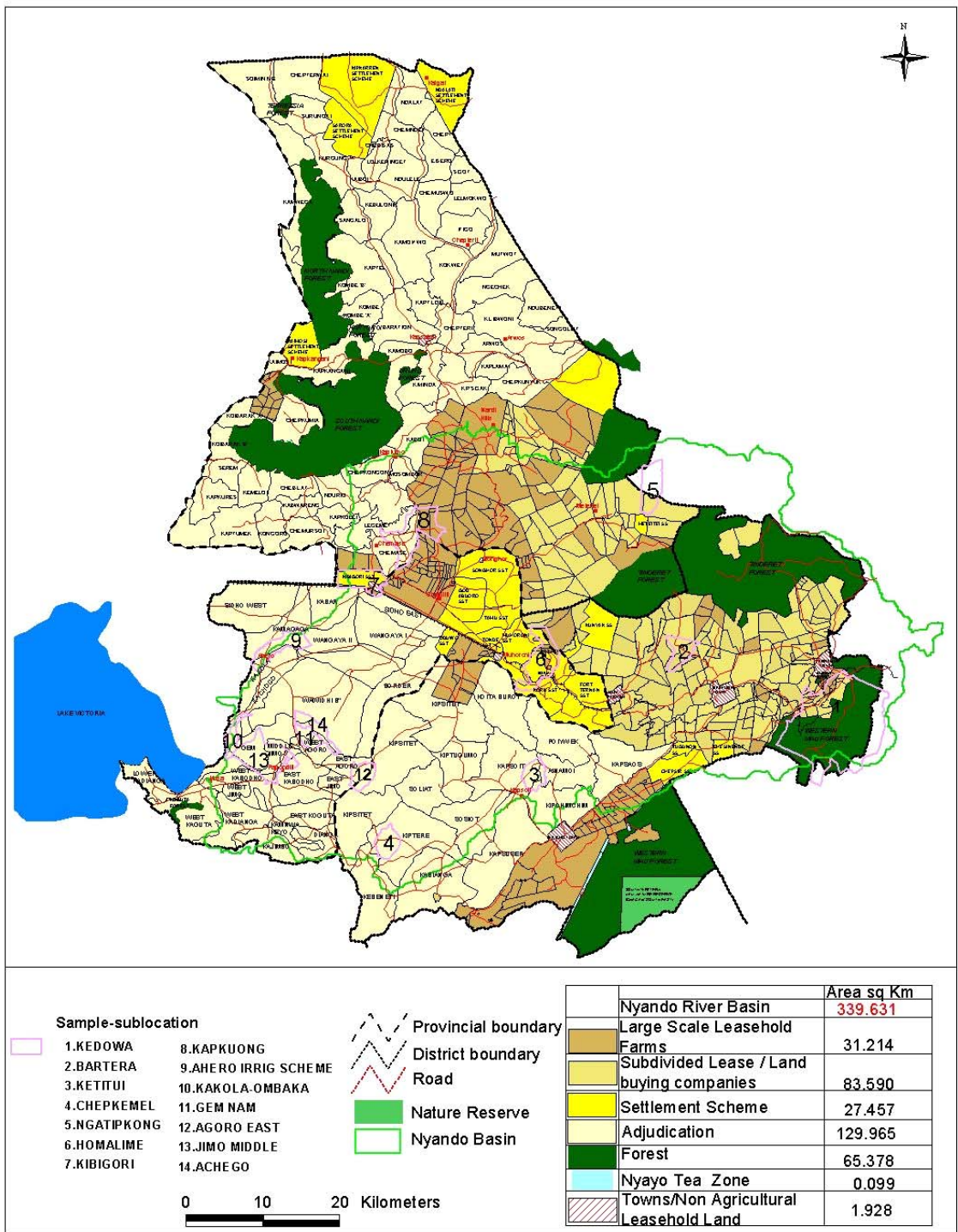
Stages of progress method as the basic data collection approach in each village – The Stages of Progress method has been developed by Anirudh Krishna of Duke University to study factors affecting inter-generational poverty dynamics. To date it has been applied in 3 states in India, Western Kenya, Uganda and Peru (Krishna, 2004; Krishna et al., 2004).

Strengthening the focus on livelihoods and property rights in the stages of progress method – The livelihood focus was closely integrated into the base method and the property rights methods stressed the legal pluralism approach.

Household survey – A stratified random total of 30 households was selected and interviewed in each of the 14 villages. The household survey focused on rights and access to land, water and trees, and livelihood strategies.

Key informant and group interviews – One of the co-authors of this paper undertook a more detailed study of gender and water management in the irrigation area in the lower Nyando basin. This study then provided the basis for the sampling of different irrigation systems as well as information used in this paper.

Table 1 presents descriptive information for the 12 zones and 14 villages included in the study. Note that the area represents a wide range of conditions. Land tenure varies from adjudicated areas, largescale leasehold, subdivided leasehold, settlement schemes, illegal “squatting” in a forest reserve, and contested property rights in an irrigation area. Average income poverty rates vary from 40% to 70%. Population density varies from less than 100 to more than 1000 people per square kilometer. Elevation varies from 1100 masl near Lake Victoria to over 2500 masl in the headwaters. The majority ethnic group in the lower part of the basin is Luo; the Kipsigis and Nandi Kalenjin are the majority in the upper part of the basin. The study also covered minority populations of Ogiek and Kisii in the upper part of the basin.



Map 1. Nyandi, Kericho and Nyando District: Land tenure

Source: Safeguard project

Results

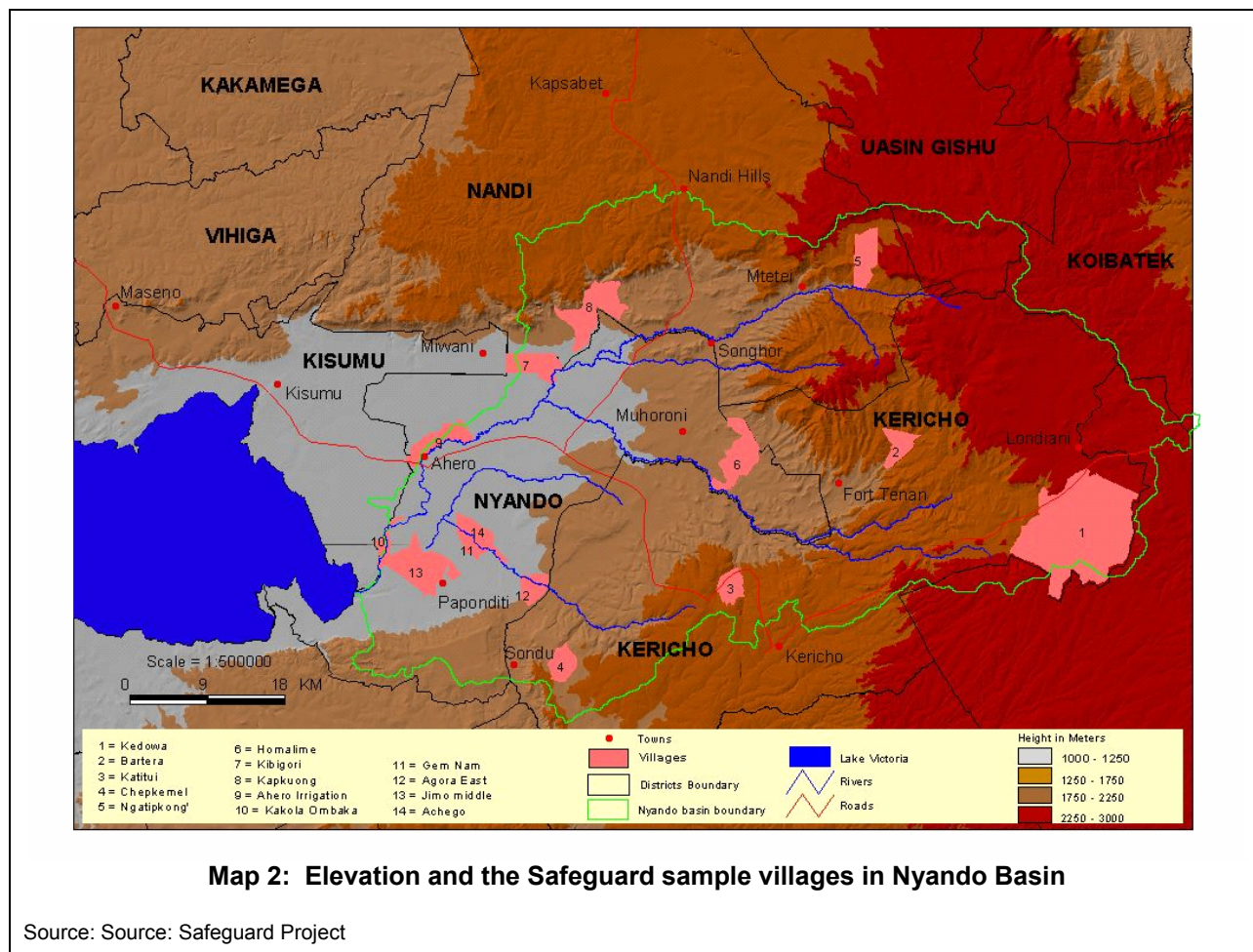
Access to water

The household survey that was conducted with a sample of about 30 households per village posed several questions about access to water. For the five villages in the Nyando floodplain, Table 1 summarizes data on the number of households who indicated that access to water was more difficult, easier or about the same as ten

Table 1. Characterization of the Safeguard study villages

Zone; elevation	Land tenure Status	Irrigation development	Safeguard village number & village name	District(s)	Population density (persons / km)	Main ethnic group	Production system	% below poverty line in location
Floodplain; 1100 masl	Adjudicated	Mixed smallholder, some ad hoc irrigation	10 = Kasirindwa; 11 = Karabok	Nyando, Kisumu	224-1000	Luo	Smallholder mixed farming, some private irrigation	37% for village 10, 55% for village 11
Floodplain; 1100 masl	Adjudicated	Irrigation development supported by PIU, operational in 14, not operational in 13	13 = Kasiwindhi; 14 = Awach scheme	Nyando, Kisumu	224-1000	Luo	Smallholder commercial irrigation and dryland agriculture	68% for village 13; 72% for village 14
Floodplain; 1100 masl	Contested; formally owned by NIB but promised to local residents	NIB irrigation	9 = Nakuru	Nyando, Kisumu	224-1000	Luo	Designed for irrigated rice; more diversification since NIB collapse in 1998	63%
Lower Awach catchment; 1250 masl	Adjudicated	None	12 = Miolo	Nyando	224-527	Luo	Mixed subsistence, NR extraction	65%
Upper Awach catchment; 1700 masl	Adjudicated	None	4 = Chepkemel	Kericho	88-149	Kipsigi/ Kalenjin	Mixed cash/ subsistence, coffee, dairy, maize, banana, s/holder tea	49%
Mid-altitude part of Kapchorean basin	Undivided leasehold	None	6 = Ongalo	Nyando	<88	Luo	Commercial Sugarcane	47%
Lower Nyando basin	Re-settlement scheme	None	7 = Kimiria Aora	Nyando	150-303	Luo	Commercial sugar	48%
Mid altitude; 1500 masl	Large-scale leasehold	None	8 = Poto poto	Nyando	88-149	Nandi Kalenjin	Commercial sugar mixed farming	48%
High altitude; 2000 masl	Adjudicated	Some home garden irrigation from springs	3 = Kiptagen	Kericho	224-500	Kalenjin	Small-scale tea, some coffee, sugarcane, maize	49%
High altitude; 2100 masl	Sub-divided leasehold	None	1 = Kaminjeiwa; 2 = Nyaribari A	Kericho	224-400	Mixture of Kalenjin, Kisii and others	mixed farming,	41%
High altitude; 2200 masl	Indigenou s forest dwellers on forest land	None	5 = Ngendui	Nandi	87-400 mixed	Ogiek / Nandi Kalenjin	Small scale mixed	60%

Source: Unpublished data compiled by the Safeguard Project; poverty and population data from CBS (200x).



years ago, while Table 2 summarizes data on the number of households who indicated that the quality of water available was better, worse, or about the same as ten years ago. The overall indication is that both water access and water quality have improved over the last ten years. Regarding water access, 49 respondents indicated improvements over the last ten years, compared to 19 indicating deterioration. Regarding water quality, 55 respondents indicated that water quality had improved over the last 10 years, compared to 17 indicating that water quality had worsened. These results were generally consistent across the five villages considered in this paper. Additional analysis (not shown) shows that there are no differences between villages in the amount of time spent collecting water in the dry season and wet season.

Table 1. Current level of access to water compared to ten years ago

Village number & irrigation system type	Missing	Easier	More difficult	About the same	Total
9 – National Irrigation Board	0	10	3	17	30
10 – Smallholder ad hoc	0	12	0	18	30
11 - Smallholder ad hoc	0	10	2	18	30
13 – Provincial Irrigation Unit support to farmers	0	13	9	7	29
14 – Provincial Irrigation Unit support to farmers	1	4	5	20	30
Total	1	49	19	80	149

Source: Unpublished data compiled by the Safeguard project.

Table 2. Current water quality compared to ten years ago

Village number & type of irrigation system	Better	Worse	About the same	Total
9 – National Irrigation Board	5	8	17	30
10 – Smallholder ad hoc	11	2	17	30
11- -- Smallholder ad hoc	12	1	17	30
13 – Provincial Irrigation Unit support to farmers	19	2	8	29
14 – Provincial Irrigation Unit support to farmers	8	4	18	30
Total	49	19	77	149

Source: unpublished data compiled by the Safeguard project.

Table 3 indicates that households in the five villages spent an average of 1.9 hours per day collecting water in the dry season and 44 minutes per day collecting water in the wet season. The average amount of water collected is 100 litres per household per day in the dry season and 25 litres per household per day in the wet season. Additional analysis (not shown) shows that households in village 10 collect significantly more water in both the wet and dry season than households in the other villages.

Table 3. Dry season and wet season water collection in Safeguard villages 9, 10, 11, 13 and 14

	N	Minimum	Maximum	Mean	Std. Deviation
Time spent (hours per day) collecting water during dry season	134	.02	8.00	1.89	1.49
Volume of water (litres) collected per day in the dry season	139	18.00	270.00	100.07	46.63
Time spent (hours per day) collecting water during wet season	93	.00	6.00	0.73	0.76
Volume of water (litres) collected per day in wet season	140	.00	160.00	24.96	32.42
Valid N (listwise)	90				

Land and water governance

The village representative groups and women-only focus groups were asked questions about access and control over water. Follow-up questions were also included in the household survey. The results are remarkably similar from village to village, except for the NIB village and village 14, which still has an operational irrigation system supported by the Provincial Irrigation Unit.

All villages are predominately Luo, and all except village 9 have been adjudicated, so that individuals hold secure title to their land.

Luo custom holds that water access should be freely available. In Village 10, for example, it was reported that: *“Everybody has access to all community water points. No one is allowed to block the recognized community water points.”* Luo custom also supports public access to private land resources for grazing, collecting firewood, and passing through. With few physical or social fences, access to water resources is relatively freely available. It appears that it is only in irrigation areas that have had strong involvement of external agencies that the Luo customs have not held sway. The community discussion in Village 9 suggests

the intriguing possibility of a spillover to local customs regarding water access: *“Water is meant for everyone’s use and there should be no restriction as to usage of water. When coming from the river, one is not allowed to pass through another person’s homestead for you are likely to fall.”*

One of the possible drawbacks of the Luo custom for land and water governance is that there is relatively little incentive for private individuals or small groups to invest in protecting existing water sources or creating new water sources. This has particular impacts on women, who are responsible for provisioning the household with water and for providing healthcare within the household.

Land tenure security is much more restricted for farmers in Village 9. When the National Irrigation Board built the irrigation system, they purchased all land in the area. Standardized plots (of 50x50 meters for homestead, and 4 acres of irrigated fields) were then allocated to farmers, who remain “tenants” of the system. The farmers are not allowed to plant any trees or have any livestock, or even to bury the dead on this land. To add to the insecurity of tenure, farmers can be evicted for “laziness” or failure to cultivate their land. The plots cannot be subdivided, which violates Luo customary norms that all sons are entitled to get land from their fathers. Because land rentals are also restricted on NIB land, landless sons have more difficulty obtaining any land to cultivate.

A detailed investigation of water governance in Village 9 indicates that not only does the National Irrigation Board influence irrigation water management, but this also had some spillovers (in terms of mediating institutions) onto other water resources in the village (Table 4). However, customary norms play more of a role in granting authority over water sources used primarily for domestic uses, whereas the Nyando River, which is used for irrigation, falls more under statutory law and government agency management.

Table 4. Water sources and their management in Village 9

Source of water	Use of water	Users of water	Where do the users draw authority to use the water	Who manages the water	Can users transfer their rights	Who owns the land on which the water is found	What forms of pollution affect the water source	Mediating Institutions
Marega river	Cooking Farming Drinking Washing	All the villagers	Customary	None	No	G.O.K/NIB	Chemicals from irrigation scheme plant and from chemical factory	The irrigation scheme and G.O.K
Nyando river			Statutory irrigation act and non statutory	Irrigation board for irrigation purposes	Yes			The irrigation scheme and G.O.K
Ombeyi river			Customary	No one	Yes			The irrigation scheme and G.O.K
Shallow well		All	Customary	Owner of land	No			

Results from the household survey indicate a fairly high level of social organization around water management in Village 14, the only village that had a functional collective irrigation system at the time of the survey. As indicated in Table 5, 29 of the 30 surveyed households in Village 14 pay their water fees, compared to only 3 of 10 households in Village 13 and 10 of 27 households in Village 9 who pay their water fees. However, the irrigation system in Village 14 is not without conflict. Table 6 indicates that this is the only village in which most households do not think that there is equality in access to water. In both Village 9 and 14, 24 respondents reported having experience with water conflicts in their village. Thus, both community-managed and NIB systems have higher degrees of conflict than those assisted by the Provincial Irrigation Unit.

Table 5. Payment of water fees in the 5 Safeguard villages in the Nyando floodplain

Village number and type of irrigation system	No	Yes	Total
9 – National Irrigation Board	10	17	27
10 – Smallholder ad hoc	1	13	14
11- -- Smallholder ad hoc	3	7	10
13 – Provincial Irrigation Unit support to farmers	18	3	21
14 – Provincial Irrigation Unit support to farmers	1	29	30
Total	33	69	102

Table 6. Payment of water fees in the 5 Safeguard villages in the Nyando floodplain

Village number and type of irrigation system	No equality of access	Equality of access	Total
9 – National Irrigation Board	7	23	30
10 – Smallholder ad hoc	10	20	30
11- -- Smallholder ad hoc	8	21	30
13 – Provincial Irrigation Unit support to farmers	5	25	29
14 – Provincial Irrigation Unit support to farmers	17	12	30
Total	47	101	148

Table 7. Experience with irrigation management conflicts in 5 Safeguard Villages in the Nyando floodplain

Village number and type of irrigation system	No experience with irrigation management conflicts	Experience with irrigation management conflicts	Missing	Total
9 – National Irrigation Board	2	24	4	30
10 – Smallholder ad hoc	1	3	26	30
11- -- Smallholder ad hoc	3	1	26	30
13 – Provincial Irrigation Unit support to farmers	6	10	13	29
14 – Provincial Irrigation Unit support to farmers	6	24	0	30
Total	18	62	71	148

Water, land and gender in the Nyando floodplain

In the Nyando floodplain, women have primary responsibility for providing water for domestic needs. Table 8 lists the first, second and third most important collectors of domestic water: clearly wives and children are the main collectors of water for the 150 households involved in the Safeguard household survey. Less than 10% of respondents indicated that husbands ever collected water. The average length of time spent collecting water in the wet season is 0.73 hours per day in the wet season (standard deviation of 0.76) and in the dry season is 1.89 hours per day (standard deviation of 1.5) (see Table 3).

Table 8. Most important household water collectors

		Most important hh water collectors		Second most important hh water collectors		Third most important hh water collectors	
		Freq.	%	Freq.	%	Freq.	%
Valid	Wife	107	71.3	14	9.3	3	2.0
	Husband	4	2.7	6	4.0	4	2.7
	All children	20	13.3	53	35.3	7	4.7
	Male children	7	4.7	23	15.3	20	13.3
	Female children	7	4.7	12	8.0	8	5.3
	Relatives	4	2.7	8	5.3	1	.7
	Total	149	99.3	116	77.3	43	28.7
Missing	System	1	.7	34	22.7	107	71.3
Total		150	100.0	150	100	150	100

Although women are not likely to own land in any of the study villages, their land rights are more restricted in Village 9 than in the other areas. Whereas in other villages wives are allocated their own plots of land to grow household food, in Village 9 all irrigated production was marketed through the husband, who collected the money and distributed it to his wives as he saw fit. This gives women less control over resources than under customary systems.

Poverty and livelihood trends in the Nyando basin

One of the outputs of the Stages of Progress village survey is a list of all households in the village, with the “stage of progress” currently attained by each household the stage attained 10 years ago by that household (or its predecessor), and the stage attained 25 years ago by that household (or its predecessor). The stages are then mapped into categories of poor, not poor, and relatively prosperous, using definitions provided by each community. Fortunately, the conceptions of poverty and the stages end up being relatively similar from village to village and thus can be compiled and compared across villages.

Figure 1 presents a compilation of the poverty to prosperity data for all households in the 14 study villages, aggregated into three elevation zones – upper, medium and lower. The results show that poverty is generally highest in the lower altitude zone, now about 40% of the sample households, and over the last 10 years has been increasingly most rapidly in this region, an increase of over 15%. These data are consistent with the national sample and census data for Kenya which show Nyanza province (which includes the lower Nyando basin) having the highest rate of poverty in Kenya, and the highest rate of increase over the 1994 to 1997 period. HIV / AIDS is one of the reasons for this overall trend in poverty: the Luo population has the highest rate of HIV / AIDS infection among both men and women in all of Kenya.

Figure 2 presents a breakdown of the poverty – prosperity data for the villages in the floodplains. The results indicate very different patterns across the three types of land tenure and water management. Twenty-five years ago, poverty rates were lowest in villages 10 and 11, smallholder agriculture areas where the residents have long held secure land tenure. Small amounts of land in those villages are irrigated using flood, bucket and pump irrigation. Poverty has increased in those villages, slowly until 10 years ago, more rapidly since. The area covered by the National Irrigation Board had a poverty rate of over 30% in the early years of the NIB irrigation scheme, a rate which fell to the high 20% 10 years ago, then exploded to over 60% at present. This corresponds to a collapse in the NIB services to the irrigation system, due to lack of financial resources for the agency to maintain the irrigation system. As a result, rice cultivation declined after 1994, and ceased in 1998. In contrast, the two villages that were supported by the provincial irrigation until from the 1980s until the present time experienced a modest decline in the rate of poverty from 25 years ago until the present time, with a current poverty rate of about 38%.

Welfare trends in the Nyando basin by altitude zone

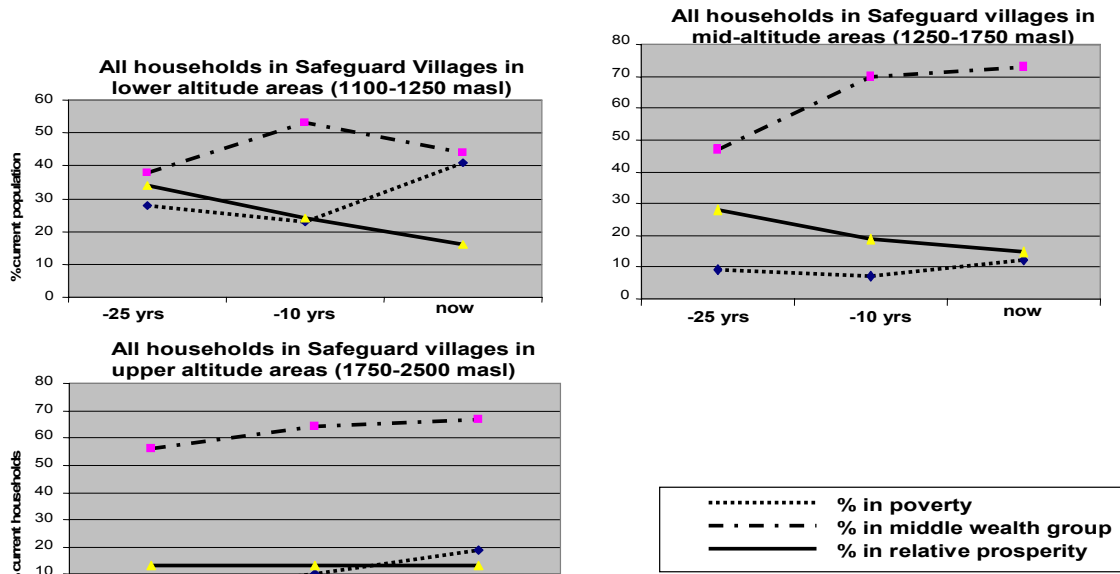


Figure 1. Welfare trends in the Nyando basin by altitude zone

Welfare trends in the Nyando floodplains

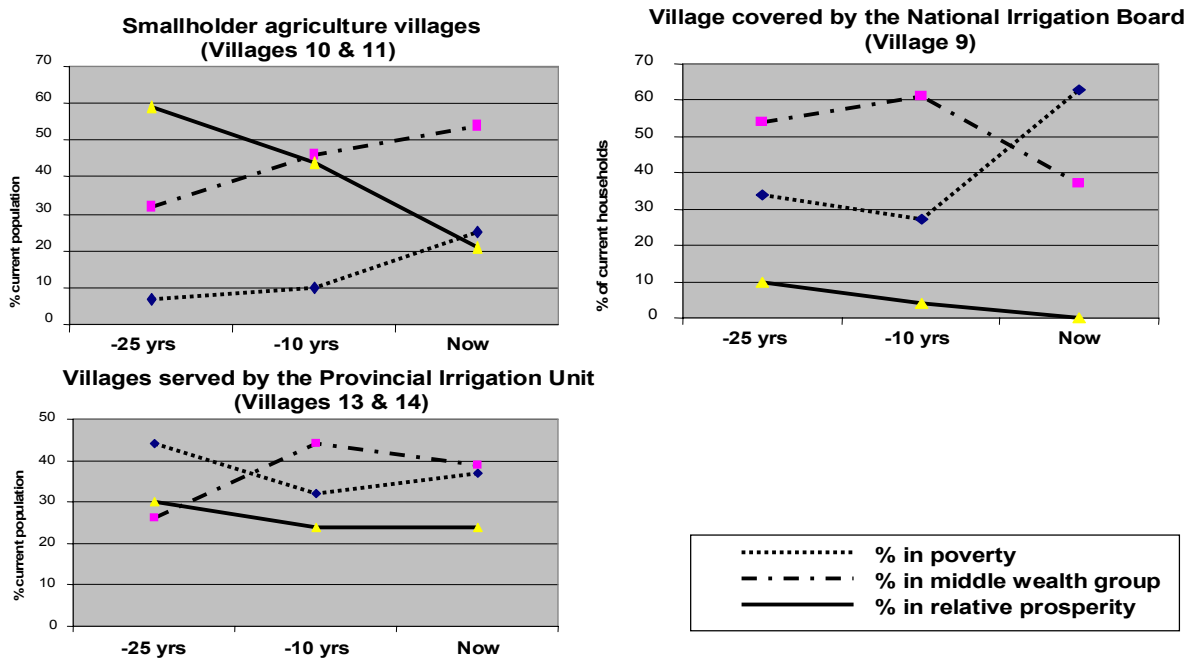


Figure 2. Welfare trends in the Nyando floodplains

Table 9 lists the number of households practicing different livelihood strategies at the present time in each of the 5 Safeguard study villages in the Nyando floodplain. It also lists the total number of strategies listed for all households in each village, the average number of strategies reported for each household, and the current rate of poverty as reported by the village representative groups. It is noteworthy that the village with the highest current rate of poverty (Village 9, 44%) has the lowest number of strategies employed per household. The village with the lowest current rate of poverty (Village 10, 18%) has the highest number of strategies employed per household. Households in the smallholder agriculture area appear to be more diversified than in the irrigation area. Village 14, which has the most functional remaining irrigation system in the area, has the highest number of households still growing rice.

Table 9. Number of households practicing alternative livelihood strategies in the 5 villages of the Nyando floodplain

	Village 9 -- National Irrigation Board	Village 10 – Smallholder mixed farming	Village 11 – Smallholder mixed farming	Village 13 – Supported by Provincial Irrigation Unit	Village 14 – Supported by Provincial Irrigation Unit
Rice	2	1	0	15	66
Maize	13	48	56	33	64
Sugarcane	0	39	1	0	0
Tomatoes	2	41	10	2	4
Kale / onion	1	50	17	1	7
Cattle	16	30	26	18	34
Sheep and goats	2	27	31	3	33
Trade	23	20	41	11	2
Casual labour	31	6	17	8	25
Boda Boda (bicycle taxi)	4	8	4	1	0
Other skilled employment	2	5	14	8	3
Formal employment	2	4	13	11	11
Total strategies in village	98	279	230	111	249
Number of households in village	70	63	103	52	90
Average strategy / household	1.4	4.43	2.23	2.13	2.77
Current poverty %	44	18	23	19	33

We conducted a further analysis in order to explore the hypothesis that the number of strategies – a measure of income and livelihood diversification – affects the extent of poverty and welfare. We compiled data for all 377 households in the 5 Safeguard sample villages in the Nyando plain, including the current stage of growth, the stage of growth 25 years ago, the stage of growth 10 years ago, the current number of livelihood strategies, whether the household had formal employment as a livelihood strategy, and whether the

household produced vegetables for sale (one of the strategies enabled by irrigation). A simple linear regression was conducted of the following model:

$$\text{Stage0}_i = f(\text{Stage-25}_i, \text{Stage-10}_i, \text{NumLS}_i, \text{FormSec}_i, \text{Vegi}, \text{Village})$$

where Stage0_i is stage of progress now for household i, Stage-25_i is stage of progress 25 years ago for household i, Stage-10_i is stage of progress 10 years ago for household i, NumLS_i is current number of livestock strategies for household i, FormSec_i is 1 if household i currently has formal sector employment and 0 otherwise, Veg_i is 1 if household i currently grows vegetables for sale, and Village is a set of binary variables representing village fixed effects (with Village 9 as the base village).

The results presented in Table 10 show that the model has quite high explanatory power, explaining 53% of the total variation and the overall equation is highly statistically significant. The number of livelihood strategies does indeed affect the stage of progress, with an estimated marginal effect of about 0.6 stages for each additional livelihood strategy. As expected, formal sector employment also has high statistical significance, with a marginal effect of almost 3 stages of progress. Vegetable production surprisingly has a negative and significant relationship with stage of progress, indicating perhaps that labour intensive vegetable production tends to be undertaken by poorer households within the community. Stages of progress 10 years ago and 25 years ago are both positively related to current stage of progress, although the stage attained 25 years ago is not statistically significant. Results that are particularly important for this study are the coefficients on the village fixed effects. Accounting for the number of livelihood strategies, formal sector employment, vegetable production, and past stages of progress, the average stage of progress achieved by households in Village 10 is significantly less than Village 9, and the average stage of progress achieved by households in Villages 13 and 14 are higher than Villages 9, 10 and 11. This suggests that the villages supported by the Provincial Irrigation Unit experienced improvements in their welfare that are not accounted for by the diversification of livelihood strategies or improved access to formal sector employment. An additional analysis of the stages of progress in the five villages shows that the inter-village differences in stages achieved may be partly accounted for by the number of stages elicited by the village representative groups. While villages 9, 10, 11 and 13 listed 11 or 12 stages of progress, village 14 listed 14 stages. Further analysis will need to adopt an analytical method that accounts for these differences.

Table 10. Regression model to examine correlates of current stage of progress in 5 Safeguard sample villages in the Nyando floodplain

Variable	Estimated coefficient	Standard error of estimate
Constant	0.984*	0.496
Stage-25	0.070	0.052
Stage-10	0.347**	0.055
NumLS	0.592**	0.058
Village10	-0.921*	0.466
Village11	0.374	0.393
Village13	2.563**	0.869
Village14	1.384**	0.406
FormSec	2.972**	0.406
Veg	-0.216*	0.088

n = 372, R² = 0.53, F = 44.67

* indicates significance at the 5% level of confidence, ** indicates significance at the 1% level of confidence.

Table 11. Stages of growth , poverty and prosperity lines in the Nyando floodplain villages

	Village 9 -- National Irrigation Board	Village 10 – Smallholder mixed farming	Village 11 – Smallholder mixed farming	Village 13 – Supported by Provincial Irrigation Unit	Village 14 – Supported by Provincial Irrigation Unit
Number of stages	11	11	12	12	14
Stage above which poverty line is drawn	6	6	5	6	6
Stage above which prosperity line is drawn	10	9	9	11	11
% households currently in poverty	44	18	23	19	33

Conclusions

One of the most important conclusions from this analysis is that there is no clear evidence of causal links between resource degradation, domestic water quality, domestic water quantity, and poverty. While other research has shown in the Nyando basin has shown large degradation of land and water resources over the last 25 years. Sediment loads in the rivers are high, much of the land area is severely degraded, floods are frequent, and sedimentation of the canal systems has contributed to the collapse of several irrigation systems (Mungai et al., 2004; Ong and Orego, 2002). Nonetheless, households in the 5 floodplain villages reported overall improvements in the quantity and quality of water available to them. Only in the National Irrigation Board village did more households indicate a reduction in water quality from 10 years ago to the present. Further analysis will need to be conducted to better understand the reasons for this apparent contradiction. The likely possibility is that villages in the Nyando floodplain have benefited from domestic water supply projects conducted outside of the main irrigation projects.

Another clear conclusion from the study is that poverty in the Nyando basin is generally concentrated in the lower parts of the basin that have greatest potential for irrigation. This geographic clustering of poverty in the lower parts of the basin contrasts with the standard situation in southeast and south Asia, but may be closely to the norm in East Africa. Failed irrigation development, particularly with large government involvement in agricultural production and local organizational arrangements (the NIB village), has been a source of impoverishment in the Nyando floodplain. Yet, the overall slight improvement in the poverty profile in the villages supported by the Provincial Irrigation Unit provide some evidence that irrigation development can contribute to welfare improvements. One of the key lessons from this study appears to be the importance of diversity. Diversification of livelihood strategies, at the household and community levels is a major source of welfare enhancement.

Results on water governance and gender equity in water access and management indicate that there has been some spillover of influence from irrigation management to management of domestic water sources. The village involved in the NIB irrigation scheme in particular noted the importance of the irrigation scheme and the government in mediating access to virtually all water sources in the village. The big difference between the NIB area and the other areas included in this study is land ownership. In the NIB area the government and the scheme are understood to be the owners of land on which water points are located; in the other villages the water points are located on individual land, but with relatively open access to other people living in the village. Results from elsewhere in the Nyando basin show that there is indeed a strong link between land ownership and water access.

Under the Water Act of 2002, water and irrigation management will for the first time be centralized in one government ministry, the Ministry of Water Resources Development and Management. This Ministry is re-assessing how best to re-vitalize the irrigation sector and improve access to domestic water sources. This research shows that land ownership is key. Farmers will be more apt to adapt to invest in land improvements and diversity their income sources if they have secure land rights. The women who collect water will have more secure access to water points that are located on land with clear private or collective ownership.

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