
Chapter 11

Irrigation Management and Poverty Dynamics: Case Study of the Nyando Basin in Western Kenya

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Abstract

Three distinct pathways of irrigation development have been pursued in Kenya over the last 20 years: a top-down planning approach, a centralized service approach and an unregulated smallholder approach. All three pathways have simultaneously unfolded in the Nyando basin flood plain in Western Kenya. Data from a particular analysis of poverty and livelihood dynamics from villages around the Nyando basin indicate that the incidence of poverty is higher in the flood plain than in the other parts of the basin. Within the flood plain, there are distinct patterns of poverty and livelihood dynamics in areas associated with different approaches to landownership and irrigation management. Over the last 10 years, poverty has jumped to over 40% in the area following the top-down planning approach, increased slowly in smallholder mixed farming areas and remained relatively stable in areas supported by the centralized service agency. Recent changes in Kenya's Water Policy offer new opportunities for reforming and reviving the irrigation sector.

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

1. Introduction

The history of irrigation development in Africa parallels that of agriculture on the continent. Between the mid-1960s and the mid-1980s, parastatal irrigation agencies were established and irrigation infrastructure was installed in significant tracts of land. Besides installing infrastructure and providing support services, many agencies took on responsibility for purchasing inputs, selling outputs and organizing production processes, in fact taking on the character of 'command-and-control' operations, with smallholder farmers largely treated as labourers. Over time, it has become clear that this approach has not been financially sustainable, that the high level of government involvement served to 'crowd out' private investment and initiative by individual farmers, and that farmers had become highly dependent upon state subsidies and direction. Efforts to reform these systems have generally proven to be problematic and, in many cases, government and project support has ended abruptly, leaving farmers with insufficient capacity to self-manage their systems. The downsizing and withdrawal of government support have led to the contraction or collapse of smallholder irrigation systems across Africa, from Sudan to South Africa, to Senegal, to Kenya. In contrast to the failure of state-sponsored smallholder irrigation, commercial irrigation operations in which commercial farmers pay for efficient irrigation services have generally remained operational and profitable (Shah *et al.*, 2002). Given that experience, Shah *et al.* (2002) call for a shift in government approach to irrigation management in Africa, with private-sector firms or professional

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farmers' associations supporting irrigation farmers with a range of high-quality services that farmers pay for.

While state-controlled irrigation systems with smallholder farmers have been declining over the last 10 to 20 years, there has been a quiet and consistent increase in 'tiny' irrigation, which has largely been unregulated and given scant support from irrigation or agricultural extension systems. Across Africa, smallholder farmers and women's groups have begun irrigating very small plots of land, producing a variety of vegetables for the expanding urban markets. There are limitations to these systems however. Many rely on untreated sewage, thus producing vegetables with potential negative health consequences for both farmers and consumers. Most of the very small irrigation farms have been established in riparian areas, reducing the value of these areas for biodiversity conservation and filtering of pollutants and nutrients that otherwise enter waterways. And most small-scale farmers lack access to the capital that would be necessary to achieve significant economies of scale and income streams.

Irrigation development in the Nyando basin of Western Kenya mirrors the situation that has unfolded across the rest of Africa. In the mid-1960s the National Irrigation Board (NIB) converted 1,700 ha of wetlands into irrigated agriculture through two pilot irrigation schemes (Ahero and West Kano irrigation schemes). These schemes were located on wetlands within former native reserve lands that had not been subjected to the process of adjudication.¹ Following the apparent success of the first two pilot schemes, the Provincial Irrigation Unit (PIU) of the Ministry of Agriculture, Livestock Development and Marketing supported the development of additional irrigation schemes on 4,000 ha of the remaining 7,000 ha of wetlands. Beginning in the mid-1990s, however, many of the irrigation schemes began to encounter severe problems, with some becoming inoperable since 1997. At the same time, there is anecdotal evidence that an increasing number of farmers outside of the formal irrigation schemes have been engaging in very small-scale irrigation in the riparian areas (Ong and Orengo, 2002).

Laws and regulations governing the irrigation sector in Kenya are embodied in the Irrigation Act (Cap 347), with the NIB created to be the main government organization involved in irrigation development. The irrigation sector can be divided into three main sub-sectors: a) the public or national schemes managed by the NIB, b) smallholder schemes managed by the farmers with support from the Irrigation and Drainage Branch through the PIU, and c) private schemes. The Irrigation Act is now considered to be outdated and in need of revision. Its main weakness is that it does not allow for farmer participation in irrigation development or management. According to the National Irrigation Board Cooperate Plan for 2003-2007, a draft legislative framework on irrigation and drainage in Kenya has been finalized and presented to parliament for approval. It proposes reforms similar to those in the water sector reforms, with the formation of the National Irrigation and Drainage Development Authority and the Irrigation and Drainage Regulatory Board. The draft legislative framework proposes reduced government involvement in non-core functions, increased stakeholder involvement, development of farmer capacity through Participatory Irrigation Management (PIM) and gradual transfer of management to farmer-based organizations through Irrigation Management Transfer (IMT). The Water Act, 2002 does not govern the irrigation sector per se. Rather, it provides for the creation of water user associations (WUAs) at the community level. These are some of the farmer-based organizations that will be used by the NIB for IMT. Toward the end of 2004, the Government of Kenya revived the Ahero irrigation scheme based on the proposals contained in the draft legislative legal framework. There is increased farmer participation and they have formed a WUA. The NIB handles water extraction, then hands over the

scheme to the WUA for management and distribution to the farmers. The NIB is currently the Water Service Provider supplying the scheme with water and is licensed by the Water Service Board. It is envisaged that this role will eventually be taken over by the WUA.² More information on the new structure of Kenya's formal sector water management institutions is given by Onyango *et al.* (Chapter 10 this volume) and Mumma (Chapter 9 this volume).

Ong and Orengo (2002) have focused on the links between irrigation development in the Nyando flood plain and the broader ecosystem. Their analysis of three irrigation schemes in the Nyando flood plain indicates that sedimentation of the intakes and irrigation canals was one major cause of the failure of the systems. Overall, the Nyando basin is an area of high erosion, with 60% of the basin, which Walsh *et al.* (2004) characterizes as having moderate to high rates of erosion. High rates of sediment carried through the Nyando river system have resulted in the need for very frequent desiltation operations, whose costs could not be justified by the modest returns generated from irrigated rice production. Ong and Orengo (2002) also note that the conversion of the Nyando wetlands into agriculture has reduced the filter function of the wetlands, leading to higher rates of sediment deposition into Lake Victoria. Walsh *et al.* (2004) have documented an increasing rate of sediment deposition over the last 100 years, which was punctuated during El Niño events of the mid-1960s, 1986 and 1997.

This chapter focuses on another aspect of irrigation development in the Nyando basin: the links between irrigation and poverty. The chapter draws upon a study undertaken by the World Agroforestry Centre, Maseno University and the International Food Policy Research Institute (IFPRI), known as the Safeguard Study. 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*. This chapter reports results from Safeguard pertaining to poverty and property rights dynamics in the lower flood plain 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.

2. Methods

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

- Address nest scales - collection of data at multiple, nested scales in recognition of the 'fractal' nature of poverty processes (see Barrett and Swallow, 2006, for a formal treatment of fractal poverty traps).
- Represent the range of circumstances in the basin, and then sample villages to represent that range.
- Understand inter-generational dynamics - focus on processes that have had effects over the last 10-25 years (following the inter-generational approach to poverty dynamics proposed by Krishna [2004]).
- Recognize 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).
- Address multiple facets of poverty - explicitly considering the consumption, vulnerability, and agency aspects of poverty (Narayan *et al.*, 2000).

- Adopt an inclusive and participatory research approach - the population under consideration should provide their own definitions of poverty, livelihood strategies and their own assessment of poverty and livelihood trends (Krishna, 2004; Krishna *et al.*, 2004).
- Adopt a 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; Meinzen-Dick, Chapter 2 this volume).

To meet these criteria, the basin was characterized according to its hydrologic and land-tenure zones (for results, see Onyango *et al.*, Chapter 10 this volume). Based on this characterization, villages were chosen to represent 12 distinct zones in the basin. Altogether 14 villages were selected, one village for each of ten zones and two villages for each of the two zones in the flood plain. These results therefore represent the variation found across the basin, including variation in elevation, production system, ethnicity, as well as land and water rights, but results cannot be simply aggregated to represent the whole basin (see Table 10.1, Onyango *et al.*, Chapter 10 this volume).

Within each village, the Stages of Progress method developed by Anirudh Krishna was used to study factors affecting inter-generational poverty dynamics. The method has been applied in India (Krishna, 2004) and Kenya (Krishna *et al.*, 2004). By systematically prompting and guiding discussions among a village representative group, the method generates a Stage of Progress ladder for the village, which ranges from absolute poverty to relative prosperity, poverty and prosperity lines defined by those stages, and measures of the level of poverty/prosperity and poverty dynamics for each household in the village. In the Safeguard Project, we added a stronger focus on livelihood strategies pursued by households in the village, as well as the assets required for those livelihood strategies.

In addition to the village-representative group interviews that generated the Stages of Progress data, other key informant and separate group interviews with men and women were conducted, with a focus on how people access and manage land, water, trees and other natural resources. This analysis of property rights used a legal pluralism approach which is centred on people's own experience with access and control of resources and their personal strategies for claiming and obtaining resources. Additional discussion probed for the role of statutory and customary institutions as sources of land and water rights, and the implications for gender relations.

For information on the household scale, a stratified random total of 30 households was selected and interviewed with a structured survey in each of the 14 villages. Because of the study's focus on poverty dynamics, the whole village was stratified according to households that remained poor, became poor, became non-poor, and stayed non-poor, based on the findings from the Stages of Progress method. The household survey focused on rights and access to land, water and trees, and livelihood strategies.

Table 11.A1 presents descriptive information on 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, large-scale leaseholds, subdivided leaseholds, settlement schemes, squatting in the 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 persons/km². Elevation varies from 1100 m asl near Lake Victoria to over 2500 m asl in the headwaters (see Map 11.1). 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 uppermost parts of the basin.

Map 11.1. Elevation and the Safeguard sample villages (Source: Safeguard Project)



3. Results

Villages 9, 10, 11, 13 and 14 are the foci of the current study. Village 9, known as Nakuru, was part of the national irrigation scheme owned and operated by the NIB. Villages 10 and 11, named Kasinrindwa and Karabok, are smallholder farming communities located outside of the public irrigation areas where some farmers have developed private micro-scale irrigation farming of vegetables. Villages 13 and 14, named Kasiwindhi and Awach Scheme, are smallholder irrigation schemes supported by the PIU.

Land and water governance

The village representative groups and women-only focus groups were asked questions about access to, 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 PIU.

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, particularly for basic household uses. 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 free. 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.

One possible drawback 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 health-care within the household.

Land tenure security is much more restricted for farmers in Village 9. When the NIB built the irrigation system, they appropriated all land in the area. Standardized plots (50 x 50 m for homesteads, and 4 acres of irrigated fields) were then allocated to farmers, who remain “tenants” of the system. The farmers are forbidden to plant trees or own 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 in obtaining any land to cultivate.

A detailed investigation of water governance in Village 9 found not only that the NIB influences irrigation water management but that it also has some spillover effects onto the management of other water resources in the village (Table 11.1). Customary norms play more of a role in granting authority over water sources used primarily for domestic uses. The Nyando river, which is used for irrigation, falls more under statutory law and government agency management. This contrasts with other villages in the area where the management of river water is primarily governed by customary norms.

Table 11.1. Water sources and their management in the village managed and controlled by the NIB (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?	Owner of land where water point is located	What forms of pollution affect the water source?	Mediating institutions
Marega river	Cooking, farming, drinking, washing	All the villagers	Customary	None	No	NIB	Chemicals from irrigation scheme	Irrigation scheme and Government of Kenya
Nyando river			Statutory irrigation act and non-statutory	Irrigation Board for irrigation purposes	Yes		From plants and the chemical factory	Irrigation scheme and Government of Kenya
Ombeyi river			Customary	No one	Yes			Irrigation scheme and Government of Kenya
Shallow well		All	Customary	Owner of land	No	Individuals		The family. The village elders if public funds were used for construction

Source: Authors’ analysis of the Safeguard group interview in Village 9.

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 11.2, 29 out of the 30 surveyed households in Village 14 pay water fees, compared to only 3 out of 21 households in Village 13 and 17 out of 27 households in Village 9. The irrigation system in Village 14 is not without conflict. Table 11.3 indicates that Village 14 is the only village in which most households do not think that there is equality in access to water. Conflicts over water management are reported in both the PIU and the NIB village, with most households in villages of both reporting experience of conflicts over irrigation management (Table 11.4).

Table 11.2. Payment of water fees in the five Safeguard villages in the Nyando flood plain.

Village number and type of irrigation system	Respondents' payments of water fees		
	No	Yes	Total
Village 9 - NIB	10	17	27
Village 10 - Smallholder ad hoc	1	13	14
Village 11 - Smallholder ad hoc	3	7	10
Village 13 - PIU support to farmers	18	3	21
Village 14 - PIU support to farmers	1	29	30
Total	33	69	102

Source: Authors' analysis of the Safeguard household survey data.

Table 11.3. Perceptions of equality of access to water in five Safeguard villages in the Nyando flood plain.

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

Source: Authors' analysis of the Safeguard household survey data.

Table 11.4. Experience with irrigation management conflicts in five Safeguard villages in the Nyando flood plain.

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

Source: Authors' analysis of the Safeguard household survey data.

Resource management and allocation

Evidence from this study indicates that customary arrangements work well for domestic water requirements in the irrigation areas because all the people are of one ethnic group and share the same customary beliefs and practices. Water for domestic use is required in relatively small volumes, with relatively little competition for available water resources. In contrast, large amounts of water are required for commercial irrigation, putting much greater pressure on available water resources. Ensuring a fair distribution of irrigation water requires a management system with capacity for efficient management, rule enforcement and conflict resolution. Customary water management arrangements among the Luo rely heavily on the individual's sense of duty and loyalty to his/her community. For instance, a person who decides not to let people fetch water from a spring located on his parcel of land will be shunned by the rest of the community but will not be formally prosecuted. Such a system may not provide enough certainty for commercial undertakings that require significant monetary investment. Statutory arrangements may thus be better suited because they are supported by legislation and can be enforced through statutory legal systems.

The issue of rights in an irrigation scheme goes beyond access to water. Equally important are rights to access and manage land, rights to manage labour and rights to participate in irrigation system management. Large-scale irrigated agriculture requires the organization of labour through both formal and informal arrangements. In the NIB irrigation schemes, labour is provided by tenant farmers, with the head of each household registered as a tenant of the NIB. The registered tenant-farmer makes informal arrangements with the rest of his/her household/family on how much labour each person will contribute to the irrigation field versus other household activities. He/she also makes informal arrangements on how the family members will divide the proceeds from the rice field. In the initial arrangement with its tenant farmers, the NIB provided farm inputs, marketed the produce and paid the tenant-farmer the difference after recovering the cost. The farmer had no control of the processes but he was sure to get his money when funds were available. However, the informal arrangements within the household depended on the integrity of the registered tenant-farmer. Qualitative studies in two of the schemes established that many of the informal income-allocation arrangements are not honoured in some households, resulting in domestic conflicts. There are no traditional institutions to address these issues since the public schemes are seen as a creation of the government.

One reason that the NIB schemes collapsed was the farmers' discontent with the system that gave them no room to participate in decision-making processes. Since these were all provisions of an act of parliament (The Irrigation Act) and could only be changed by amending the act - a long and laborious process which requires the goodwill of the government. This has discouraged many people from being involved. The NIB appropriated all land in the area, so that household members not involved in rice irrigation are only able to engage in other land-based livelihood strategies by hiring land outside of the community. This helps explain why poverty is worst and livelihood strategies fewest in the NIB irrigation areas. With their major source of income removed, the people lack capital to invest in non-land-based livelihood strategies. Capable young people move out of the area in search of employment elsewhere, while more wealthy households purchase land outside of the scheme and move out. The result is a further concentration of poverty in the failed schemes.

In contrast, the smallholder irrigation schemes supported by the PIU are based on informal arrangements for labour allocation and sharing of produce which are based on customary norms. Every member of the household with customary rights to land is allocated individual portions for which he/she is responsible for labour and inputs and controls the products generated on that land. This gives each person and household incentive to invest more time and money and may be part of the explanation why villages where this system is practised have a lower incidence of poverty.

Livelihood and poverty outcomes under different types of irrigation practised in the Nyando basin

One of the outputs generated by 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 and 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 11.1 presents a compilation of the poverty to prosperity data for all households in the 14 Safeguard study villages, aggregated into three elevation zones - upper, medium and lower. The results show that poverty is generally highest in the lower altitude zone, with about 40% of the sample households now considered poor, with poverty rising by over 15% over the last 10 years. These data are consistent with the national sample and census data for Kenya which show the 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. A high incidence of 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 11.2 presents a breakdown of the Safeguard poverty-prosperity data for villages in the flood plains. The results indicate 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, and more rapidly since. The area covered by the NIB had a poverty rate of over 30% in the early years of the NIB irrigation scheme, a rate which fell just below 30% 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, making irrigation no longer possible. Rice cultivation in the NIB village declined after 1994, and ceased in 1998. In contrast, the two villages that have been supported by the PIU since the 1980s experienced a modest decline in the rate of poverty from 25 years ago to the present time, with a current poverty rate of about 38%.

Figure 11.1. Welfare trends in the Nyando river basin by altitude.

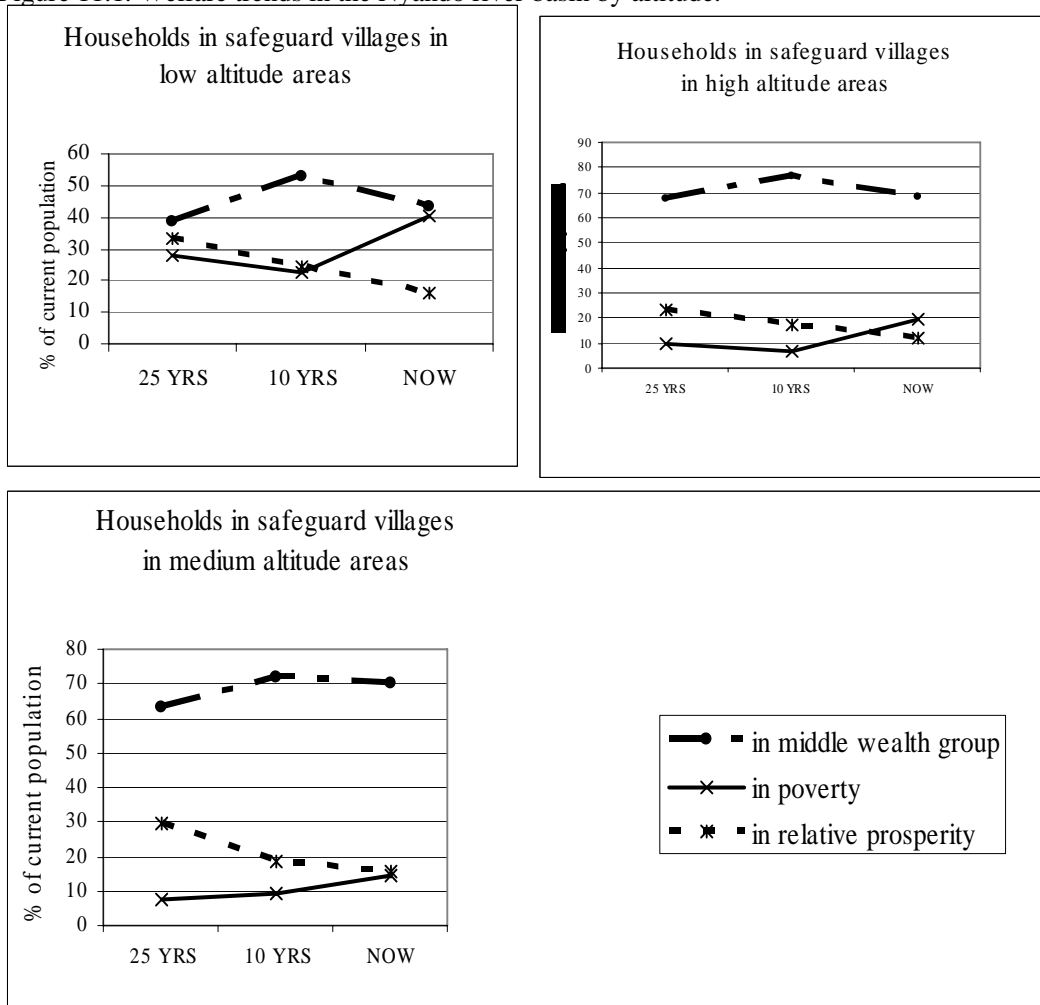


Figure 11.2: Welfare trends in the Nyando flood plains.

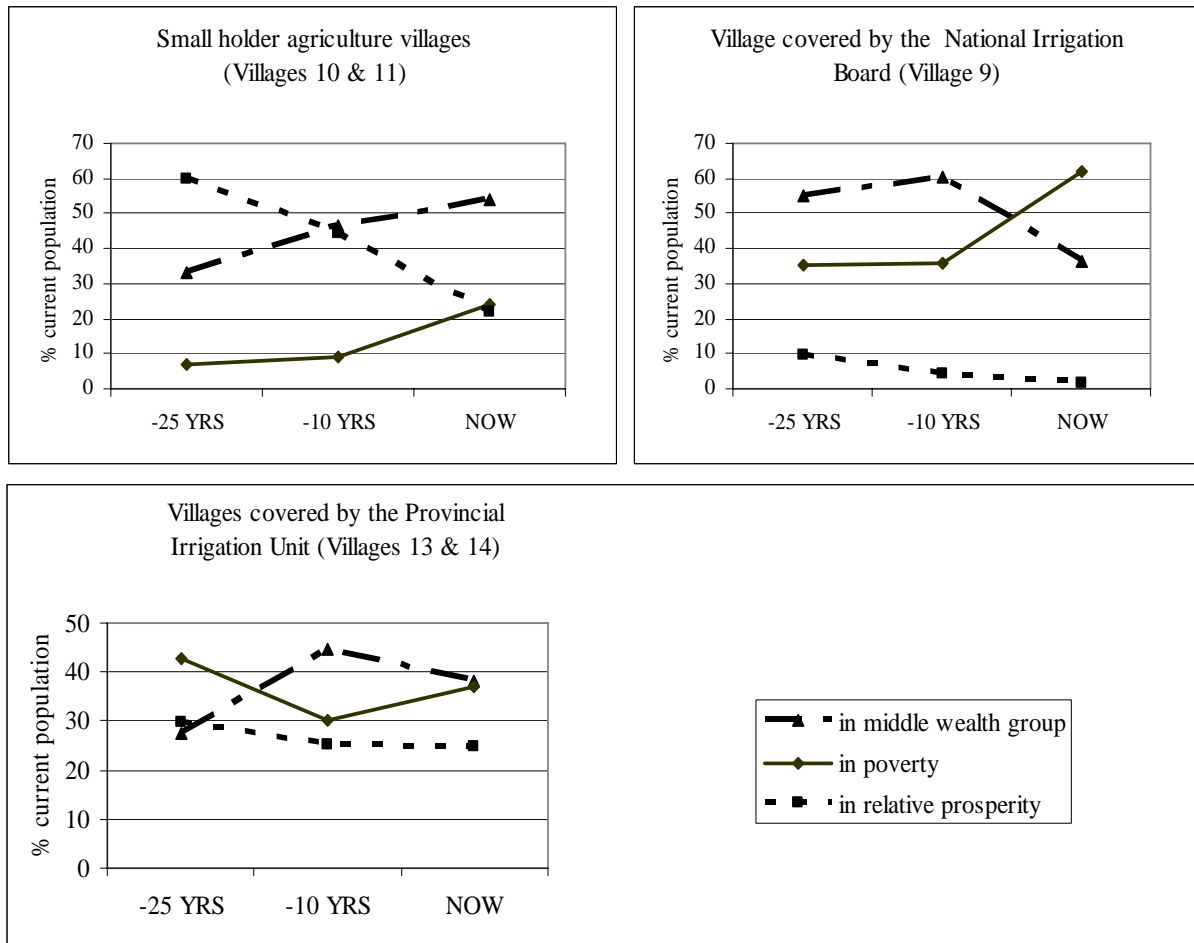


Table 11.5 lists the number of households practising different livelihood strategies at the present time in each of the five Safeguard study villages in the Nyando flood plain. It also lists the total number of strategies listed for all households in each village, the average number of strategies reported 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, 62%) has the lowest number of strategies employed per household. Households in the smallholder agriculture area are more diversified than in the irrigation areas. Village 14, which has the most functional remaining irrigation system in the area, has the highest number of households still growing rice.

Table 11.5. Number of households practising alternative livelihood strategies in the five villages of the Nyando flood plain.

Strategy	Village 9 - NIB	Village 10 – Small-holder mixed farming	Village 11 – Small-holder mixed farming	Village 13 - Supported by PIU	Village 14 - Supported by PIU
Beans			17	6	
Boda boda (bicycle taxi)	4	8	5	1	4
Casual labour	31	3	8	3	22
Cattle	17	29	28	20	39
Formal employment	4	6	20	11	13
Maize	15	46	61	33	71
Other skilled employment	14	13	22	14	10
Other small-scale farming	4	13	16	5	4
Rice	3	1	1	15	73
Sheep or goats	2	48	63	6	74
Sorghum or millet	1	15	37	17	70
Sugarcane		40	1		
Tomatoes	2	42	11	2	5
Trade	28	20	46	12	4
Vegetables/onion	1	51	19	1	7
Total strategies in village	126	335	355	146	396
Number of households in village	74	63	102	52	94
Average strategies/household	1.70	5.32	3.48	2.81	4.21
Current poverty status (%)	62	29	22	37	37

Figure 11.2 indicates that 25 years ago the introduction of irrigation had the effect of reducing the levels of poverty in the initial stages by introducing a cash crop in a region where agriculture had been predominantly for subsistence. Irrigation was introduced at a time when the government subsidized agricultural inputs heavily. Later policy changes reduced the subsidies. This had the effect of reducing the profits realized by the rice farmers. In the NIB schemes the people were not involved in management and blamed the decline on the NIB. It was the beginning of discontent. In the smallholder schemes supported by the PIU the people understood the reasons for decline of profits and sought ways of surviving. During the period 25 - 10 years ago the negative impacts of the reduced subsidies had not yet started being felt extensively and the irrigation communities were still enjoying the benefits of cash crop farming. From 10 years ago to date the situation has been made worse by liberalization. Governments in the developing world found it hard to protect their farmers from cheaply produced agricultural goods. The high cost of farm inputs and a competitive market have reduced the gains of rice irrigation. In Village 9 the collapse of the scheme is indicated by a steep increase in the number of people living in poverty beginning 10 years ago and continuing to date. The proportion of the community living in relative prosperity stood at 10% 10 years ago but today it has dropped to almost 1%.

The irrigation scheme in Village 13, which has been supported by the PIU, has also ceased activity. The main reason that the scheme ceased operations was the extremely high levels of siltation of the irrigation intakes and canals. Desiltation proved a high recurrent cost for the communities, a cost that they were not able to sustain over time (Ong and Orengo, 2002). The results presented in Figure 11.2 and Table 11.5 indicate that poverty has increased in Village 13 over the past 10 years,

although not nearly as much as in Village 9. Livelihood strategies are more diverse in Village 13 than in Village 9, although not as diverse as in Villages 10, 11 or 14. Interpreted another way, households that had control of their own farmland were able to respond to the collapse of irrigated rice production with some types of agricultural enterprise, while households that did not have that control were generally forced to low-return non-agricultural livelihood strategies. These results support the argument of Shah *et al.* (2002) that sudden withdrawal of state support in smallholder irrigation schemes is bound to lead to collapse.

4. Conclusions

It is clear from the study that poverty in the Nyando basin is generally concentrated in the lower parts of the basin that have the greatest potential for irrigation. This geographic clustering of poverty in the lower parts of the basin contrasts with the standard situation in southeast Asia and parts of south Asia but it may be closer to the norm in East Africa. Failed irrigation development, particularly with heavy government involvement in agricultural production and local organizational arrangements (the NIB village) has been a source of impoverishment in the Nyando flood plain. Erosion in the upper reaches of the basin has also contributed to the decline of irrigation systems in the flood plain because the heavy siltation washed down by the floods has blocked the irrigation supply channels. In the context of high HIV/AIDS infections and other diseases, it is very difficult for farmers to mobilize enough labour to desilt the canals themselves, thereby increasing their dependence on government agencies for equipment in the larger-scale irrigation systems. Yet, the overall small improvement in the poverty situation in the villages supported by the PIU provides some evidence that irrigation development can contribute to welfare improvements.

One of the key lessons from this study appears to be the trade-offs between specialization and diversity in production under irrigation. While there may have been efficiency gains associated with specialized rice production when the NIB was functional, this specialization implied high risk in the event of failure of the irrigation system. Diversification of livelihood strategies at the household and community levels is a major source of welfare enhancement and risk minimization.

A major difference between the NIB area and the other areas included in this study lies in land tenure: in the NIB scheme, farmers are considered only “tenants,” with little tenure security. They thus have less incentive to invest in developing the land or even the irrigation facilities, and have less decision-making authority, which is needed for diversifying livelihoods. Women in the NIB village also have less control over resources than in other villages. Tenure security and resource control of both households as a whole and women in the households are important to address poverty reduction in the irrigated areas.

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 schemes and the government in mediating access to virtually all water sources in the village. 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. Other results from the Nyando basin show that there are indeed strong links between landownership and water access (Onyango *et al.*, Chapter 10 this volume).

Under the Water Act, 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 reassessing how best to revitalize the irrigation sector and improve access to domestic water sources. In 2004-5, the intakes and canals in some of the schemes were desilted through food-for-work schemes and irrigation water began to flow again in some of the schemes. This research shows that landownership will be key to maintaining these gains. Farmers will be more apt to adapt to invest in land improvements and diversify their income sources if they have secure land rights.

The results from this study and experience from elsewhere in Africa indicate that markets and efficient service provision will also be important (Shah *et al.*, 2002). Different approaches to marketing may be taken. The smallholder farming approach, exemplified by the NALEP approach, would support common interest groups around a diversity of crops, perhaps focused on vegetables sold into the Kisumu market. An alternative approach, that has proven successful in the revitalization of the Mwea irrigation scheme on the slopes of Mount Kenya (Shah *et al.*, 2002), has been to support the development of a multi-purpose farmers' cooperative to engage in input and output marketing arrangements for high-quality irrigated rice. Such a cooperative could pay the PIU to provide irrigation services to the scheme. Another alternative that is being tried out for the first time at the NIB schemes in Ahero, a west Kano irrigation schemes, is engaging with micro-finance organizations for financing of inputs and marketing of produce. The arrangement is done by the farmer organizations and is for a specific time period.

Notes

¹The process of adjudication and registration was initiated by the government to convert customary land rights to statutory land rights. After adjudication - passing judgment that a certain plot of land does belong to a particular individual according to customary arrangements - the government went ahead to survey and register the said parcel of land in that person's name and issue him with a title deed. Adjudication thus reaffirmed customary land claims and converted them into statutory rights (described in Onyango *et al.*, Chapter 10 this volume)

² Since water resources management and irrigation are both in the new Ministry of Water and Irrigation, the institutions created by the different acts have cross-cutting functions. All of the institutions created by the Water Act, 2002 will provide services for the irrigation sector.

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Table 11.A1. Characterization of the Safeguard study.

Zone; elevation	Land Tenure Status	Irrigation development	Safeguard village number and village name	District(s)	Population density (persons /km)	Main ethnic group	Production system	Per cent below poverty line in location
Flood plain; 1100	Adjudicated	Smallholder mixed farming; 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
Flood plain; 1100 m asl	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
Flood plain; 1100 m asl	Contested; formally owned by NIB but promised to local residents	Irrigation by NIB	9 = Nakuru	Nyando, Kisumu	224-1000	Luo	Designed for irrigated rice; more diversification since NIB collapse in 1998	63
Lower Awach catchment; 1250 m asl	Adjudicated	None	12 = Miolo	Nyando	224-527	Luo	Mixed subsistence, NR extraction	65
Upper Awach catchment; 1700 m asl	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 sugarcane	48
Mid altitude; 1500 m asl	Large-scale lease-hold	None	8 = Poto poto	Nyando	88-149	Nandi Kalenjin	Commercial sugarcane and mixed farming	48
High altitude; 2000 m asl	Adjudicated	Some home garden irrigation from springs	3 = Kiptagen	Kericho	224-500	Kalenjin	Small-scale tea, some coffee, sugarcane, maize	49
High altitude; 2100 m asl	Subdivided lease-hold	None	1 = Kaminjeiw a; 2 = Nyaribari A	Kericho	224-400	Mixture of Kalenjin, Kisii and others	Smallholder mixed farming,	41
High altitude;	Indigenous forest	None	5 = Ngendui	Nandi	87-400 mixed	Ogiek / Nandi	Small-scale mixed farming	60

2200 m asl	dwellers on forest land					Kalenjin		
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Sources: Unpublished data compiled by the Safeguard Project; poverty and population data from the Central Bureau of Statistics.