Effect of land use changes on adaptive strategies for smallholder agro-pastoralists in Kenya

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Abstract

A study to characterize existing adaptive strategies and shifts in smallholder agro-pastoralists in relation to changes in land use and land subdivisions was carried out. A total of 48.9% of respondent indicated that there had been a shift in the adaptive strategies where unreliable rainfall, better access to land and water, acquisition of skills, shortage of pastures and proximity to wildlife habitats were the main factors influencing the shifts. Shortage of rainfall, lack of capital in terms of technology resource requirements, predation, livestock diseases and lack of seeds for both pastures and crops were ranked as the major constraints recording 88.9, 55.6, 45.6, 35.6 and 30% of respondents, respectively (N=90).

Early planting, use of drought resistant crops, predation control and feed conservation were some of the important agro-pastoral adaptive strategies in the study area. The change in land-use led to increased problems of predation and depredation leading to increased livestock/wildlife and crop/wildlife conflicts. Proximity to infrastructures such as water sources, road networks or transport, access to credit facilities for input acquisition also affected land-use practices.

Key words: constraints, land fragmentation, ranches, strategy shifts, wildlife conflicts

Introduction

Traditionally, rangelands supported pastoral subsistence economy that was mainly milk based but included other livestock products. Livestock production was then the main source of livelihood that provided the pastoral communities with food and played a major role in their cultural and religious activities. Livestock acted as reservoir for family wealth, insurance against disaster and/or social capital. To ensure sustainable subsistence production, the pastoralists employed several strategies such as: (1) keeping diverse livestock species to provide a broad, flexible, opportunistic and temporarily stable resource availability resulting from complementary use of range forage, (2) establishment and maintenance of a social system for resource sharing or

borrowing, (3) mobility to obtain sufficient utilization of forage and water resources, (4) splitting of livestock into spatially separate units based on species, management, milk production, age or property units thus minimize the effects of disease outbreaks and droughts and (5) maximizing on stock numbers to increase the chances of survival in case of severe droughts (Kariuki et al 1996; Herlocker 1999).

Over time, there have been a lot of changes that have necessitated a change in the adaptive strategies to better cope with the changing pastoral production systems. Some of the causative factors include sedentarization of pastoralists due to increased influence of central governments that provided social amenities such as health centers and vet services and improved infrastructures and permanent watering sources at specific points in the extensive grazing lands in the ASALs. Also, sedentarization has occurred due to change in land tenure resulting from sub-division and individualization of ranches. The mobility of pastoral herds allowed for maximum and equitable exploitation of patchily distributed water and pasture in the rangelands. However, increased sedentarization has reduced pastoral mobility and concentrated the people and their livestock around the water points, resulting in increased land degradation. This has also increased their vulnerability to drought and in the long run may jeopardize the viability of the livestock enterprise upon which pastoral livelihoods depends.

In addition to sedentarization, higher potential rangelands have been converted into other land-uses (IRIN 2007), which have reduced the dry season grazing areas. As a result of diminishing forage resource base, the pastoralists who could no longer maintain subsistence livestock production have adapted other sources of livelihood including farming and wage employment. This has led to shifts in pastoral strategies such as the use of secondary grazing land rights that involve provision of farm labour or exchange of ox plough for grazing rights by the agro-pastoralists (Nyangito et al 2008). Also, pastoral and agro-pastoral communities have had to reduce their livestock herds due to diminishing grazing areas thus loosing on the benefit of maximizing on livestock numbers to cushion against total losses in case of drought. In some cases, changes in livestock breeds have occurred with fast growing and higher yielding animals being preferred (Wangui 2003).

The shrinking resource base coupled with shifts to cultivated agriculture has also led to increased resource-based conflicts (Kariuki et al 1996). Also, the pastoralists have had to rely more on the market economy while restructuring their livestock herds, particularly towards keeping more small stock that reproduce more quickly and have higher economic rate of return.

Changes in land-use have had implications on gender roles in the households. Due to the adoption of cultivated agriculture by the pastoral Maasai community, the

responsibility of managing livestock is no longer solely handled by men (Wangui 2003). Women are spending more time in livestock production than in the past. In addition, Wangui (2003) observed that there was a positive correlation between the number of hours wives spent on crop production and the length of time a household had spent since it started farming. Furthermore, significant reduction in livestock holding per household due to the effect of reduced grazing areas coupled with drought has resulted in Maasai men loosing interest in management of the remaining animals leaving the responsibility to their wives.

On the other hand, overall shift in pastoral coping strategies may not have taken place despite strong external forces of change. For example, pastoral communities have opted to re-aggregate post group ranch subdivision as a means of maintaining flexibility in their land-use system (BurnSilver and Mwangi 2007). Kariuki et al (1996) also reported a shift back to pastoral coping strategies among pastoral communities in Isiolo as a result of poor crop output from irrigated farms. In fact, most pastoralists settled for irrigated agriculture after the droughts with the aim of building up their livestock herds and return back to full pastoralism after getting enough animals. Other cases include the reinvestment of proceeds from irrigated agriculture in livestock by the pastoral Turkana community (Henricksen 1975).This study therefore aimed at characterizing existing adaptive strategies and shifts in smallholder agro-pastoralists in relation to changes in land use and land subdivisions

Materials and Methods

Study area

The study was carried out in 3 smallholder agro-pastoral sites in former ranching areas located South East (SE) of Nairobi on the Athi Kapiti plains in Machakos and Makueni Districts. Konza smallholder farm (SMF) was from the subdivided area of Konza ranch located in Kimutwa and Muumando Sub-locations of Machakos District and while Kima and Kiu SMFs were from Kima and Kiu ranches located in Kiima-kiu Sub-location of Makueni District. Machakos district covers about 14,000km^2 and lies in the SE of Kenya. Rainfall is highest in the hills on the North West (NW) (1,000mm) declining to the SE (600mm). Most of the areas in Machakos District receive annual mean rainfall of less than 800mm. Makueni District receives an average of 1,200mm rainfall in the highlands located in the North and declines to 500mm in the lowlands in the South.

The main economic activities in the smallholder agro-pastoral households include crop farming, keeping of livestock and small business enterprises. The main food crops cultivated include drought tolerant crops varieties such as maize, beans,

cowpeas and pigeon peas. The dominant types of livestock kept are goats, cattle, donkey and chicken.

Data collection and analysis

Data was collected using a semi-structured questionnaire. The information collected included land size, adaptive strategies, limitations and factors causing the change in adaptive strategies ranked in order of importance. This information was collected through Focus Group Discussions (FGD) and face-to-face interviews with household heads. The households were sampled at every 500m along main paths in the 3 SMFs above. A total of 90 smallholder households were interviewed. One FGD was held after the household survey involving 14 participants selected from the 3 SMFs with the assistance of area local leaders. The FGD was used to complement the information from the face-to-face interviews, particularly the constraints, possible opportunities and coping strategies.

Data entry was done in Microsoft office excel 2007 and analyzed using the Statistical Package of Social Scientists (SPSS) version 10.

Results and Discussions

Constraints to smallholder production systems and the adaptive strategies in Machakos and Makueni districts

The study considered characterization of constraints affecting smallholder households in the study area particularly with regard to the changing land-use and further fragmentation of the land. Shortage of rainfall was the most mentioned constraint (88.9%) affecting both crop and livestock production in the study area (Figure 1).

Figure 1: Constraints to smallholder households in Machakos and Makueni Districts

The area receives an annual rainfall of less than 800mm per annum (Jaetzold et al 2006) that is highly variable in space and time (Nyangito et al 2008). This constraint was also ranked first during the focus group discussions (FGDs). Lack of capital, predation, livestock diseases and lack of seeds for both pastures and crops were ranked as the other major constraints recording 55.6%, 45.6%, 35.6% and 30% of respondents, respectively. Among the respondents that mentioned lack of capital as a

constraint, 52% indicated enhanced access to loans as a possible opportunity. Capital in this case refers to technology resource requirements and lack of it has had a negative effect in technology uptake in the ASALs. Access to credit as a strategy to cope with effects of changing environmental conditions in the ASALs was cited by 24.4% of the respondents (Figure 2). Lack of capital also ranked second during the FGD.

Predation within the study area was mainly through depredation of crops by wild animals. This was as a result of encroachment of cultivated agriculture into areas previously used by wildlife and proximity of croplands to wildlife reserve areas such as the none-subdivided ranches. This led to crop farmer-wildlife conflicts. In response to this conflict, the farmers opted to control the wild animals using methods that are contrary to the law such as poaching. Predation was also viewed as a problem to livestock production particularly to chicken and small ruminants. Among the adaptive strategies, predation control by use of fences, traps and poaching ranked second after early planting as indicated by 36.7% of the smallholder farmers. Identification of predation as one of the major constraint was in agreement with findings by Esikuri (1998), Kimani and Pickard (1998) and Muthiani (2004) that change in land-use leads to increased problems of predation and depredation leading to increased livestock/wildlife and crop/wildlife conflicts. Wild animals have been known to coexist with livestock in the rangelands through integrated pastoral production systems that use the range complementarily. However, land subdivision and changes in land-use in the rangelands have led to increased crop-wildlife and livestock-wildlife conflicts (Esikuri 1998; Kimani and Pickard 1998). In addition, fencing as a predation control method restricts wildlife movement and may cut off national wildlife reserves from wildlife dispersal areas resulting in isolation of populations and reduced genetic variability (Kimani and Pickard 1998).

The mitigative strategies mentioned by the smallholder farmers in the study closely matched with the constraints mentioned. For instance, early planting and use of drought resistant crops ranked highly (46.7% and 32%, respectively) among the strategies targeted to mitigate against unreliable rainfall (Figure 2).

Figure 2: Strategies employed by smallholder households in Machakos and Makueni Districts

Similarly the FGD confirmed early planting and planting of drought resistant crops as important adaptive strategies and ranked them first and second. Few of the respondents (3.3%) opted to non-agriculture related strategies such as business

enterprises to cope with continued crop failure as a result of unfavourable climatic conditions. Other highly ranked strategies during the FGD included proper grazing management, feed conservation and leasing of pastures during times of shortage.

Characterization of shifts in adaptive strategies in Machakos and Makueni districts

The study observed that the agro-pastoral households had shifted from their traditional adaptive strategies. These included high seasonal livestock mobility, herd splitting, social networks and keeping of large livestock numbers. A total of 48.9% of the respondents indicated that there had been a shift in adaptive strategies due to several factors (Table 1).

Table 1: Factors causing shift in adaptive strategies

Factors for change	Respondents (%)
Unreliable rainfall	29.5
Available water	22.7
Available land	20.5
Acquired skills	18.2
Predation	15.9
Feed shortage	11.4
No markets	6.8
Available capital	4.5
Alternative income	2.3
Pasture available	2.3
Transport access	2.3

Unreliable rainfall, availability of land and water, acquisition of skills, shortage of pasture and predation were the main factors influencing shifts in adaptive strategies. The study also indicated that land-use practices were affected by proximity to infrastructures such as water sources, road networks or transport, access to credit facilities for input acquisition and environmental conditions such as rainfall amounts, which determined the production enterprise. For instance, access to a reliable source of water and credit facility for purchase of inputs led to a shift to irrigated agriculture in some of the households. The shift in the adaptive strategies resulted in increased production of crops, livestock or both. However, a large percentage of the households (51.1%) did not change their livelihood options (Table 2).

Table 2: Shifts in livelihood options by households

Change option	Households (%)
No change	51.1
To business	2.2
Increased livestock production	10
Increased cultivation	15.6
Combined crop and livestock	21

The shift to increased livestock production was through households starting to keep animals or increasing their livestock numbers, particularly the adapted local breeds. This shift was partly attributed to frequent crop failure (44%), feed shortage for exotic animals (22%) and predation on chicken (22%). Few households, 4.5% and 2.3%, opted for only bee keeping and chicken production, respectively. The reasons behind this shift were lack of markets for other livestock products and unreliable rainfall that was affecting both pastures and crop production. These enterprises are regarded as landless livestock production systems because of their low land requirement. Poultry production especially indigenous chicken is a source of quick cash to the agro-pastoral community in Makueni District (Nyariki and Wiggins 1999).

In this study area, 21% of the households shifted their production strategies to both crop and livestock production. Of this group, 52.6% opted for high yielding animals in combination with irrigated agriculture and/or cash crops. The rest (47.4%) shifted to keeping indigenous livestock breeds either from cultivated agriculture or keeping of exotic animals. However, none of their decisions was affected by reduced land size except for unreliability of rainfall and predation due to proximity to wildlife habitats. Change in land-use to smallholder settlements in areas inhabited by wildlife has a negative effect. It intensifies human-wildlife conflicts, particularly due to encroachment of cultivated agriculture to areas used by wildlife (Esikuri, 1998).

Shifts to keeping both high yielding animals and improved crop production was attributed to bigger land size (30%), proximity to a source of water (50%), acquisition of livestock management skills, shortage of feed for free ranging animals (10%) and predation on small stock (10%). The bigger land size is as a result of acquisition of land through subdivision of ranches particularly to those without any land before. In this case, the fragmentation of ranches had a positive impact on the households. This is further confirmed by the high number (97.8%) of respondents that indicated that they were better off in their current settlement, which resulted from subdivision of ranches. Among this group, 65, 19, 5.7 and 5.7% were better off because of adequate land size, better crop yields, water availability and access to transport, respectively. Also, due to individual ownership of resources, 31.8% could make investment decisions on land-based resource utilization including charcoal burning without external interference particularly from relatives or authorities.

Despite the many constraints faced under land subdivision, majority of smallholder agro-pastoralists (97.8) supported the subdivision and asserted that it had influenced their livelihoods favourably. Only 2% of the respondents mentioned small land size as a constraint.

Conclusions and recommendations

- Some of the highly ranked constraints by the smallholder agro-pastoralists included low rainfall, lack of capital, predation, livestock diseases and lack of seeds for both pastures and crops.

- The identified coping strategies by the smallholder agro-pastoralists in the study included acquisition of loans, adoption of water harvesting technologies, irrigated agriculture, use of drought resistant crops, early planting, predation control and diversification into none-agriculture related strategies such business enterprises. Of these, early planting and use of drought resistant crops were ranked as the most important coping strategies targeted to mitigate against the effect of unreliable rainfall in the study area. Predation control, proper grazing management, feed conservation and leasing of pastures during times of shortage were also highly ranked.

- With increased land degradation in the study area which is as a result of the change in land-use, there is need for development of appropriate technologies that would contribute to reversing degradation trends and increase land productivity. The appropriate technologies should build on the important SMFs adaptive strategies, particularly use of drought tolerant crops, feed conservation and proper grazing management. There is need also for development of policies regulating the way land should be utilized. This should aid in the allocation of appropriate land-uses to parcels of land

Acknowledgements

The authors acknowledge funding support from the EU through KASAL Programme without which this work would not have been achieved. Also, we are grateful to the Director KARI and KARI Kiboko staff for their logistical assistance.

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Received 24 April 2012; Accepted 13 July 2012; Published 1 August 2012