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Diversity in Income-Generating Activities for Sedentarized Pastoral Women in Northern Kenya

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As East African pastoralists settle around market centers, women often adopt new town-based activities to generate income. While settling in or near towns presents women with new opportunities, household poverty may prevent them from exploiting these opportunities or lead them to adopt environmentally unsustainable survival strategies that contribute to the localized degradation of the natural resource base. A survey of 102 Rendille women in and around Korr town in Marsabit District of northern Kenya was undertaken to understand their income-generating strategies. Strategies analyzed in this study are the sale of milk, based on pastoral production; the collection and sale of firewood, which may be environmentally unsustainable; and income generation through small-scale trading, which has become increasingly important as market integration increases in northern Kenya. The results show that Korr women are by no means all pursuing the same income-generating activities. Potential poverty-alleviation strategies include emphasis on research and investments aimed at improvements in milk marketing opportunities and efficiencies, increasing regional employment opportunities, strengthening collective action by pastoral women, and increasing their level of participation in decision making aimed at sustainable use of natural resources.

Keywords: pastoral, income diversification, livelihood strategies, sedentarization, Kenya

Sedentarization of formerly nomadic pastoralists in East Africa has been widespread over the past 30 years. When nomads settle, they seek to adapt traditional practices to their new and challenging circumstances. Previous studies have explored diverse issues arising from this adaptation, such as diet and nutrition (Nathan, Frantkin, and Roth1996), political organization and land tenure (Ensminger 1992), gender roles and labor time (Smith 1998; Fratkin and Smith 1995), and the environmental impact of town growth (Keya 1998). These studies indicate that the move toward sedentarization in pastoral societies has greatly changed their traditional livelihood strategies.

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Small towns have grown rapidly as pastoralists settle around market centers. Women have in many cases been able to adopt new town-based livelihood strategies such as milk sales or garden vegetable sales (Smith 1999; Little et al. 1999; Talle 1987; Coppock 1994). While settling in or near towns presents women with new opportunities, household poverty may prevent them from exploiting these opportunities or lead them to adopt environmentally unsustainable options that contribute to the degradation of the natural resource base (Keya 1998; Schwartz, Shaabani, and Walther 1991; McPeak 2000).

One income-generating strategy, the sale of milk, is based on pastoral production, but may only be possible if a woman has access to many animals. A second strategy, the collection and sale of firewood, may not be environmentally sustainable. The final strategy considered here, small-scale trading, has become increasingly important as market integration increases in northern Kenya.

This study asks if female pastoralists settle in an area with limited food and income options, are they still able to diversify their livelihood options? If they can, what factors influence their choice of activity? A survey of 102 Rendille women in and around Korr town in Marsabit District of northern Kenya elicited an understanding of income-generating strategies being pursued and the factors affecting those choices.

Since reaching out to women is critical for poverty alleviation, understanding the factors driving women's choices is important for the development of sound policies and will contribute to better targeted research and development efforts. The implications of these choices are explored both

in terms of policy options and in terms of possible environmental impacts.

Background and Study Area

Tropical and subtropical, arid and semiarid grasslands largely define Kenya's north and northeast regions: 10.2 million people live here, as well as 3.9 million cattle and 4.8 million sheep and goats (Seré and Stienfeld 1996; Thornton et al. 2000). According to a recent survey, 88 percent of rural people in Marsabit District fall below the absolute poverty line, defined as minimum requirements in terms of calories and nonfood basics considered adequate to satisfy minimum basic needs (Ministry of Planning and National Development 1998). If this percentage is applied to the entire Livestock, Grassland-Based, Arid/Semi-Arid Livestock Production System (LGA), it implies that 9 million nomadic pastoralists and agropastoralists are living in poverty.

Korr, located in Marsabit District, occupies the arid lowlands of the Kaisut Desert below Marsabit Mountain. It experiences unreliable and erratic rainfall at levels below 300 mm. annually. In this hot, harsh, rocky environment, raising livestock is the single most important economic activity.

Increases in the settled population in northern Kenya have occurred sporadically over the last 30 years. Town populations increased notably following the droughts of the early 1970s, in 1984-1985, and in 1992. Destitute herders moved to towns to meet subsistence needs, often by becoming food aid recipients.

The town of Korr was originally a camel satellite camp, but after the 1971 drought, which wiped out more than half of the Rendille livestock, many families settled down because their decimated herds could not support a migratory lifestyle. The arrival of a missionary, who built a school and a dispensary, drilled boreholes, set up a retail shop, and established a restocking program, was also critical to the initial establishment of the settlement (Dolan 1980).

The present population of Korr is estimated at around 21,000 people, distributed around the town in a radius of approximately 10 kilometers (Ndung'u et al. 1999). Most inhabitants are Rendille, an Eastern Cushitic-speaking people linguistically related to the Somali. Culturally, they are related to the Gabra, with whom they share similar ceremonies and prohibitions (Schlee 1989).

The Rendille continue to have two different types of settlements: main camps in the vicinity of towns and permanent water sources, and satellite camps that make use of extensive grazing areas. Main camps are located in settlements of 70-100 houses, arranged in a circle around livestock enclosures (NOPA 1992). Married women and men, children, and the old typically reside in the main camps.

Satellite camps are used to access remote rangelands. Physically, satellite camps often consist of little more than a windscreen behind which cooking and sleeping take place. Next to these are night enclosures for the animals. Although sedentarization has influenced the traditional division of labor in Rendille society, unmarried men, teenage boys, and girls tend to the livestock in satellite camps.

Security has been noted as a major problem in this area (Dolan 1980; Meadows 1999) and has affected the Rendille directly through attacks on their own livestock and indirectly through the restriction of their movement. While it is not clear what proportion of town residents settled due to herd losses from raids, anecdotal evidence suggests it is an important factor. McPeak (2000) notes that for the neighboring Gabra, fear of raiding leads to spatial concentration of livestock near towns and partially explains the pattern of localized degradation observed in this region.

Data

Survey Methods

Forty-three settlements in a 10 km^2 radius around Korr town were randomly chosen. A sample of 102 women was purposively selected to maximize the scope and range of variation in those characteristics meaningful to the topic under study within each settlement. Variables considered were age and education of the respondent, proportion of her household that has received formal education, size of household, livestock holding and composition, and involvement in nonpastoral activities. The sample included literate women, illiterate women, housewives, herders, women household heads, women in petty trade, and women involved in the sale of natural resources such as firewood and charcoal. The formal survey, using a structured questionnaire, built upon earlier informal focus group discussions and participatory rapid appraisals. It was carried out from August through November 1999 by a female researcher from the Kenya Agricultural Research Institute (KARI), located in the area. Three local enumerators (two men and one woman) were trained and assisted in the administration of the questionnaire.

Descriptive Statistics

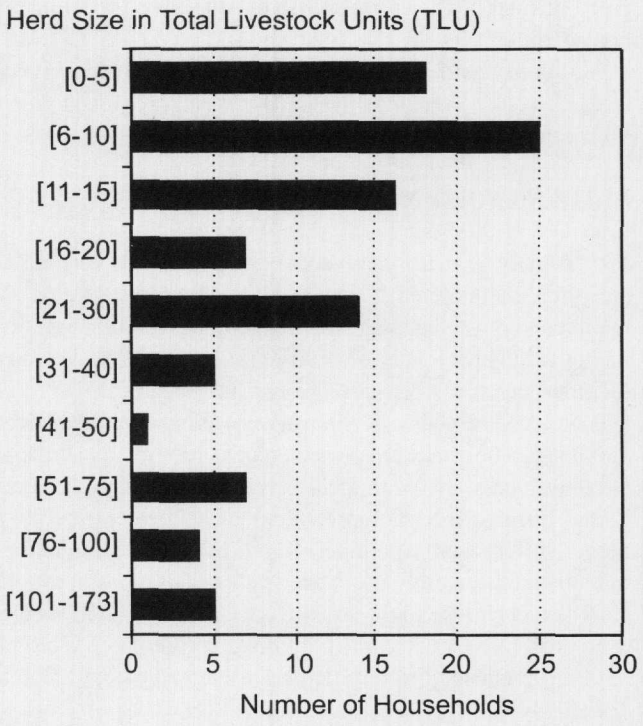
Variables hypothesized to explain women's behavior with respect to livelihood strategies are presented in Table 1. To aggregate and compare ruminants, following convention, livestock holdings were converted to tropical livestock units (TLUs), where 1 TLU is the equivalent of 250 kilograms of livestock weight (Bekure et al. 1991). Since the exact weight of animals was unknown, weightings for this livestock production system were calculated as: small stock (sheep and goats) equal to .1 TLU, cattle .8 TLU, camels 1.2 TLU, and donkeys 1 TLU.

Average herd size (TLU) for the households surveyed was 21.4, with large variability across households (a standard deviation of 26.4). The average number of camels per household was 7, the same as the mean number of cattle. Small stock are much more numerous than cattle or camels, with an average herd size of 60 sheep and goats. The

Table 1. Variables Hypothesized to Explain Women's Behavior with Respect to Livelihood Strategies (n = 102 households)

Variable	Mean	Std. Deviation	Measurement/ Description
Total TLU	21.39	26.38	Total TLU = no. of small stock x 0.1 + cattle x 0.8 + camels x 1.2 + donkeys x 1.0
Presence of husband	0.65	0.48	1 = Present 0 = Absent
Distance from Korr town center	5.74	3.11	Kilometers
Age	46.77	12.43	Years
Education of respondent	0.19	0.39	1 = Some formal education 0 = No formal education
Children in paid work	0.26	0.44	1 = Has at least one child in paid work 0 = Has no children in paid work

Figure 1. Herd Size Distribution



distribution of the total sample herd size across households is shown in Figure 1. Fifty-eight percent of the households surveyed had herds with 10 Tropical Livestock units (TLU) or less: and half of the households owned 12 percent of the overall herd, with the other 88 percent of the herd owned by the other half of the households.

Using the number of unmarried children plus parents as a proxy for household size (realizing that older people are not accounted for), the average household size is 5.7 people. This corresponds to a per capita average herd size for the households sampled of 3.7 TLU per person. Little et al. (2000) give some historical data on the number of livestock per capita for the Rendille, estimated at 11 TLU per person in the 1981-84 period and at 1.9 TLU per person in 1995.

More than a third of the women interviewed (all married, ranging in age from 25 to 85) had permanently absent husbands, due to death, out-migration, or desertion. In this patrilineal society, widows with young children reported having some control over the household herd, but older women with grown children had no animals of their own and depended on the generosity of their children, particularly the first-born son who inherits the herd. The vast majority (81%) of sampled women had no formal education. Only one-quarter of the mothers sampled had at least one adult child (over 18 years) earning some wages in either the informal or formal sector.

Options for income diversification pursued by women in Korr are sale of milk, sale of firewood, petty business, carrying water for pay, being employed by others, sale of charcoal, production and sale of crafts, home-brewing, and sale of alcohol. Income diversification of some kind was pursued by 63 percent of surveyed women, and 18 percent of women pursued two or more of these activities. This study focuses on the three most commonly adopted activities of milk sales, firewood sales, and petty business.

Thirty percent of the respondents sell milk. Rendille women have absolute rights over distribution of milk, which is a major component of the Rendille diet. However, as men make the decision over which animals are to be sent to satellite camp and which are to be retained at base camp, women's rights to milk are conditioned on men's rights to animals. Milk is sold to Rendille families located in town who do not have livestock of their own or whose livestock is kept with relatives located far from town, to businessmen who trade in Korr, and to the occasional visitors to Korr.

Twenty-two percent of respondents collected and sold firewood. Firewood is usually collected in areas away from town and carried by women to town for sale. Keya (1998) presents evidence that calls into question the environmental

sustainability of this strategy, as woody cover in the Korr area declined significantly in recent years.

Twenty-three percent of respondents were involved in petty business. This often involves small-scale trading of commodities such as tea, tobacco, and sugar. As O'Leary (1985) notes, market penetration has been rapidly increasing in the Rendille area since the 1970s, which presents women with an option for nontraditional income.

Model Specification

In analyses using cross-sectional data, binary responses are often encountered because of the categorical nature of the decisions—either women engage in a particular activity or not (eliciting levels of remuneration from the various income-generating activities would have been difficult and was beyond the scope of this survey). When the dependent variable can only take two values, represented as 1 or 0, qualitative or binary choice models are most appropriate for analytical purposes. Since application of a linear probability model suffers from a number of deficiencies, two transformations are frequently used, one leading to the probit model and the other to the logit model (Judge et al. 1982). Both are estimated using maximum likelihood techniques. A probit model was chosen for this analysis (as described in Maddala 1983).

In our particular case, three models were specified, where the dependent variable (Y), choice of income-earning activity(ies), equals 1 if: 1) the female respondent sells milk; 2) she chooses to collect and sell firewood; 3) she engages in petty business; and 0 otherwise.

The independent variables (denoted as X below) are defined in Table 1. The relationship between the dependent variable and the independent variables is assumed to be represented by the following equation:

$$Y = \beta_1 + \beta_2 TLU + \beta_3 TLU^2 + \beta_4 DIST + \beta_5 DIST^2 + \beta_6 AGE + \beta_7 EDUC + \beta_8 HUSB + \beta_9 PAID + u$$

It is further assumed that the error term u is normally distributed. This allows use of a probit model to estimate how the independent variables influence the probability that a woman will follow a particular income generation strategy. In technical terms, the following probit model was estimated:

$$\text{Probability (participation in an activity} = 1) = \Phi(\beta' X),$$
$$\text{Probability (participation in an activity} = 0) = 1 - \Phi(\beta' X),$$

where $\Phi(\ .)$ is the standard normal cumulative distribution function and β and X are defined as above.

Predicted Influence of Independent Variables on Dependent Variables

With respect to milk sales, a priori, the signs of the coefficients for herd size (TLUs) and distance are predicted to be positive. Women coming from households with larger herds are hypothesized to be more likely to sell milk. This is because those with larger herds are more likely to have surplus milk to sell. The coefficients for the variables recording the presence of a husband and whether the household has children in paid work are predicted to be negative. This is because the presence of a husband can lead to decreased access to milk when animals are sent to satellite camp, and having children in paid work decreases a woman's need to diversify if she receives remittances. No a priori prediction is made for the sign of the coefficient for the variable recording a woman's education status. On the one hand, educated women are generally assumed to be more likely to diversify their income sources. On the other, sale of milk is a diversification strategy based on pastoral production, and educated women may be more removed from this more traditional system. Likewise, increased distance from town could both increase a woman's probability of selling milk, as rangelands around town tend to be degraded (Keya 1998) thus decreasing production, or could decrease the probability of selling milk, due to the cost of transporting the milk to the market in town.

For firewood selling, it is hypothesized that the larger the herd the household has to rely on, the less likely the woman is to sell wood. This assumes firewood sales are a poverty induced income-generation strategy. The expected signs of the coefficients for education and children in paid work are negative. Educated women are assumed to be more likely to understand the environmental implications of participating in this activity, and also are assumed to have alternative options not available to women without formal education. The reason the coefficient for the children in paid work is expected to be negative is as described in the previous paragraph. No prediction is made as to the signs of coefficients for the other variables. For example, the further a household lives from town, the greater its access to wood, but the greater the effort required in carrying the wood to town for sale.

Education, age, and distance are expected to have the greatest influence on the probability that a woman will engage in petty business activities. Younger, more educated women living closer to town are most likely to participate in markets, since they have grown up with them. Educated women are likewise predicted to be better prepared to keep track of their business. As before, children in paid work are predicted to decrease the need for a woman to diversify. No prediction is made for the coefficients for the other variables.

Results of Regression Analysis

The results of the probit regression analysis are shown in Table 2. Consider first the factors influencing women's choice to sell milk. As expected, herd size (TLU) has a positive and significant effect on a woman's choice to sell milk. Variables with a significant and negative effect on a woman's

Table 2. Probit Estimation Results: Coefficients with Standard Errors in Parentheses

	Milk Sales	Firewood Sales	Petty Business
TLU	0.0540 ***	0.0034	0.0010
	(0.0181)	(0.0207)	(0.0172)
$TLU^2 \times 10^{-2}$	-0.0416 **	-0.0129	0.0001
	(0.0173)	(0.0245)	(0.0154)
Distance	0.2018	0.0058	-0.2832 **
	(0.1586)	(0.1279)	(0.1210)
$Distance^2$	-0.0107	-0.0031	0.0189 **
	(0.0108)	(0.0100)	(0.0093)
Age	-0.0060	0.0083	-0.0306 *
	(0.0152)	(0.0150)	(0.0179)
Education	-0.9491 *	-0.7306	0.1832
	(0.5391)	(0.4581)	(0.3885)
Presence of husband	-0.6738 *	-0.0120	-0.0421
	(0.3567)	(0.3405)	(0.3396)
Children in paid work	-0.6173 **	-0.5572 *	-0.1971
	(0.3027)	(0.3107)	(0.3061)
Constant	-0.9186	-0.7602	1.3102
	(0.9095)	(0.8697)	(0.9518)
Madalla R^2	.29	.08	.14
$c^2_{(8)}$	34.5 ***	8.4	15.1 *

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

choice to sell milk include if she is educated, has employed children, and if her husband is present.

The specified model was not able to explain the factors affecting wood sales. The only variable with a significant and negative effect on a woman's probability of selling firewood is whether she has employed children. This result implies that women with children earning an income are less likely to be gathering and selling firewood.

For petty business activities (e.g., small open-air retail outlets for tobacco, red ochre, cloth, foodstuffs, or tailoring shops), negative and significant explanatory variables include age and distance to town. Younger women living close to or in town are more likely to engage in market-based income diversification activities.

Discussion

Rendille women do not have a wide range of income-earning options when they settle in the arid area of Korr. The three options analyzed in this study are based on traditional pastoral production, natural resource exploitation, and market integration.

The option based on traditional pastoral production, milk sales, is the option most clearly influenced by household wealth status. The activity is more likely to be undertaken by women from households with large herds. However, note that the conditionality of women's rights to milk is also represented in the results. The presence of a husband decreases a woman's milk sales. While a woman has the right to sell milk, it is her husband who decides which animals remain near town where she will be able to sell their milk. This suggests the intrahousehold separation of rights over animals and rights over milk influences income-generating activities.

The income-generating strategy based on natural resource exploitation does not appear to be significantly influenced by household-level variables. This suggests that natural resource exploitation is not a poverty-induced strategy and that efforts to modify current firewood harvesting practices need to be targeted at all women, not just the poorest women.

Income generation through petty business is spatially differentiated. Access to the market is conditioned on proximity to the town center. Age also influences participation in petty business, with younger women being more likely to adopt this strategy.

Two other results merit mention. First, woman's education has either a negative influence or no significant influence. This suggests that education has not been effective at helping women diversify their income-generating activities. Second, when the number of children in paid work variable is significant, it is negative. This suggests that diversification by women in Korr is part of a larger process of household-level diversification (i.e., through salaries from employed children), and that analyzing women in isolation of other household members may not capture important variables.

This study found that the only significant predictor of whether a woman is less likely to sell firewood is if she has an employed child. However, further analysis of the data reveals that the children's level of education has no significant relationship with the children's employment status. While outside employment offers an opportunity to Rendille households, it is not clear how households can increase their children's chances of obtaining such employment, as discussed by Roth (1991).

Conclusions

Almost two out of every three women in this sample are pursuing some kind of income-generating activity. Women

are clearly adapting to the new opportunities and challenges brought about by settling near the market town of Korr. The study reveals a great deal of diversity in the economic activities women adopt and provides some insight into what lies behind the choices particular women make. This concluding section discusses the study's overall finding and draws some tentative policy conclusions.

We have used milk sales as a proxy for a pastoral-related income diversification since it is not an activity that was traditionally used by pastoral women. Not surprisingly, it is those with access to larger herds who are more likely to follow this strategy. This suggests the best way to help women pursue income diversification based on pastoral production is to increase their ability to market milk. This could include efforts that facilitate transport of milk to market centers through marketing groups or technologies that improve milk conservation. However, the results also suggest this may only provide direct assistance to wealthier households.

The factors that underlie participation in the firewood market were much harder to predict, even though it is being done by a significant proportion of the women (22%). However, women are not involved in any community-level decision making regarding environmental management efforts (e.g., environmental management committees, traditional council of elders). Clearly women have an important role to play in policies and collective action aimed at sustainable use of natural resources, and more attention should be paid to their input. The results also show that having an employed child is a factor in decreasing participation in firewood marketing. Strategies aimed at increasing employment opportunities in the region may lessen the incentive to participate in firewood marketing.

Women in Korr are involved in marketing products obtained outside the pastoral sector. However, participation in petty business was found to increase with proximity to the center of Korr town and decrease with age. Improved market organization through collective action could help lower transaction costs, as could improved transport infrastructure.

Two overall implications are drawn from these results. First, the education women have received in this area is not helping them significantly increase their economic options. Education that would help women achieve the objective of collective action and help individuals in marketing skills such as numeracy would be of assistance to women in Korr. Second, income diversification appears to be a household-level process, so that focusing on women alone may overlook important aspects of overall household income diversification. Increased employment opportunities in this region would assist households in their goal of income diversification. It would be particularly beneficial if these opportunities assist educated household members to benefit from their training and help recover past household expenditures on education.

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