When Nomads Settle: The Effects of Comoditization, Nutritional Change, and Formal Education on Ariaal and Rendille Pastoralists

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The shift to sedentism by East African pastoralists increased dramatically in the late 20th century as a result of sharp economic, political, demographic, and environmental changes. Some pastoralist groups have settled in response to political turmoil and civil war, as in Sudan, Ethiopia, and Somalia, while other groups such as Maasai and Boran in Kenya were involuntarily relocated or confined under British rule (Sobania 1988, Waller 1993). Today, many Kenyan pastoralists have settled in agricultural or urban communities to escape impoverishment and land loss as well as to obtain social services including health care and formal education. As Salzman (1980), whose title we borrowed, points out from experiences in the Middle East, much of contemporary pastoral sedentarization occurs as families shift away from pastoral specialization to seek new livelihoods through agriculture, agro-pastoralism, trade, or part- and full-time urban occupations. The trend toward sedentarization is not entirely voluntary, however. Maasai in southern Kenya, for example, have faced confiscations on their grazing lands due to growth of agricultural and pastoral populations, privatization of land for commercial farms and ranches, and the expansion of tourist game parks (Campbell 1993; Fratkin 1994, 1997; Galaty 1994; Homewood 1995; McCabe, Pekin, and Schofield 1992).

Several studies report negative social and health consequences of pastoral sedentarization, including poorer nutrition, inadequate housing, lack of clean drinking water, and higher rates of certain infectious diseases including malaria, bilharzia, syphilis, and AIDS, despite better access of settled populations to formal education and health care (Chabasse et al. 1985, Galvin, Copcock, and Leslie 1994, Hill 1985, Klepp, Biswalo, and Talle 1994, Nathan, Frankin, and Roth 1996). Despite these findings and criticism by anthropologists in the field (e.g., Dyson-Hudson 1991, Fratkin 1991, Hogg 1986, Horowitz 1993, Jacobs 1980, Little 1987), the settling of pastoral nomads in East Africa has been advocated by international development agencies such as the World Bank and USAID, as well as national governments, particularly to facilitate the integration of pastoral populations into larger commoditized livestock markets. The settling of former nomads is seen as providing benefits to the national economy, assimilating marginal populations, forging national identity, and improving the material well-being of all parties involved.

The costs and benefits of sedentarization to the pastoralists are in fact not clearly known. For the past ten years the three of us—a cultural anthropologist, an anthropological demographer, and a physician—have engaged in longitudinal research examining the biosocial concomitants of sedentism for Ariaal and Rendille pastoralists of northern Kenya (Fratkin 1991, 1998; Fratkin and Roth 1996; Fratkin and Smith 1995; Nathan, Fratkin, and Roth 1996; Roth 1990, 1991, 1993, 1994, 1996). More recently (1994–97), we initiated a systematic comparison of five Ariaal and Rendille communities ranging from fully nomadic through agro-pastoral to irrigation agriculturalist. This report summarizes our findings to date, focusing in particular on the costs and benefits of voluntary sedentarization when measured in terms of child health and nutrition, level of formal education, and degree of market integration. These three topics are vital and interrelated concomitants of sedentarization that can be measured, compared, and used to assess the degree to which the assumptions underlying policies advocating sedentarization are correct.

ARIAAL AND RENDILLE SEDENTARIZATION

Until recently Rendille pastoralists subsisted by mixed-species [i.e., camel, cattle, and small stock] pastoralism in Marsabit District, Kenya's largest, most arid, and least populated region. The Rendille live in the arid lowlands, subsisting mainly on camels' milk and the trade of their small stock (goats and sheep). The related Ariaal [Rendille who raise cattle as well as camels and small stock and speak Samburu, a Maasai dialect] live in the highlands of Marsabit Mountain and the Ndoto Mountains, subsisting on the milk and trade of their animals. Both Ariaal and Rendille supplement animal products with cereals (maize) acquired by selling livestock, usually male cattle or goats (Fratkin 1998, Spencer 1973). Having endured extensive droughts in 1968–73, 1983–84, 1992, and 1996, today over half of the Rendille population of 25,000 are settled permanently in or around four towns—Marsabit, the district capital, and the Catholic mission towns of Korr, Kargi, and Laisamis. Sedentarization was brought about by both ecological decline and the active intervention of government and international
development and religious organizations seeking to facilitate famine relief efforts, encourage wider market integration, and, in the case of religious missions, engage in religious proselytism [Fratkin 1998].

A prevalent theme in our investigation of Rendille sedentarization is that it constitutes an ongoing process consisting of constraints and opportunities, attracting both wealthy and poor members of the pastoral community. Our research shows that it is mainly poor people whose livestock herd sizes decline below 4.5 livestock units per person, rendering them no longer capable of subsisting off their herds, who migrate temporarily or permanently to towns. These impoverished herders range from 10 to 40% of the population, depending on drought and other conditions [Fratkin and Roth 1990]. At the same time, wealthier Rendille and men with several wives often move part of their families to town to take advantage of new opportunities and to find physical security.

In 1990 we began a longitudinal study comparing one nomadic and two sedentary Ariaal and Rendille communities, evaluating women and their children under six years old for diet, nutritional status, fertility, morbidity and anemia [Nathan, Fratkin, and Roth 1996]. In 1994 we expanded our original study population to compare five communities selected for different economic practices and microenvironmental adaptations. These communities are as follows:

1. Lewogoso Lukumai, a nomadic camel-, cattle-, and small-stock-keeping settlement of approximately 250 people practicing mixed-species husbandry. This community forms a control community for the comparison of the sedentary villages.

2. Ngurunut, a sedentary agro-pastoral community of approximately 1,200 people located in a forested valley in the Ndoto Mountains. This community has a church, school, and small dispensary but is isolated and not well integrated into marketing activities.

3. Korr, a new town in the arid lowlands of the Kaisut Desert below Marsabit Mountain created initially by the Catholic diocese to feed destitute Rendille during the famine of the 1970s. Today Korr has a resident population of about 6,000, with seminomadic Rendille settlements around it. Korr has poor marketing facilities, although the town provides a local market for surrounding pastoralists.

4. Karare, a settled highland community on Marsabit Mountain about 17 km from Marsabit. Its 2,000 residents both keep cattle herds and raise dryland maize. Karare has access to good marketing facilities as well as a large urban population and is located on the major truck road from Nairobi to Addis Ababa. Karare women sell milk on a regular basis to townspeople.

5. Songa, a highland agricultural community of 2,000 people founded by American missionaries from the African Inland Church in 1973 in a forest on Marsabit Mountain. Practicing drip irrigation, Songa’s population grows maize, kale, peppers, tobacco, and the stimulant mira’a [Catha edulis] for sale in Marsabit town. Its residents resemble highland agricultural communities of Kenya more than their camel-keeping kin in the desert below.

Sedentism and Commoditization

East Africa pastoralists have long exchanged livestock for agricultural products with their farming neighbors (Sobania 1980, Spear 1997). Today pastoralists consistently sell 5–10% of their herds, with higher offtake occurring in response to higher prices or the need for grain during drought, when milk supplies are low [Little 1994, O’Leary 1999]. Most pastoralists raise livestock for daily food consumption, and production is subsistence-based rather than market-oriented. However, international development assistance from USAID and the World Bank encourage commoditization of livestock production, particularly of beef for domestic markets, and pastoralists are finding their lands increasingly privatized for commercial production [Galaty 1999].

While the Rendille, living in the more arid north, have not faced as much pressure for grazing lands, they have increasingly entered the livestock market in the past 20 years. The study communities produce a variety of agricultural livestock products for exchange, including seasonally available vegetables [kale, tomatoes] from Songa, cattle milk from Karare, and cattle and goats from all sites except Songa. Market destinations vary, Songa vegetables and Karare milk being bought daily by foot to the market of Marsabit town while livestock from the lowland communities of Korr, Ngurunut, and Lewogoso are either sold to local butchers or taken down-country to the larger market at Isiolo, near Mt. Kenya.

The effects of sedentarization and commoditization appear varied, reflecting access to markets, type of large stock raised, and the effects of drought. Comparing 1995 annual livestock sales data from lowland Korr [145 households] with those from highland Karare [251 households] for the same year, we found that the two communities differed markedly. Residents of Korr who keep camels and small stock sold mainly goats for local consumption, while Karare residents earned three times as much income as Korr by selling cattle and milk products in both local and national markets (table 1). Karare is more fully integrated into the commercial livestock market than Korr. Karare is located on the main road, close to the major market at Marsabit town, whereas Korr is an isolated mission outpost 45 km from the main road.

<table>
<thead>
<tr>
<th>TABLE 1: Average 1995 Household Livestock Ownership and Sales by Size Category in Korr and Karare</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stock Owned</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Korr</td>
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<tr>
<td>Karare</td>
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</tbody>
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Although camels are readily bought and sold in neighboring Somalia and Saudi Arabia (Little 1994), the Kenyan government has not encouraged the marketing of camels, and Rendille are reluctant to sell their camels because of the slow rate of herd growth (Spencer 1973).

We also can assess market integration over time for nomadic Rendille, represented by the Ariaal community of Lewogoso Lukumai, for which we have data on livestock ownership and transactions for 1976–96. In 1976, Lewogoso pastoralists sold 11% of their cattle and 14% of small stock. In 1985, following the severe famine of 1982–84, sales dropped to 8% of cattle and 5% of small stock. In 1996 Lewogoso sold 26% of their cattle and 21% of their small stock, a 100% increase in cattle sold since 1976 (table 2). These increased livestock sales, as well as increased prices for animals, raised average Lewogoso household incomes dramatically, from $175 in 1976 and $182 in 1985 to $655 in 1996 (all standardized in 1996 dollars). The last figure is far in excess of the average livestock sale values recorded in 1995 for the sedentary communities of Kor and Karare. We attribute this dramatic increase in offtake largely to the high costs of maize, health care, and school fees. These costs increased 300% between 1976 and 1996, in no small part because of World Bank structural adjustment policies ending price supports and cutting social spending in Kenya throughout the 1990s. Ariaal pastoralists sold proportionally larger numbers of their animals in response to greater cash needs but perhaps also in response to greater animal surpluses, particularly of small stock in 1996. The ability of nomadic pastoralists to increase their herd size may be related to the out-migration of poorer pastoralists from the livestock economy, allowing fewer pastoral households grazing opportunities to increase their herd size.

Overall, these results show mixed results for commoditization with sedentism for the Rendille, based on ecological, economic, geographical, and historical factors, with type of livestock raised, distance from market, and drought all affecting sales. Most surprising, the 1996 nomadic sample of Lewogoso showed far higher average livestock sales than either of the two sedentary communities for 1995, indicating no linkage between sedentism and increased commercialization.

Sedentarization and Child Nutrition

Market integration of rural producers in Africa may have both positive and negative consequences for child health and nutrition. Sales of agricultural commodities may diminish child nutrition when they lead to replacement of high-calorie or -protein foods by cheaper, poorer ones (Lappé and Collins 1977). However, other studies report improved child nutrition associated with commercial agriculture when, as among Taita farmers of Kenya (Fleuret and Fleuret 1991), it is combined with subsistence production. Emsinger’s (1991) study of the economic transformation of the Orma of Kenya found increased residence in market centers and agricultural commercialization associated with improved nutritional markers (weight for height) for adults and male children but not for female children.

Until recently, little was known about the health and nutritional consequences of sedentarization for pastoralists. Nutritional studies have now been conducted among both nomadic and settled pastoralists. Works on Turkana (Galvin 1985, 1992; Little, Gray, and Leslie 1993; Shell-Duncan 1994, 1995), Maasai (Nestel 1986), Fulani (Hilderbrand 1985), and Rendille (Nathan, Pratkin, and Roth 1996) describe traditional pastoral diets as protein-rich but calorie-poor, with milk providing the daily food supplemented by meat and blood and by cereals obtained by trade during the dry seasons. Milk, meat, and blood contain animal protein, fat, calcium, and iron and supply more than 200% the recommended daily intake of protein among Masai and 400% among Turkana (Galvin, Coppock, and Leslie 1994). Vitamin and most mineral deficiencies are rare. However, iron deficiency is high, particularly among women and children, who consume large quantities of milk but have less access to meat and blood than men. The main nutritional challenge for pastoralists is obtaining sufficient calories daily, as the calorie content of milk is low and the seasonal variation in milk yields is high. Most pastoralists supplement their livestock-based diet with grains to provide carbohydrate calories and attempt to maintain their food supply in times of drought (Galvin, Coppock, and Leslie 1994, Nathan, Pratkin, and Roth 1996).

Health consequences attributed to pastoral sedentarization include increased iron-deficiency but overall decreased morbidity among pastoralist Turkana when com-

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**Table 2**

<table>
<thead>
<tr>
<th>Date</th>
<th>Sample Population</th>
<th>Owned Per Capita</th>
<th>% Sold</th>
<th>Owned Per Capita</th>
<th>% Sold</th>
<th>Owned Per Capita</th>
<th>% Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>249</td>
<td>5.01</td>
<td>11</td>
<td>2.14</td>
<td>0</td>
<td>9.77</td>
<td>14</td>
</tr>
<tr>
<td>1986</td>
<td>239</td>
<td>3.37</td>
<td>8</td>
<td>2.74</td>
<td>0</td>
<td>12.62</td>
<td>5</td>
</tr>
<tr>
<td>1996</td>
<td>105</td>
<td>3.84</td>
<td>26</td>
<td>3.44</td>
<td>0.19</td>
<td>19.0</td>
<td>21</td>
</tr>
</tbody>
</table>
pared with settled fish-eating Turkana [Murray, Murray, and Murray 1980]. In another comparison, Chabasse et al.’s [1985] study of the health and nutritional status of pastoral and sedentary populations in Mali revealed that nomadic groups have higher rates of tuberculosis, bronchitis, syphilis, trachoma, and child mortality [children five and under], attributed to differences in health care services. Settled agricultural populations, however, had higher rates of bilharzia, intestinal helminths and other parasites, malaria, and anemia attributed to their riverine locations.

Recently we published results of pilot studies conducted in 1990 and 1992 recording anthropometric, nutrition, and morbidity data for children and their mothers at three of the five study sites, Korr, Ngurunit, and Lewogoso [Nathan, Fratkin, and Both 1996]. These constituted cross-sectional data gathered at the same point of the annual cycle, the end of the long dry period, for two very different years, 1990 [a “normal” year of about 500 mm of rain] and 1992 [a “drought” year, with total rainfall less than 250 mm]. The end of the dry season is the most dangerous period for human health in pastoral societies. The lack of rainfall translates into decreased forage production, reduced milk production, and low levels of fat and protein consumption at a time of increased human activity associated with longer trips with animals to find graze and water. It was our working hypothesis that commoditization under sedentary conditions would alleviate drought stress by providing a more consistent diet through purchases of grain. We were wrong. When we calculated the percentage of children malnourished—defined as falling below two negative standard deviations from the median values of the reference population for the World Health Organization [1983] reference standards for the age-independent measurement of weight-for-height—the results showed far fewer cases of child malnutrition in the nomadic community of Lewogoso than in any of the sedentary communities.

In the present analysis this approach was expanded to include all five communities during the 1992 drought year. As shown in figure 1, adding Songa and Karare only confirmed the pattern previously detected, with all sed-

**FEMALE CHILDHOOD EDUCATION**

One potential advantage of town life is increased education for pastoral children. Most growing towns in northern Kenya have elementary schools with burgeoning enrollments. Today education represents a tremendous potential engine for both demographic and social change, female education being one of the most important factors associated with mortality and fertility decline in Kenya [Brass and Jolly 1993, Down et al. 1994]. Caldwell [1979] first called attention to the role of female education in lowering both mortality and fertility rates.

![Fig. 1. Malnourished children by community, 1992.](image)

![Fig. 2. Cups of milk per day by community, means and standard deviations.](image)
His analysis of Nigerian surveys revealed that mother's education was a far more important determinant of childhood mortality than familial economic markers, including father's occupation. Caldwell (1982) also argued that female education leads to increased autonomy, exhibited in the use of modern contraceptives, a prediction borne out throughout sub-Saharan Africa [National Research Council 1993].

A more neglected aspect of the education-demographic link is that dealing with parental decisions about which children to enroll in primary school. Attendance at school means that the child is at least partially removed from the household labor pool, to which children in Third World settings make significant contributions from an early age. Culture-specific patterns may also influence parental decisions about schooling. In a study of Rendille childhood education based on survey data collected in Korr in 1987 [Roth 1991], boys were overwhelmingly chosen more frequently than girls to attend school. Since young women reside away from their natal homes after marriage, the benefits of education accrue to the groom's household, while the expense of girls' schooling, represented by lost labor in addition to school fees, will be borne by their parents. Ten years later, the survey was repeated in the same study site, yielding a 1996 sample of 546 school-aged children drawn from 145 households. Logistic regression analysis assessed the effect of independent variables upon the dependent dichotomous categorical variable formed from "yes/no" responses to a question whether each child had ever attended school. Independent variables included the following: (1) WEALTH, "poor" or "wealthy" by the median per capita level of the tropical livestock unit (1 camel = 1 TLU, 1 cow = 0.8, 1 small stock = 0.1), an indicator of household resources; (2) BIRTH, either first-born or later; (3) SEX; (4) AGE-SET, distinguishing between parents of age-sets initiated before 1962 and others; and (5) SIBS, having one or more siblings chosen for school or no siblings so chosen. Analysis used the LOGISTIC procedure on the SAS system, Release 6.12, employing the backward elimination option to remove nonsignificant independent variables [step 1, SIBS, Wald $\chi^2 = 0.2603$, Pr > $\chi^2 = 0.6099$; step 2, BIRTH, Wald $\chi^2 = 0.8910$, Pr > $\chi^2 = 0.3452$; step 3, WEALTH, Wald $\chi^2 = 2.5955$, Pr > $\chi^2 = 0.1072$]. The results [table 3] reveal that only two variables, AGE-SET and SEX, are statistically significant. The AGE-SET variable indicates that parents from earlier age-sets are only half (odds ratio = 0.49) as likely to send a child to school as parents from more recent age-sets.

This points to a change in parental decision making over time. However, no trend is found for selection of children, boys still being two and one-half times (odds ratio = 2.46) more likely to attend school. Thus, ten years after the original study, sedentary Rendille families at Korr are increasingly sending their children to school, but the potential for demographic and social change from female education still appears unfulfilled.

**CONCLUSIONS**

Sedentarization is rapidly occurring among pastoral populations throughout Africa. For Rendille pastoralists, sedentism and commoditization have increased in the past 30 years, "pushed" by the forces of drought, political insecurity, and loss of grazing lands and "pulled" by attractions of town life including access to livestock markets, wage-paying jobs, schools, and health clinics. Our research perspective is that sedentarization represents both opportunities and costs for formerly nomadic pastoralists. From the present analysis these costs and benefits include the following:

1. Sedentarization does not provide equal marketing opportunities for sedentary pastoral communities. Historical, political, and ecological factors distinguish pastoral communities that have better access to markets and sell more valuable commodities from those that do not, exemplified here by the marketing of cattle rather than camels and small stock. Furthermore, commoditization does not appear to be correlated with sedentarization. Nomadic Lewogoso surprisingly featured far higher average household incomes from livestock than either of the two sedentary communities of Korr and Karare.

2. Contrary to our initial predictions, town life does not appear beneficial to the nutritional status of children. The nomadic community control sample from Lewogoso displayed far lower levels of child malnutrition. We attribute this to their access to livestock herds providing milk for both children and adults. This suggestion is based on our findings of nonsignificant differences in childhood morbidity among all five communities despite the sedentary populations' easier access to health care interventions and higher levels of vaccinations against polio, diphtheria-tetanus-pertussis, and measles.

3. Not everyone benefits equally from town life. While town life offers the opportunity for public education for all pastoral children, analysis of parental decision making from the sedentary community of Korr reveals that

**TABLE 3**

Results of Logistic Regression Analysis with Dependent Variable Yes/No Response to Question "Has This Child Ever Attended School?"

<table>
<thead>
<tr>
<th>Variable</th>
<th>D.F.</th>
<th>Parameter Estimate</th>
<th>Wald Chi-Square</th>
<th>Pr &gt; Chi-Square</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE-SET</td>
<td>1</td>
<td>-0.7718</td>
<td>10.7299</td>
<td>0.0011</td>
<td>0.491</td>
</tr>
<tr>
<td>SEX</td>
<td>1</td>
<td>0.8981</td>
<td>15.7488</td>
<td>0.0001</td>
<td>3.455</td>
</tr>
</tbody>
</table>
educational opportunities continue to be greater for boys than for girls. While more and more children are being sent to school, a pattern of male bias is consistent over a ten-year period, with girls being selected for schooling less than half as frequently as their brothers.

Each aspect of this analysis has produced results not predicted by our own previous models of pastoral sedentarization and those of national governments and international assistance organizations. Faced with economic, ecological, and political pressures, pastoralists will respond with a variety of strategies including increased marketing of livestock and their products, urban migration, wage labor, and agriculture. Equally important, not everyone, even within the same community, will be affected in the same way by these changing behaviors. Instead, some will benefit, others will pay a cost, and yet others will remain unaffected. Furthermore, analysis to date shows that this variation will hold at different levels, exemplified by community variation in child nutrition and livestock marketing, family variation represented by poor and wealthy families’ becoming sedentary, and individual variation in the selection of children for public education. Our continuing research focuses on variation between and among individuals, families, and communities with the goal of understanding this variation within the historical, ecological, and social contexts of each specific case of pastoral sedentarization.

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