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# Seeking Alternative Livelihoods in Northern Kenya: Costs and Benefits in Health and Nutrition

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## **Seeking Alternative Livelihoods in Northern Kenya: Costs and Benefits in Health and Nutrition**

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The seeking of alternative livelihoods by former pastoralists is not a new phenomenon in East Africa, as many nomadic livestock keeping people have historically utilized ties with foraging, farming and more recently urban communities in times of drought and conflict. But the settling of former pastoralists has increased dramatically in the past half century, driven mainly by impoverishment and stock loss due to reduced mobility, drought, raiding, and political instability while simultaneously attracted to the benefits of settled life including food security and physical security, health care, formal education, and new economic opportunities. Former pastoralists have settled in rural, urban, or peri-urban settings to seek new livelihoods as farmers, agro-pastoralists, and town dwellers engaged in trade, wage labor, and craft production. Formal education has been a primary benefit to children in these communities who as adults have pursued employment in government, business, and non-government organizations.

Alternative livelihoods in northern Kenya are based on a variety of strategies, including the marketing of livestock, dairy products, hide and skins, and cultivated crops; a variety of wage-earning occupations ranging from professional to manual labor; and entrepreneurial activities including shop keeping, craft production and sales, and transportation. With the exception of livestock, women play a key role in petty commodity trade activities, particularly the sale of garden vegetables, tobacco, and *mira'a*, (*khat*), and at lower rungs of the economic ladder, firewood or charcoal sales, beer brewing and prostitution. Alternative strategies for men include wage earning labor in construction, truck driving, security work, farm work, and shop employment, and entrepreneurial occupations including shop keeping, construction, and transportation. Education has played an increasing important role, particularly in obtaining professional employment in hospitals and health clinics, government offices, military and police, and employment in non-government organizations.

This paper looks at the experiences of recently settled Rendille and Ariaal (mixed Rendille/Samburu) communities in Marsabit District in northern Kenya. In particular we report on our earlier research on the effects of settled life on diet and nutritional changes as well as changes in morbidity former pastoralists experience with settling, whether on farms, towns, or famine relief communities. Alternate livelihoods have been accompanied by greater food security (buying food, access to relief foods, or growing of crops), improved health care particularly vaccinations and malaria interventions, and increased participation for children in formal education which can result in salaried employment. Health costs included nutritional declines in women and children, where there was a greater degree of both stunting and wasting among settled children compared to nomadic livestock keeping communities, and greater risk of respiratory, diarrheal, and sexually transmitted diseases including HIV/AIDS. Malaria remained consistently high for all lowland communities – settled and nomadic alike, and continues to pose

a principal cause, with diarrheal diseases, of mortality in children (Fratkin et al. 2004; Fratkin and Roth 2005).

### **Factors Leading to Alternative Livelihoods**

*Population Growth* - Kenya, Tanzania, and Uganda continue to have among the world's highest population growth rates (2.6%, 2.9% and 3.1% annual increase respectively in 2010). Rapid population growth has affected rural and urban areas alike, where farmers increasingly move onto less productive lands to raise their crops and families. Furthermore, pastoralists have increased farm cultivation, leading to a loss of pasture and water resources for pastoral production. In the more arid north of Kenya where agriculture is possible only in isolated highlands, population growth in both herds and humans has led to increasing competition with pastoral neighbors for pasture and water, leading to recent armed attacks between Turkana and Pokot, Boran and Rendille, Turkana and Samburu, and Somali and Boran.

*Drought and Famine* - Drought has occurred with greater frequency in the second half of the 20<sup>th</sup> century compared to the first, with severe droughts reported in Kenya in 1960-61, 1968-69, 1974-76, 1979-81, 1991-93, 1996, 2000, 2008-09. Pastoralists have historically adapted to conditions of drought or low and erratic rainfall by physical mobility, dispersion of their herds and people, and seeking different food sources through fishing, hunting, gathering, and agriculture. Today pastoralists have added new options including migration to famine relief centers, urban migration for wage labor, and the widespread adoption of agriculture.

*Loss of Common Property Resources* - Since Independence, Kenya has moved away from recognizing communal land tenure in favor of individual tenure rights. In pastoral Maasai regions the government established "group ranches" in the 1960s and subsequently promoted private and individual land titles since the 1980s, leading to a scramble for land similar to the American West in the 19<sup>th</sup> century (Galaty, 1994). Kenyan and Tanzanian pastoralists have also lost former grazing lands to national game parks including Amboseli, Mara Masai, Tsavo, and Samburu Parks in Kenya and the Serengeti, Ngorongoro Crater, and Mkomazi in Tanzania (Brockington, 1999; Homewood, 1995). While pastoralists in northern Kenya's Marsabit District live in more arid and less populated conditions, they too are experiencing land crowding and, in highland locations including Marsabit Mountain, are beginning to privatize and title farm plots (Adano and Witsenburg 2005).

*Commoditization, Sedentarization, and Urban Migration* - Pastoralists have modestly shifted their economy from subsistence to commercial production. Both the demands and opportunities for market sales of livestock in northern Kenya have increased substantially in the past twenty-five years, as have opportunities for wage labor (McPeak and Little 2005). However, increased commoditization of the livestock economy has benefited those with large livestock herds, allowing them to remain in the pastoral economy, while those without sufficient herds often migrate out of the pastoral economy and seek jobs in towns or livelihood on farms (Fratkin and Roth, 1990).

*Political Turmoil, Civil War, and State Intervention* – Although not experiencing the civil wars of neighboring Sudan, Ethiopia, Uganda, and Somalia, northern Kenya has seen its share of

violence, mainly from banditry and inter-ethnic livestock raiding in an area not well policed. This has increased in the 1990s and 2000s; more recently, police interventions have been harsh. As reported in other areas of Africa, political conflict and violence has negative effects including economic disruption, displacement, and moves to refugee centers as both internally displaced and internationally displaced persons, although studies among Tuareg in Mali show no significant demographic shifts in reproduction (Randall 2005).

Broadly speaking, sedentarization is the process of individuals, households, or entire communities of formerly nomadic populations settling into sedentary, non-mobile, and permanent communities seeking alternative livelihoods. Sedentism is neither a recent event nor a unidirectional process, and has occurred in many regions of the world at different points in history. Fulani pastoralists in West Africa long have had ties to sedentary agricultural villages and mercantile towns, trading or selling livestock, leather, and meat for grains and other commodities (Bayer and Waters-Bayer 1994). In East Africa, pastoralists obtained necessary grains by trading regularly with agricultural neighbors (e.g. Maasai with Kikuyu in the 19<sup>th</sup> century (Waller 1993)), or taken up agriculture themselves, as did the Arusha or “agricultural” Maasai (Spear 1997). In the 20<sup>th</sup> century, many Maasai settled near roads for access to cattle markets, while in northern Kenya, Boran and Samburu cattle herders provided beef and milk to both colonial administrators and growing towns (Adano and Witsenburg 2005). Maize cultivation is becoming increasingly important for Maasai pastoralists living in southern Kenya and northern Tanzania McCabe et al. 2010). In addition to cultivation, pastoralists have also settled near urban areas to market milk, meat, and livestock (Little 1994; Salih and Baker 1995).

### **Features of Sedentarization**

1. *Sedentarization represents an alternative economic strategy as part of a larger set of diversification strategies.* Diversification is an essential component of pastoral decision making to cope with varying and unpredictable resources. Pastoralists practice multi-species herding, enabling them to utilize different herding environments. Similarly, settled life in towns and farms represents additional resources, where one can take up, permanently or temporarily, farming, wage labor, or entrepreneurial activities including shop keeping, livestock marketing, charcoal or beer production, etc.

2. *Sedentarization does not result in a sharp break with the pastoral community or economy.* Former pastoralists living in towns or farms often own livestock which are herded by kinsmen or friends in the pastoral economy, or divide up their households with some members farming and others herding. Grain for livestock exchange or herding labor is maintained by social ties and ritual life (marriages, age-set rites) and serve to keep the pastoral and agricultural/town communities integrated. Sedentarization is a process that operates along a continuum from highly mobile pastoral households to permanently settled households, of which individuals may move from one domain to the other.

3. *Sedentarization does not imply one type of lifestyle or economic activity, but includes a range of economic choices.* Some communities, including Ariaal and Boran on Marsabit Mountain, are sedentary livestock keepers who graze and water their cattle from permanent homes on the mountain, while taking advantage of schools, dispensaries, and markets in Marsabit town. Other

communities may be exclusively agricultural, including the Rendille living in Songa or Boran at Badessa on Marsabit Mountain. In the lowlands, pastoralists live in close proximity with their animals to towns, including Gabra near Maikona or Rendille near Korr, while impoverished pastoralists may live in town and depend on famine relief foods or odd jobs such as house cleaner or watchman for a living.

4. *Sedentarization is usually accompanied by larger socio-cultural change.* Despite ties to the pastoral communities, settled townspeople and farmers often undergo dramatic changes in customs and relationships, including a departure from communal and kin-based relations in the pastoral communities to individualized identities in the towns and farms. For settled Rendille in the farming community of Songa, former age and gender roles break down, including the collective power of male elders to control younger men (Smith 1999). There is also a breaking down of the “moral economy” of redistribution, where women living on isolated farming plots no longer share food with others as they did in the pastoral setting. But some women also benefit from new opportunities denied them in male dominated livestock economy including in the selling of milk or vegetables which allows them modest but not insignificant income (Fratkin and Smith 1995). Other women may be forced by poverty to depend on beer brewing and prostitution to survive in the urban economy, increasing their exposure to HIV/AIDS and other sexually transmitted diseases (Klepp et al., 1995).

5. *Sedentarization entails costs and benefits.* Former pastoralists living in settled communities often have increased access to health care, formal education, and markets, but they may also incur losses in nutritional status and new health hazards, particularly women and children (Nathan et al., 1996; Sellen, 1996; Fratkin and Roth 2005). Although towns provide increased access to health clinics and vaccinations, there are higher respiratory and diarrheal disease rates among children living in towns, with particular differences between highland and lowland residences. Breastfeeding mothers living in highland farms suffer more malnutrition than women living in lowland pastoralist communities, as protein-poor grains replace milk as a staple food (Fujita et al. 2004). However, settled life also results in explicit benefits. McPeak and Little (2005) point to education and wage labor as important strategies to avoid risk, where having one employed child can guarantee food security for an entire household. Roth and Ngugi (2005) point to the importance of educating females, despite the strong bias for male education, and correlate female’s education to knowledge about and reduction in sexually transmitted illnesses.

### **Alternative Livelihoods in Marsabit District**

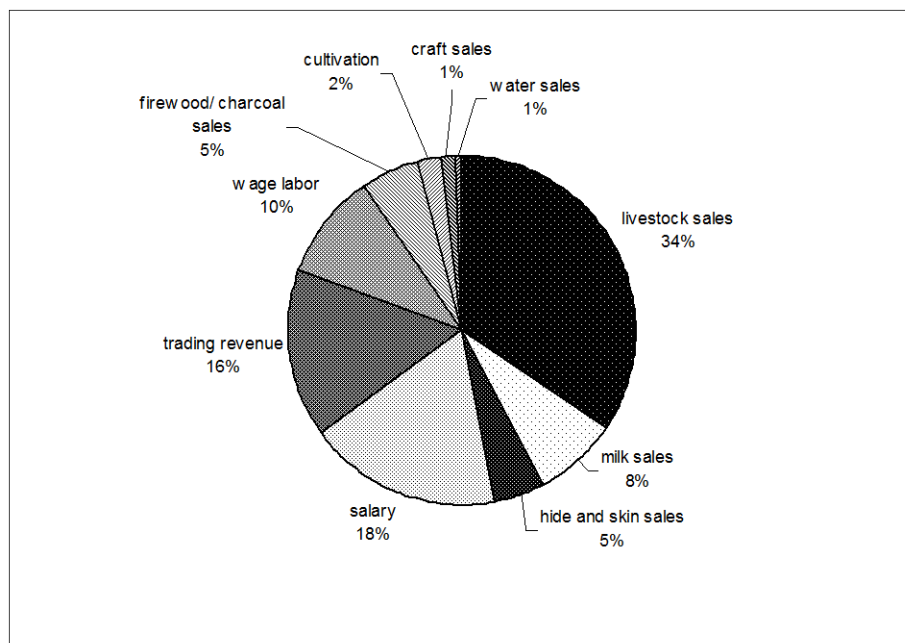
The idea of sustainable livelihoods was initially raised in the work of Robert Chambers (1983; Chambers and Conway 1992) who focused on assessing rural livelihoods in light of rural poverty, marginalization, indigenous knowledge and survival strategies. They define livelihood as a means of living and the capabilities, assets, and activities required for it. Livelihood is defined as sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, provide sustainable livelihood opportunities for the next generation, and generate net benefits for other livelihoods at the local and global levels, in both the short and long terms (Chambers and Conway 1992). The term gained currency after the appearance of the Brundtland Report “Our Common Future,” (1987) and became a critical element of “good development,” in the words of Ian Scoones, focusing on the ability of a system

and individuals within it to bounce back from shocks and stresses and adopting stable states (Scoones 2007: 590-91). Scoones developed the notion of sustainable livelihoods:

The framework shows how, in different contexts, sustainable livelihoods are achieved through access to a range of livelihood resources (natural, economic, human and social capitals) which are combined in the pursuit of different livelihood strategies (agricultural intensification or extensification, livelihood diversification and migration). Central to the framework is the analysis of the range of formal and informal institutional factors that influence sustainable livelihood outcomes” (Scoones 1998:1).

John McPeak and Peter Little (2005) working with the PARIMA project (Pastoral Risk Management Project of the Global Livestock Collaborative Research and Support Program, Coppock 2004; Gebru et al. 2003) studied alternative livelihood strategies in six pastoral, agro-pastoral, and agricultural communities in northern Kenya, representing different pastoral ethnic groups of the region including Ariaal, Boran, Gabra, Il-Chamus, Rendille, and Samburu. Drawing a composite of income generating strategies, they found the following distribution of activities:

Livestock Sales	34%
Salary	18%
Trading revenue	16%
Wage labor	10%
Milk sales	8%
Hide and skin sales	5%
Fuelwood/charcoal sales	5%



(Mcpeak and Little 2005:95)

McPeak and Little drew several important conclusions from their study:

1. Larger herds tended to be concentrated in drier areas, and where herders derived a higher share of their income from livestock and livestock production. They also had more milk available for home consumption;
2. Those herders who were more mobile suffered lower losses during drought. Those household with larger herds before the drought had larger herds after the drought, showing that herd accumulation at the household level provided a self insurance role;
3. Areas with higher share of income from non-pastoral sources had higher welfare in terms of higher income, higher expenditures, and lower variability in the measure of milk value plus expenditure. In some cases they were more food secure because they could convert wages into food purchases;
4. Formal education played an important role in how households earned their income and coped with food insecurity. Areas where household member spent more time in formal education drew higher shares of their income from non-pastoral sources and had higher incomes and expenditure levels, including food. There was an inverse relationship between enrollment in school and education. They concluded that investment in formal education for children in order to obtain salaried jobs was one of the most significant diversification strategies employed by these households.

Another extensive research project was carried out by Wario Roba Adano and Karen Witsenburg on pastoral sedentarization and livelihood on Marsabit Mountain. This area has attracted 30,000 settlers in the past 40 years, mainly impoverished Rendille and Boran who settled on church initiated agricultural schemes and who engaged in cultivation and agro-pastoralism. The District capital of Marsabit has also attracted Burji agriculturalists and shop-keepers from a variety of ethnic backgrounds including Amhara, Somali, Indian, and Kikuyu. As with McPeak and Little's study, they found a strong correlation between household income, children's education, and livestock wealth. Income from arable farming was much more meager, relying on market sales of women grown vegetables including kale, tomatoes, *khat* (*Catha edulis*) and tobacco, although Maize brought in considerably more income, averaging 1000 kg per household in many of the households. Nevertheless, the authors found that each household needed 253 kg of maize per year to be self sufficient in grain, and only 12-20% of households on Marsabit Mountain reached that level. In both scheme and non-scheme farms, only 3% of households earned Ksh. 2100 per capital per month, which is the same proportion of those living above the poverty level of US\$1 per person per day (Adano and Witsenburg 2005:125).

How does one judge the success of alternative livelihoods? Several studies of settling of former nomads point to problems of impoverishment and destitution (Hogg 1986; Little 1985) which may particularly affect women (Talle 1988), while others point to increased marketing benefits (Ensminger 1992; Sato 1997; Zaal and Dietz 1999) including those to women selling milk and agricultural products (Fratkin and Smith 1995, Little 1994; Waters-Bayer 1988). 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; Fratkin *et al.* 2004; Fratkin and Roth 2005; Galvin *et al.* 1994; Hill 1985).

The South Turkana Ecosystem Project of the late 1980s carried out extensive research on ecology, health, nutrition, and fertility of nomadic Turkana (Little and Leslie 1999); they also looked to a lesser degree at health and nutrition among settled farming Turkana populations. Researchers found that settled Turkana experienced reduced fertility, increased morbidity (particularly from malaria) and increased child mortality. Settled children under five showed more growth stunting than nomadic children, although settled children over five were heavier, which is attributed to greater role of carbohydrates in their diets, particularly for children receiving supplemental feeding in schools. Nomadic Turkana women, however, were taller, heavier, and had lower blood pressure than settled women (Brainard 1990; Galvin 1992; Little *et al.* 1988; Little and Leslie 1999).

### **Case Study: Rendille and Ariaal of Northern Kenya**

In the 1990s we, a cultural anthropologist, medical doctor, and demographer, undertook a three year study examining differences in maternal and child health and nutrition in five Rendille and Ariaal (Samburu/Rendille) communities in Marsabit District (Fratkin *et al.* 2004; Fratkin and Roth 2005; Nathan *et al.* 1996). Our intention was to compare health and nutritional outcomes of different livelihood strategies, ranging from livestock based pastoralism to settled communities engaged in agro-pastoralism, cultivation, town incomes, and famine relief dependence. In particular we looked at health and nutritional consequences of these different strategies particularly as they affected women and children, those most vulnerable to disease risk (Panter-Brick 1998).

### **Diet and Nutrition**

Pastoral diets generally are characterized as high in protein but low in calories, with marked seasonal variation in both protein and energy content (Galvin and Little 1999; Little *et al.* 1993). During dry periods as milk supplies diminish, small stock are increasingly sold to purchase foods particularly grains (maize meal or *posho*) and other carbohydrates (sugar to mix with tea). The milk-based, high-protein diet of pastoralists, nonetheless, appears to contribute positively to their adaptation to a highly seasonal environment with limited resources for dietary energy (Galvin and Little 1999). The positive ramifications of a pastoralist high-protein diet may be particularly significant for infants, pregnant women, and lactating mothers, who are particularly at risk from poor environments (Panter-Brick 1997). Since protein is an indispensable nutrient for reproductively active pastoral women and for infants and growing children (Young and Jaspers 1995), the potential protein loss associated with agricultural sedentism may also have a negative impact on maternal nutritional health.

Market integration may have both positive and negative consequences on child health and nutrition. Sales of agricultural commodities may diminish child nutrition when they lead to substitution of cheaper, poorer foods for high calorie or protein ones (Lappé and Collins, 1977). However, other studies report improved child nutrition associated with commercial agriculture



when combined with subsistence production in various production strategies of Taita farmers of Kenya (Fleuret and Fleuret 1991).

Diets change when pastoralists settle. Pastoral diets generally include more protein (mainly from milk) but fewer calories than do sedentary diets, and both protein and energy content vary markedly with seasonal rainfall (Galvin and Little 1999; Sellen 1996). The lean seasons for northern Kenya occur at the end of the two dry seasons (November-March and May-August) when livestock water and pasture become scarce in turn limiting availability of drinking water and milk for human consumption. During dry periods, pastoralists are forced to sell their small stock to purchase foods, mostly grains (maize meal called *posho*) and other carbohydrates, including sugar to mix with tea. The milk-based, high-protein diet of pastoralists, nonetheless, appears to give them a nutritionally adaptive advantage, despite its seasonal fluctuations and overall limited energy content

However, former pastoralists who have settled and engage in the commercial livestock economy or cash-crop agriculture may have a wider economic resource base than pastoral communities. This allows them not only to alleviate seasonal fluctuation of food availability but also to widen the variety of food in their diet. Typically, there are contrasting seasonal patterns of nutritional stress between agriculturists and pastoralists. Critical periods for agriculturists coincide with the food shortage and high labor demand associated with farming and harvesting during the pre-harvesting time (Simondon et al., 1993: 166). Families with sufficient agricultural and/or pastoral resources will be able to even out the seasonal stresses associated with each subsistence mode. By contrast, poorer families who rely on smaller pastoral or agricultural holdings for their subsistence and cash income are more likely to experience seasonal stresses distinct from those of wealthier families.

### **Morbidity and Mortality**

Health problems among pastoral populations include high rates of malaria, STDs, accidents; contagion from livestock including anthrax, trachoma, brucellosis, tuberculosis; reduced risks of 'settled' diseases including measles, cholera, worm loads; and poor access to health clinics, medicines, and vaccinations (Sheik-Mohamed and Velema 1999).

Under-five mortality in Kenya is high at 84 per thousand. (UNICEF 2010). The major infectious killers of Kenyan children remain diarrhea, acute respiratory infection, and malaria, with measles declining precipitously in many areas due to effective immunization. HIV/AIDS is a risk for childhood mortality. Our research aimed at discovering differences in childhood morbidity among settled and nomadic Rendille in northern Kenya.

Over a 35 month period (1994-1997) we compared levels of child malnutrition and morbidity among five different Rendille and Ariaal communities based on analysis of bimonthly dietary recalls, anthropometric measurements, morbidity data, and economic differentiation and specialization among 200 mothers and their 488 children under age 9. Four of the communities were sedentary (Korr, Karare, Ngrunit, and Songa) and one nomadic (Lewogoso); their locations are shown in Figure 1.

1. *Lewogoso* (altitude 400 m, annual rainfall 200mm) is a nomadic camel-, cattle-, and small-stock-keeping settlement of thirty five male stockowners, 250 people ,with approximately 600 large stock and 1500 small stock. This community forms a control community for the comparison of the sedentary villages (Fratkin 2004).

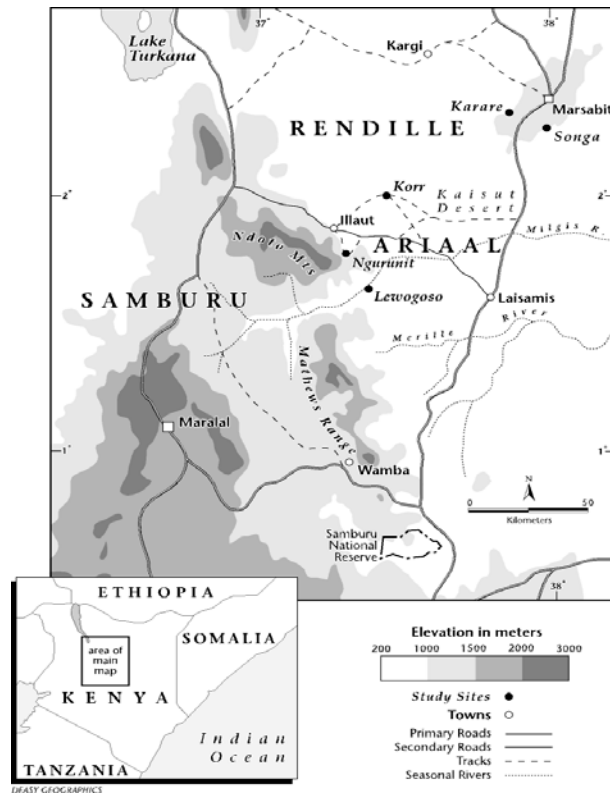
2. *Ngrunit* (altitude 400 m, annual rainfall 200mm) is a sedentary agro-pastoral community of approximately 1,200 people located in a forested valley in the Ndoto Mountains. This community has a church, school, and small dispensary but is isolated and not well integrated into marketing activities. Its inhabitants raise vegetables from their gardens and market livestock.

3. *Korr* (altitude 400 m, annual rainfall 200mm) is 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 sedentary population of about 6,000, with semi-nomadic Rendille settlements around it. Korr has poor marketing facilities, although the town provides a local market, mainly represented by small stock sales, for surrounding pastoralists.

4. *Karare* (altitude 1400 m, annual rainfall 800mm) is a settled highland community on Marsabit Mountain about 17 km from Marsabit Town. Its 2,000 residents both keep cattle herds and raise dry land maize. Karare has access to good marketing facilities as well as a large urban population in Marsabit Town and is located on the major truck road from Nairobi to Addis Ababa. Karare women sell milk on a regular basis to Marsabit townspeople.

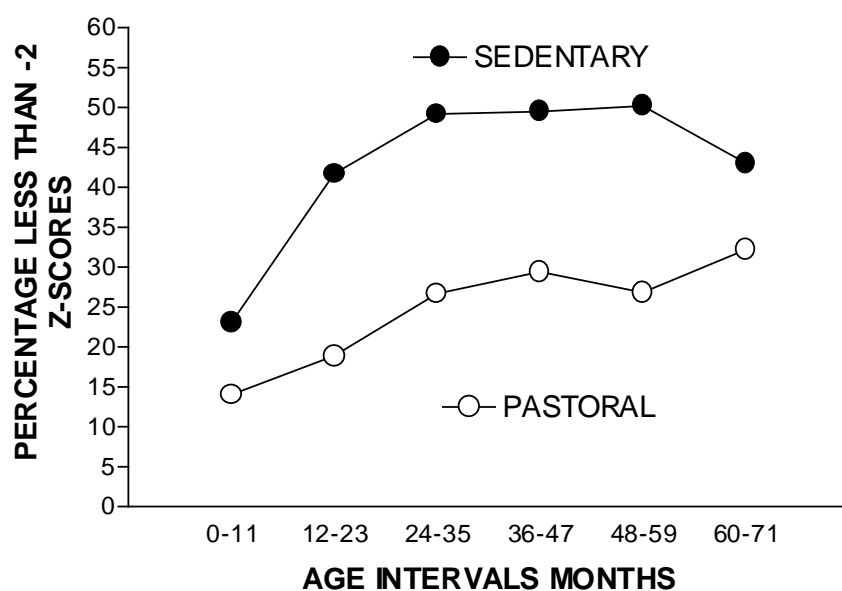
5. *Songa* (altitude 1250 m, annual rainfall 1000mm) is a sedentary highland agricultural community of 2,000 people founded by a coalition of Christian organizations (National Christian Council of Kenya, African Inland Mission, Catholic Diocese of Marsabit)in the 1970s in a forest on Marsabit Mountain. Practicing drip irrigation, Songa's population grows vegetables for sale in Marsabit town (Adano and Witsenburg 2005).

**Figure 1. Location of Rendille Maternal and Child Health Study**

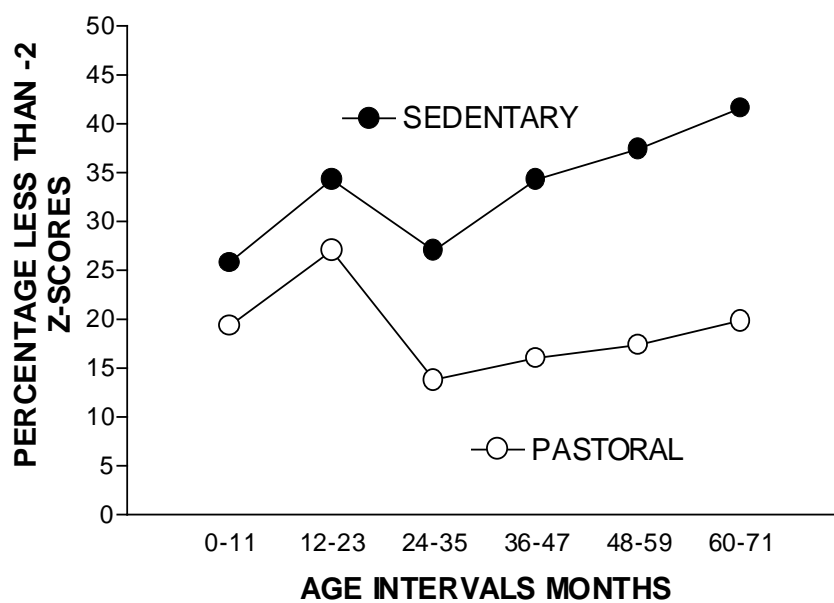


Examining levels of child malnutrition rates using these measurements, as shown in Figures 2 and 3, reveals large differences in the growth patterns of children for communities. Age-specific height and weight measurements for the nomadic Lewogoso community were uniformly higher than same-aged measurements from the sedentary villages. For the latter, growth faltering, characteristic of many African populations at about the six month range (cf. Eveleth and Tanner, 1990; Little et al. 1993) was notable for both height and weight measures, while this is true only for weight in Lewogoso, and not nearly to the same extent. In contrast height remains stable in Lewogoso, and even increases on average throughout the final four periods.

**Figure 2. Measures of malnutrition for weight-by-age, pastoral versus sedentary samples, wasting defined as below  $-2$  Z-scores**



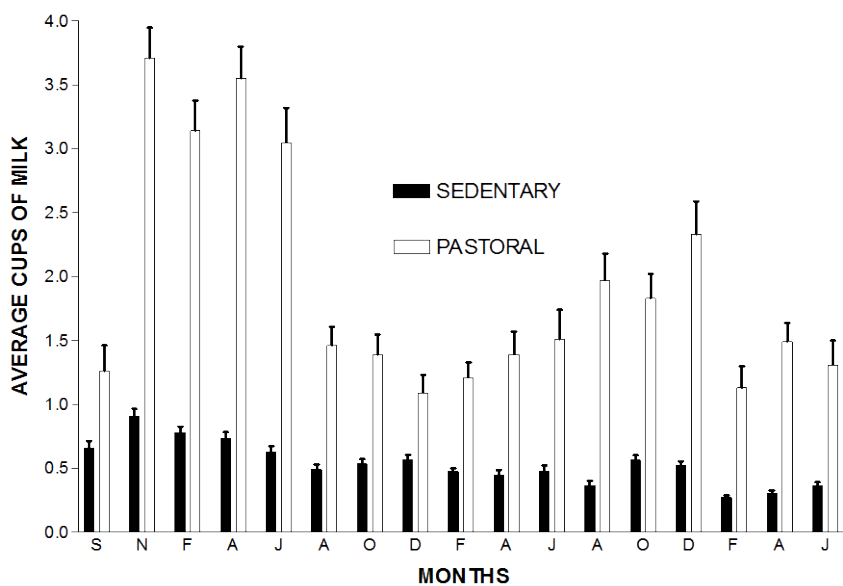
**Figure 3. Measures of malnutrition for height-by-age, pastoral versus sedentary samples, stunting defined as below  $-2$  Z-scores**



These data show children in the nomadic pastoral community were heavier and taller than their same-aged counterparts in the four sedentary communities. Children in settled communities suffered both short term malnutrition (resulting in wasting) and long term malnutrition (stunting). Starting at about six months, settled children are more likely to be thin and stunted, whereas nomadic children are thin but continue to gain stature. In contrast height remains stable in nomadic Lewogoso, and even increases on average throughout the final four periods. (see Roth et al. 2005 for data analysis).

We accounted for these differences as fundamentally related to protein deficiencies brought about by a greatly reduced access for children to milk and a higher reliance on *poshos* grains in all settled communities. Figure 4. shows daily average milk intake measured in cups between nomadic and sedentary children across the study period. Nomadic Lewogoso children having up to three times the average reported cups of milk relative to children from the four sedentary communities. These large community differences remain throughout the study period, even during the drought periods of 1995/6 when milk production fell. Student t-tests revealed highly significant statistical differences ( $p < 0.0001$ ) between milk intake in the two types of communities over all seventeen sampling times (Fratkin et al. 2004).

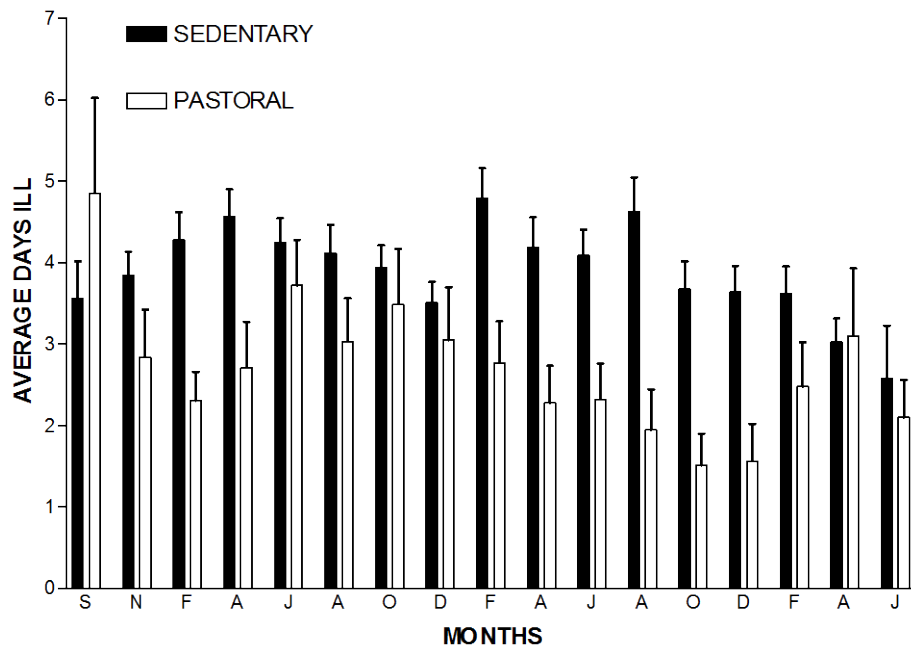
**Figure 4. Daily cups of milk over study period, pastoral versus sedentary samples, means and standard errors of the means**



## Morbidity

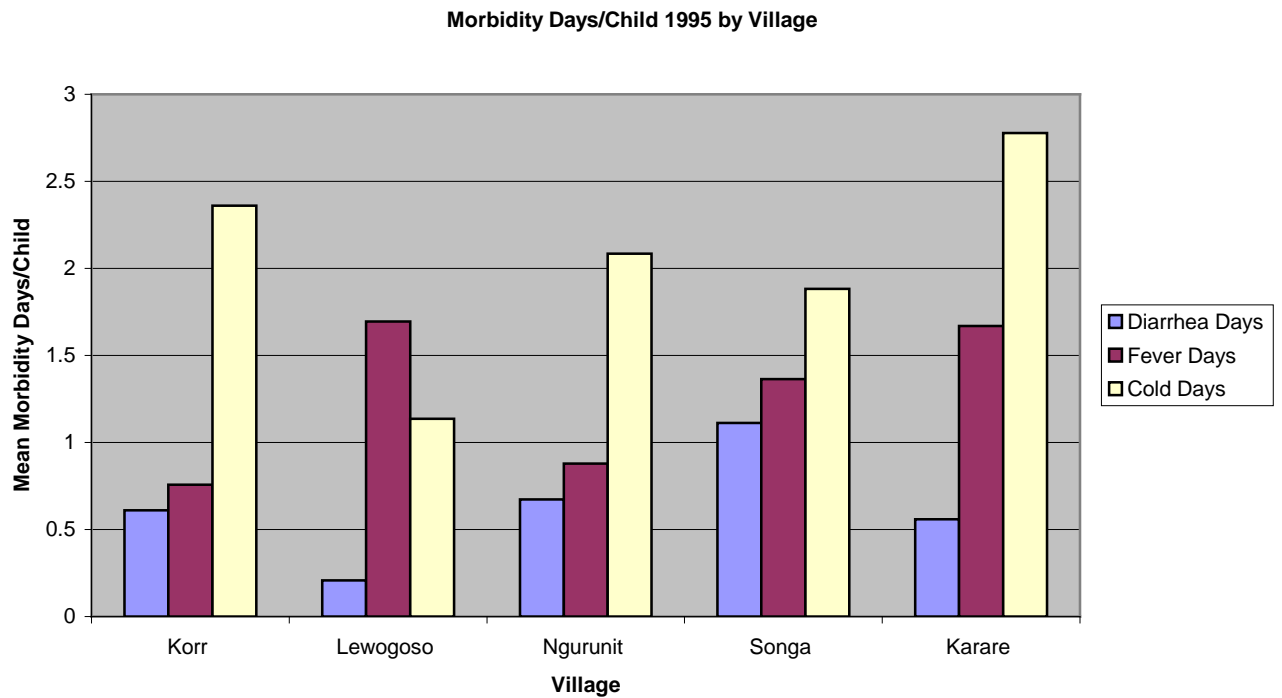
Determination of health statuses in women and children were obtained by bimonthly diaries over thirty five months of the 202 women for their 488 children in the study for “days of colds,” “days of fever,” and “days of diarrhea” per child per month. These were compared to clinic records for the same period of four primary health clinics (Laisamis, Ngrunit, Korr, and Karare) and the Marsabit District Hospital. In addition, physical examinations by an MD and nurse were obtained for women and children in the study. (Nathan et al. 2005). Figure 5 shows results of clinic and interview data, indicating a greater percentage of days ill – combined as respiratory, diarrhea, and fever – in all settled communities

**Figure 5. Days ill over study period, pastoral versus sedentary samples, means and standard errors of the means**

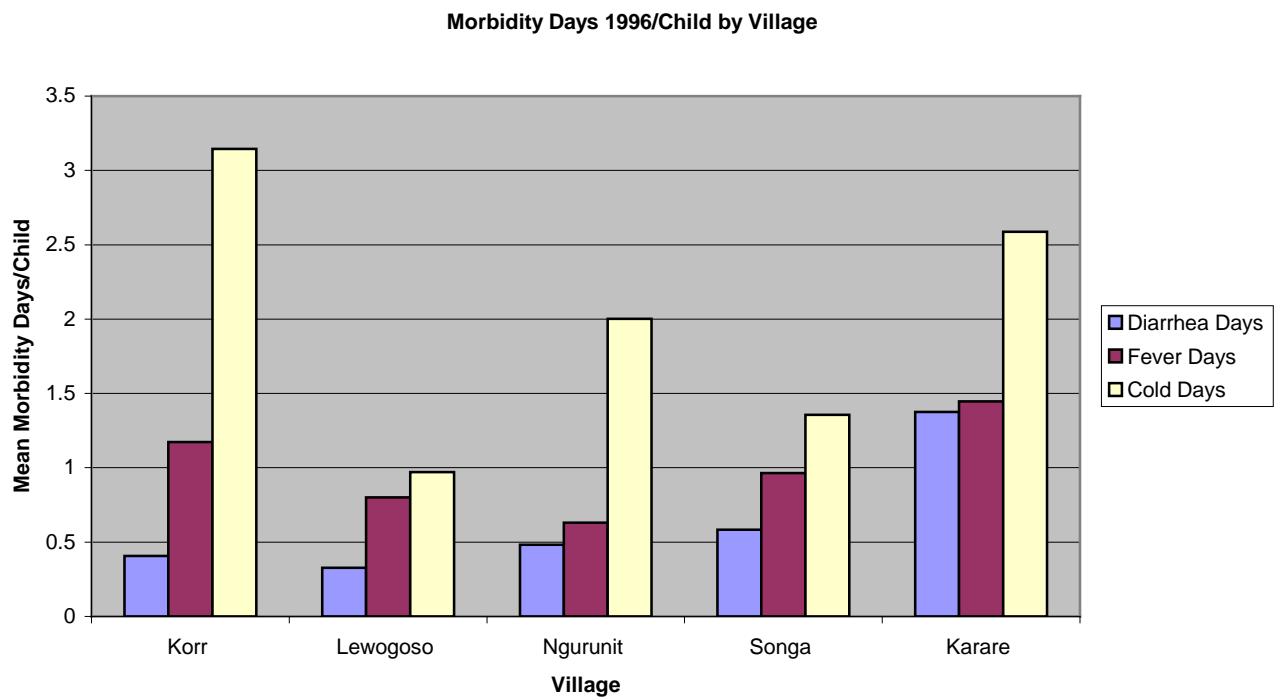


Sedentary populations had greater number of self-reported days ill (fever, respiratory, and diarrhea) than the nomadic community. As shown in Figures 6 and 7, there were markedly fewer days of diarrhea and colds/month/child for children in the nomadic community of Lewogoso than any of the four sedentary villages in both 1995 and 1996. Korr, the other lowland sample, had lower rates of diarrhea/child/month than did the highland towns of Songa and Karare, but had a higher incidence of cold days/child/month than any of the other towns in 1996 and the second highest of all the towns in the normal year 1995. Thus respiratory illness incidence for children did not seem to fit the highland/dry lowland dichotomy established by the clinic.

**Figure 6. Morbidity Days/Child by Village 1995 (Normal Year)**



**Figure 7. Morbidity Days/Child by Village 1995 (Normal Year)**



Fever days/child/month, which include malaria but certainly not exclusively, were highest in Lewogoso in 1995 and lowest in Korr of all the communities. In Lewogoso in the normal rainfall year of 1995, there were more fever days/child/month than cold days/child/month, the only village and year in which this pattern occurred. Fever days/child/month decreased overall in the dry year, except in Korr, the lowland town.

Other results showed upper respiratory infections were significantly higher in the highland communities of Karare and Songa, and malaria/fever days significantly higher in the lowland communities of Lewogoso, Korr, and Ngrunit. Nomadic pastoralist children suffered significantly less morbidity from diarrhea and respiratory disease than did children from any of the settled towns. The significantly lower rates of diarrhea and respiratory diseases for the nomadic children were unexpected. These families live long distances from clinics and lack clean water supply and access by mothers to education. The lower number of diarrhea days and cold days held in normal and drought years.

It is of particular interest that nomadic Lewogoso children suffered the least number of diarrhea days in each year of any of the communities. The nomads have the most tenuous access to water – walking long distances to fetch it from Ngrunit in the dry season and relying on rain catchments in the rainy season. They also have no formal sanitation system, simply walking outside the village to relieve themselves. However, the striking decrease in diarrheal and respiratory diseases for the nomadic children vs. settled children coupled with the previous findings of a relative decrease in malnutrition and stunting indicate an unexpected edge for health and growth of nomadic Rendille children.

An unknown variable in this study is the prevalence of HIV. Diagnosis of HIV was not recorded in clinic records during the period of our study, but was acknowledged with increasing frequency (personal communication, Marsabit Hospital physician) in the district during the 1990s. Its impact is simply unknown, but can be presumed to affect the settled communities more than the more isolated nomads.

What is apparent in the analyses is the synergism between nutrition and infection, represented by milk consumption and days ill. These findings supported our hypotheses that sedentism among Rendille children would be associated with reduced milk consumption and increased morbidity due to the spread of density-dependent disease. In addition, economic stratification played an important role in the present analysis, suggesting continuing economic differentiation over time what were previously considered egalitarian populations (Fratkin et al. 2004).

As with previous studies, the policy implications of our findings are significant. Though pastoralism is not an option for all those in northern Kenya, the decrease in diarrheal and respiratory illness for pastoralist children is important for those policy-makers interested in decreasing child mortality and morbidity for African children, particularly those involved in settling of traditional nomads. According to our findings, the consequences of settling for the health and nutrition of pastoralist children may be negative ones.



## Summary

The analysis of nutrition and morbidity data revealed significant differences between the sedentary and nomadic samples. Together these results support our initial hypothesis that child nutrition and morbidity would worsen in the transition to sedentism for formerly nomadic Rendille and Ariaal pastoralists. In addition to this specific example of the long-recognized nutrition-infection synergistic effect on child growth, we also found socio-economic variables, in the form of household wealth differentiation, exacerbating levels of childhood malnutrition. These consistent findings point to maladaptive biological consequences of sedentism for children in Rendille and Ariaal populations. Indeed, the fact that the nomadic Rendille sample exhibits better growth patterns in both wet and dry years argues strongly for the pastoral existence as a stronger and more flexible adaptation to the cyclical droughts and accompanying famines that characterize East Africa.

At the same time that we recognize that sedentarization and alternative livelihoods confers both benefits and constraints. Included among these benefits are increased access to public education, food security, health facilities and larger markets, and increasing female involvement in all. We recommend that government agencies and NGOs pursue ways to introduce and maintain milk stock in the sedentary communities, and provide increased health care delivery to the nomadic communities. All these factors have the potential to beneficially influence childhood health.

## REFERENCES CITED

- Adano, Wario Roba and Karen Witsenburg 2004. Surviving Pastoral Decline: Pastoral Sedentarization, natural resource management, and livelihood diversification in Marsabit District, Northern Kenya, PhD Dissertation, Department of Geography, University of Amsterdam.
- Adano, Wario R. and Karen Witsenburg 2005. Once Nomads Settle: Assessing the Process, Motives and Welfare Changes of Settlements on Mount Marsabit. . In E. Fratkin and E.A. Roth (eds.) As Pastoralists Settle: Social, Health, and Economic Consequences of Pastoral Sedentarization in Marsabit District, Kenya, pp. 105-136. New York: Kluwer Academic/Plenum Press.
- Bayer, W. and A. Waters-Bayer. 1994. Coming to Terms: Interactions between Immigrant Fulani Cattle keepers and Indigenous Farmers in Nigeria's Subhumid Zone. Cahiers d'etudes Africaines XXXIV (1-3): 213-229.
- Brainard, Jean M. 1990 Nutritional status and morbidity on an irrigation project in Turkana District, Kenya. American Journal of Human Biology 2:153-63.
- Chabasse, D., C. Roure, A.G. Rhaly, P. Rangque, and M. Quilici 1985. Health of Nomads and Semi Nomads of the Malian Gourma: An Epidemiological Approach. In A. Hill (ed.) Population, Health and Nutrition in the Sahel, pp. 319-333. London: Routledge and Kegan-Paul.
- Chambers, R. 1983. Rural Development: Putting the Last First. New York: Longman.
- Chambers, R. and G.R. Conway 1992. Sustainable Rural Livelihoods: Practical Consequences for the 21<sup>st</sup> Century. Discussion Paper 296. Brighton UK: Institute of Development Studies.
- Coppock, D.L. 2004. Improving pastoral risk management on East African rangelands. Pages 36-80 in 2003 Annual Report for the Global Livestock Collaborative Research Support Program (GL-CRSP). University of California at Davis.
- Ensminger, Jean 1992. Making a Market: The Institutional Transformation of an African Society. New York: Cambridge University Press.
- Eveleth, P. B and James Tanner 1990. Worldwide Variation in Human Growth. Cambridge: Cambridge University Press.
- Fleuret, Patrick and Ann Fleuret 1991. Social Organization, Resource Management, and Child Nutrition in the Taita Hills, Kenya. American Anthropologist 93: 91-114.
- Fratkin, E., 2004, Ariaal Pastoralists of Northern Kenya, second edition. Needham Heights, MA: Allyn and Bacon.

Fratkin, Elliot and Eric Roth 1990. Drought and economic differentiation among Ariaal Pastoralists of Kenya. Human Ecology 18:385-402.

Fratkin, Elliot and Kevin Smith 1995. Women's changing economic roles with pastoral sedentarization: Varying strategies in alternative Rendille communities. Human Ecology 23:433-454.

Fratkin, Elliot M., Eric A. Roth, and Martha A. Nathan MD 2004. Pastoral Sedentarization and its effects on children's diet, health, and growth among Rendille of northern Kenya. Human Ecology 32 (5): 531-559.

Fratkin, E and E.A. Roth (eds.) 2005 As Pastoralists Settle: Social, Health, and Economic Consequences of Pastoral Sedentarization in Marsabit District, Kenya. New York: Kluwer Academic Publishers

Fujita, M, EA Roth, MA Nathan, and E Fratkin. 2004. Sedentism, Seasonality and Economic Status: A Multivariate Analysis of Maternal Dietary and Health Statuses Between Pastoral and Agricultural Ariaal and Rendille Communities In Northern Kenya. American Journal of Physical Anthropology 123(3):277-91.

Galaty, John 1994 Rangeland tenure and pastoralism in Africa. In E. Fratkin, K. Galvin, and E.A. Roth (eds.) African Pastoralist Systems. Pp.185- 204. Lynne Rienner Publishers, Boulder.

Galvin, Kathleen 1992. Nutritional ecology of pastoralists in dry tropical Africa. American Journal of Human Biology 4: 209-221.

Galvin, Kathleen A. and Michael A. Little 1999 Dietary intake and nutritional status In Turkana Herders of the Dry Savanna: Ecology and biobehavioral response of nomads to an uncertain environment, Michael A. Little and Paul W. Leslie(eds.), pp. 125-145. New York: Oxford University Press.

Galvin, K., D.L. Coppock, and P.W. Leslie 1994. Diet, Nutrition, and the Pastoral Strategy. IN E. Fratkin, K. Galvin, and E.A. Roth (eds.) African Pastoralist Systems, pp.113-132. Lynne Rienner Publishers, Boulder.

Geburu, G., S. Desta, and D.L. Coppock 2003. Managing risk in pastoral systems: Research and outreach experiences of the PARIMA project in southern Ethiopia and northern Kenya. In: Proceedings of the Tenth Annual Conference of the Ethiopian Society of Animal Production (ESAP). Held August 23-24, 2002, at the Hiruye Hall, Addis Ababa, Ethiopia

Hill, Allen (ed.) 1985. Health and Nutrition in Mali. Population, Health and Nutrition in the Sahel: Issues in the Welfare of Selected West African Communities. London: Routledge and Kegan Paul.

Hogg, Richard 1986. The new pastoralism: Poverty and dependency in Northern Kenya. Africa 56 (3):319-333.

Klepp, K-I, P.M. Biswalo, and A. Talle 1995. Young People at Risk: Fighting Aids in Northern Tanzania. Scandinavian University Press Oslo:

Little, M.A., K. Galvin, and P.W. Leslie 1988. Health and energy requirements of nomadic Turkana pastoralists. In I. De Garine and G.A. Harrison (eds.) Coping with Uncertainty in Food Supply. Oxford: Clarendon Press. Pp. 290-317

Little, Michael, Sandra Gray and Paul Leslie 1993. Growth of nomadic and settled Turkana infants of north-west Kenya. American Journal of Physical Anthropology 92:335-344.

Little, M.A. and P.W. Leslie (eds.) 1999. Turkana Herders of the Dry Savanna: Ecology and Biobehavioral Response of Nomads to an Uncertain Environment. New York: Oxford University Press.

Little, P. D. 1985. Social differentiation and pastoralist sedentarization in N. Kenya. Africa 55 (3): 243-61.

Little, P. D. 1994. Maidens and milk markets: The sociology of dairy marketing in southern Somalia. In African Pastoralist Systems E. Fratkin, K. Galvin, and E. Roth, eds. Pp. 165-184. Boulder: Lynne Rienner.

McCabe, J. Terrence, Paul W. Leslie, and Laura DeLuca. 2010. Adopting Cultivation to Remain Pastoralists” The diversification of Maasai Livelihoods in Northern Tanzania. Human Ecology 38: 334.

McPeak, John and Peter D. Little 2005. Cursed if You Do, Cursed if You Don’t: The Contradictory Processes of Pastoral Sedentarization in Northern Kenya. In E. Fratkin and E.A. Roth (eds.) As Pastoralists Settle. Pp 87-104. New York: Kluwer Academic Publishers.

McPeak, John G., Peter D. Little, and Cheryl R. Doss (In Press). Risk and Social Change in an African Rural Economy: Livelihoods in Pastoralist Communities. London: Routledge.

Nathan, M.A., E. Fratkin, and E.A. Roth . 1996. Sedentism and Child Health among Rendille Pastoralists of Northern Kenya. Social Science and Medicine 43(4): 503-515.

Panter-Brick, Catherine 1998. Biological anthropology and child health: context, process and outcome. In C Panter-Brick (ed.) Biosocial Perspectives on Children. Cambridge: Cambridge University Press.

Randall, Sara. 2005. The Demographic consequences of conflict, exile and repatriation: A Case study of Malian Tuareg. European Journal of Population 21: 291-320.

Roth, E.A. and Elizabeth Ngugi 2005. Female Education in a Sedentary Ariaal Rendille Community: Paternal Decision-Making and Biosocial Pathways. In As Pastoralists Settle, edited by E. Fratkin and E.A. Roth, pp. 255-269. New York: Kluwer Academic/Plenum Press.

- Salih, Mohammed A. M. Salih and J. Baker 1995. Pastoralist Migration to Small Towns in Africa. In The Migration Experience in Africa, J. Baker and T. A. Aina (eds.), pp. 181-196. Uppsala: Scandinavian Institute of African Studies.
- Scoones, I. 1998. Sustainable Rural Livelihoods: A framework for analysis. IDS Working Paper 72, University of Sussex).
- Scoones, I. 2007 Sustainability. Development in Practice 17 (4/5): 589-596.
- Sellen Daniel W., 1996, Nutritional status of Sub-Saharan African pastoralists: A Review of the Literature. Nomadic Peoples 39:107-134.
- Sheik-Mohamed, Abdikarim and Johan P. Velema 1999. Where health care has no access: the nomadic populations of sub-Saharan Africa. Tropical Medicine and International Health 4(10): 695–707.
- Simondon K.B., E. Bénéfice, F. Simondon F., V. Delaunay, A. Chahnazarian, 1993, Seasonal variation in nutritional status of adult and children in rural Senegal. In Seasonality and human ecology, edited by S.J. Ulijaszek and S.S. Strickland, pp. 166-183. Cambridge: Cambridge University Press.
- Smith, K., 1999, The Farming Alternative: Changing Age and Gender Roles among sedentarized Rendille and Ariaal. Nomadic Peoples (NS) 3 (2): 131-146.
- Sobania, N. W. 1991. Feasts, famines and friends: nineteenth century exchange and ethnicity in the eastern lake Turkana Region. In Herders, Warriors and Traders, eds. J. G. Galaty and P. Bonte; Westview Press, Boulder, Colorado. pp. 118-142.
- Spear, Thomas 1997. Mountain Farmers: Moral Economies of Land and Agricultural Development in Arusha and Meru. London: James Currey Publishers.
- Talle, Aud 1988. Women at a Loss: Changes in Maasai Pastoralism and their effects on Gender Relations. Stockholm Studies in Social Anthropology, 19. Stockholm: Department of Social Anthropology, University of Stockholm
- UNICEF 2010. UNICEF Statistics, <http://www.unicef.org/infobycountry/>
- Waller, R. 1993. Acceptees and Aliens: Kikuyu Settlement in Maasailand. In Spear, T. and R. Waller (eds.) Being Maasai: Ethnicity and Identity in East Africa. Pp.226-257. London: James Currey.
- Waters-Bayer, Ann 1988. Dairying by Settled Fulani Women in Central Nigeria: The Role of Women and Implications for Dairy Development. Kiel: Wissenschaftsverlag Van Kiel.
- Waters-Bayer, Ann 1988. Dairying by Settled Fulani Women in Central Nigeria: The Role of Women and Implications for Dairy Development. Kiel: Wissenschaftsverlag Van Kiel.

WHO 2010. World Health Organization Statistics, <http://www.who.int/countries>

Young, Helen and Susanne Jaspars 1995. Nutrition Matters: People, Food and Famine. London: Intermediate Technology Publications.

Zaal, Fred and Ton Dietz 1999. Of Markets, Maize, and Milk: Pastoral Commoditization in Kenya. In D.M. Anderson and V. Broch-Due (eds.) The Poor are not Us: Poverty and Pastoralism in Eastern Africa, pp. 163-198. Oxford: James Currey