JRAI Journal of the Royal Anthropological Institute

Pastoral intensification in West Africa: implications for sustainability

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African pastoral systems have been under pressure from steady population growth and an expansion of agriculture into grazing lands. This neo-Malthusian predicament has been considered the beginning of the end for African pastoralism. The article describes how peri-urban FulBe pastoralists in the Far North Region of Cameroon have adapted to population pressures on grazing lands by pursuing a combination of extensive and intensive pastoral strategies in which they entrust part of their herd to mobile pastoralists, while using industrially produced cottonseed cakes to feed cattle kept in the village. The reliance on cottonseed cakes has resulted in a more capital-intensive production system. This article considers whether pastoral intensification, in which animal productivity is increased through capital inputs, offers an alternative Boserupian model for African pastoralists.

> Pastoralism is doomed to extinction as a way of life by the increasing pressure of population growth.
> Spencer 1998: 227

In African pastoral systems, herd animals have economic and cultural importance. These systems have been under pressure from steady population growth and an expansion of agriculture and wildlife conservation into grazing lands (Fratkin 1997; Galvin 2009; Homewood 2008). This predicament has been presented as the beginning of the end for pastoralism in Africa (Baxter 2001; Hogg 1986; Markakis 2004; Sandford 2006*a*). Spencer sketches a neo-Malthusian scenario for East African pastoralists in which economic development compounds the problem of population growth, as it confines pastoralists increasingly to the most marginal regions (1998: 219, 227). There the confinement leads to increasing pressures on natural resources, underdevelopment, and a neo-Malthusian destruction of the environment (1998: 228-9).

Sandford (2006*b*) claims that there is a fundamental imbalance in the Greater Horn of Africa, which he summarizes as *too many people, too few livestock*. He argues that over the years there has been a growing imbalance between humans, livestock, and the natural environment and that this has led to greater economic inequality and impoverishment in East African pastoral societies (2006*a*; 2006*b*). Specifically, he suggests that pastoral populations are growing steadily despite emigration, but there is no increase in

Journal of the Royal Anthropological Institute (N.S.) **18**, *418-438*

livestock numbers because of the decrease in grazing lands resulting from an expansion of cultivation and wildlife conservation areas. The possibilities of increasing livestock productivity are limited, and so are the possibilities of improving household incomes through livestock marketing or livelihood diversification. In brief, there are too many people and too few resources, and there are limited technical or market solutions for solving the disastrous imbalance within pastoral systems (Sandford 2006*a*; 2006*b*).

Scholars of agricultural systems in West Africa are equally pessimistic about the future of pastoral systems. Based on a comparative study of four villages in Northeast Nigeria, Mortimore and Adams (1998) argue that agricultural populations will continue to increase and so will livestock populations, which tend to correlate positively with rural population densities. Simultaneously, agricultural expansion into grazing lands means that livestock can no longer subsist on natural forage alone. The solution, Mortimore and Adams suggest, is to intensify the production of livestock and to integrate it into agricultural systems by feeding cattle with farm-produced fodder. However, the intensification and integration route is available only to agro-pastoralists who already have title to lands; mobile pastoralists without land titles will have to move elsewhere to increasingly scarce pastoral areas (Mortimore & Adams 1998).

However, in a comparative analysis of seven case studies, we (Moritz *et al.* 2009) found that West African pastoral systems were not in a crisis, despite high population growth and densities (Raynaut 2001). As evidence of successful adaptation, we found not only that pastoral systems continued to exist and adapt to changing circumstances, but also increases in agro-pastoral production and market value of these products. The adaptations took several forms: movement to sub-humid zones (Bassett & Turner 2007; Boutrais 1996), extensification (Adriansen 2006), and an intensification of livestock production and its integration into agricultural systems (Moritz 2010). Results from this comparative study suggest that there are alternatives to the neo-Malthusian trajectory described by Sandford and others (Baxter 2001; Hogg 1986; Markakis 2004; Sandford 2006*a*; Spencer 1998).

The purpose of this article is to examine whether pastoral intensification offers a Boserupian model for African pastoralists who face population pressures on grazing resources. In doing so, it uses an ethnographic case study of peri-urban FulBe pastoralists in the Far North Region of Cameroon. These pastoralists, also known as Fulani or Peul, number among the 20 million speakers of Fulfulde who are found throughout West Africa, from Senegal in the west to Sudan in the east. The peri-urban FulBe have adapted to population pressure on grazing resources by pursuing both extensive and intensive strategies. They entrust part of their herd to mobile pastoralists who are permanently on transhumance, while feeding their cattle in the village cottonseed cakes and hulls in the dry season. The increasing reliance on cottonseed cakes has resulted in a more capital-intensive production system. The case study shows that population pressure on grazing resources does not have to lead to the demise of pastoralism as Spencer (1998) has suggested, and that pastoral intensification is not a contradiction in terms. The changes in the peri-urban pastoral system are part of a larger trend towards pastoral intensification that is currently taking place in pastoral systems across Central (Boutrais 1999; Requier-Desjardins 2001), West (Buhl 1999; Demirag 2004; Ramisch 1998), and East Africa (BurnSilver 2007; Homewood, Kristjanson & Trench 2009). In this context, an examination is merited of the relevance of Boserupian models of development for African pastoral systems. In this article, I will examine the sustainability of the peri-urban adaptation of pastoral intensification and

under what conditions this autonomous development can serve as a model for other African pastoralists.

This article focuses on population pressures and agricultural encroachment onto grazing lands as drivers of change in African pastoral systems. Other processes, such as growing insecurity, climate change, commoditization, changes in pastoral land tenure, and pastoralists' increasing demand for education, health care, and consumer goods, are also shaping pastoral societies (Fratkin 1997; Galvin 2009; Homewood *et al.* 2009; McCabe, Leslie & DeLuca 2010), but pastoralists in the Far North Region of Cameroon experience population pressures on natural resources as the most significant force driving change in pastoral production systems.

Defining pastoral intensification

The dominant narrative about the future of African pastoral systems is decidedly neo-Malthusian. This is curious because in the literature on African agricultural systems there is a continuing debate about the relevance of both Malthusian and Boserupian trajectories (Scoones & Wolmer 2002; B.L. Turner, Hydén & Kates 1993). Ester Boserup (1965) outlined an alternative to the Malthusian scenario of the relationship between population growth and economic development in agricultural systems. Boserup argued that people will change their production system, through intensification, innovation, or adoption of new technologies, only when populations grow beyond the limits of production. In this model, population pressure is the motor behind agricultural transformation. Empirical studies of agricultural systems in Africa have generally supported the Boserupian thesis, although the picture has become more complex because of the role of the environment, socio-cultural systems, the market, and the larger political economy in which agriculturalists operate (Netting 1993; Stone 1996; B.L. Turner *et al.* 1993; Widgren & Sutton 2004). The Machakos district in Kenya is probably the most closely examined case study of a Boserupian transition in Africa (Tiffen, Gichuki & Mortimore 1994) as it is both complex and controversial (Murton 1999; Zaal & Oostendorp 2002) and has implications for the direction of agricultural development in dryland Africa (Mortimore 2005).

However, Spencer (1998) notes that Boserup's thesis focuses on agricultural systems and that it is irrelevant for African pastoral systems because intensification or technical solutions are generally not possible in the semi-arid and arid areas where pastoralists live. Moreover, changes such as a shift to agro-pastoralism or irrigated agriculture only aggravate the problem by increasing pressure on remaining grazing lands (Spencer 1998: 207-30). However, some pastoralists live in areas where agro-pastoralism is possible. For example, by adopting agriculture, Maasai pastoralists in the Ngorongoro Conservation Area in Tanzania have adapted to increasing population pressures on natural resources through a diversification of livelihoods (McCabe 2003*a*; McCabe *et al.* 2010). The addition of agriculture required significant labour inputs but allowed the Maasai to adapt successfully to population pressures on natural resources and maintain their pastoral identity.

Spencer is correct that Boserup's thesis focuses on agricultural systems and that her concept of intensification describes the process of increasing the productivity of land, either through capital or labour inputs or through technological innovation (Boserup 1965). Spencer and others who use the term 'intensification' in the context of pastoral systems describe it as a broad process of change (Galaty & Johnson 1990: 27; Homewood 2008: 244-5; Spencer 1998), or, more specifically, as the transition

from pastoralism to agro-pastoralism (McCabe 2003*a*). In the last case, intensification refers to the conversion of grazing land to agricultural fields, not to the intensification of the pastoral production system itself. However, in pastoral systems the unit of production is not land; it is animals.

Spencer's argument that intensification is not relevant in pastoral systems rests on confusion about the concept of intensification, which can refer to different units of production: land in the case of agricultural intensification or animals in the case of pastoral intensification. Agricultural intensification and pastoral intensification thus refer to different processes (Galaty & Johnson 1990: 4). It is therefore important to have a clear definition and conceptual clarity. I define pastoral intensification as the process of increasing the productivity of animals through capital or labour inputs or technological innovation. Animal productivity can be measured in terms of fecundity, milk, and/or meat production.

Unfortunately, the term 'intensification' is often used loosely in the literature on pastoral systems and no distinction is made between agricultural and pastoral intensification. Homewood *et al.*, for example, define intensification simply as 'increasing inputs' (2009: 30), but do not make a conceptual distinction between agricultural and pastoral intensification. A whole range of different economic activities, including irrigation systems, tree planting, and fodder purchase, are all glossed as intensification, which is part of a broader process of diversification within East African pastoral systems. This is problematic when the authors write that 'intensification may be poorly compatible with conservation goals [and] offer limited scope for development and improved standards of living' (2009: 32), but we are not told whether this concerns agricultural or pastoral intensification. This is important as broad statements are made about the sustainability of pastoral systems. Similarly, pastoral development projects that aim at increasing livestock production for the market are often glossed as intensification (BurnSilver 2009: 194), even though the activities, like increased offtake, limited mobility, and privatization of grazing land, are more appropriately characterized as modernization projects often pushed by external agencies (Moritz 2008).

The term 'intensification' is also ambiguous because there are different kinds of inputs – labour and capital – that can be increased or decreased independently of each other. Production systems can be labour-intensive and capital-extensive, or labour-extensive and capital-intensive, or any other combination (see Table 1). For conceptual clarity, it is thus important to specify the unit of production (land or animals) and the particular input (labour or capital).

Some of the conceptual confusion comes from the fact that intensification is a relative term. When we refer to intensive or extensive production systems, we basically describe one system as comparatively more or less intensive than before or more or less intensive than another system. There is a continuum of intensification, in which the US agro-industrial complex may be at one end of the scale and reindeer hunter-herders in northern Scandinavia at the other. It is thus important to make the comparison explicit. For example, the peri-urban pastoral system discussed in this article is best described as capital-intensive compared to other pastoral systems in West Africa (however, compared to US agro-industrial systems, it is more like a small family farm).

If we define pastoral intensification as the process of increasing the productivity of animals through capital or labour inputs or technological innovation, then pastoral systems that have generally been considered extensive, because the number of animals per unit of land is low, are actually more appropriately described as intensive because

Table 1. Types of intensification in West African drylands.

	Unit of production: animal		Unit of production: land	
	Labour-intensive	Labour-extensive	Labour-intensive	Labour-extensive
Capital-intensive	A. Peri-urban FulBe, Far North Cameroon (Moritz 2003)	B. Fattening of animals for market, Far North Cameroon (Moritz 2003)	E. Kano close-settled zone, Northern Nigeria (Mortimore 2005)	F. Wealthy cotton farmers, Southwest Mali (Moseley 2005)
Capital-extensive	C. WoDaaBe mobile pastoralists, Southeast Niger (Schareika 2003)	D. Agro-pastoralists, Southwest Niger (M.D. Turner & Hiernaux 2008)	G. Senufo hoe farmers, Southwest Mali (Ramisch 1998)	H. Agro-pastoralists, Far North Cameroon (Moritz 2003)

Note: Pastoral production systems can be more labour-intensive and more capital-extensive (C), or more labour-extensive and more capital-intensive (B), or any other combination. These different forms of intensification are always relative to the comparison at hand. The shift C → A represents the process of capital intensification of FulBe peri-urban pastoralists, while the shift C → D represents the process of labour extensification in the agro-pastoral production system in Southwest Niger that is described by M.D. Turner & Hiernaux (2008). The goal of the table is not to define categories of production systems.

the labour inputs per animal are relatively high. For example, the most labour-intensive pastoral strategies, like splitting herds, moving herds over long distances, and night grazing, are more commonly found in mobile pastoral systems like that of the Turkana of Kenya (McCabe 2004) or the WoDaaBe of Niger (Krätli 2008; Schareika 2003).

While much has been written about agricultural intensification or agro-pastoral conversion in pastoral systems (for a review, see Homewood 2008: 88-9), little has been written about pastoral intensification (but see Bencherifa & Johnson 1990; Burn-Silver 2009; Chatty 1996). One of the few discussions of pastoral intensification comes from Bencherifa and Johnson (1990), who describe processes of intensification in four pastoral communities in Morocco. In the twentieth century, the expansion of agriculture into grazing areas resulted in the intensification of pastoral production systems in Morocco as 'more people and animals had to be supported on less land' (1990: 399). The intensification process involved a number of changes in the pastoral production system, including: a shift from small stock to cattle; fodder production for cattle; stall feeding during part of the year; and the use of improved local breeds and cross-breeding with exotic breeds (1990: 414). Many of these changes entailed greater capital investments in the pastoral production system. Similar processes of intensification of livestock production by pastoralists are now taking place across West Africa (Buhl 1999; Demirag 2004; Moritz 2003; Ramisch 1998) and East Africa (Homewood *et al.* 2009).

Below I discuss an ethnographic case study of a peri-urban pastoral system in the Far North Region of Cameroon that is representative of a larger trend of pastoral intensification in West Africa. It shows how FulBe have intensified their pastoral production system by increasing the capital inputs in animals to cope with population pressures on grazing resources. I use the case study to examine whether pastoral intensification, in particular capital-intensification, offers a Boserupian model for other African

pastoralists who are adapting to population pressures on natural resources. In addition, I argue that peri-urban FulBe do not cease to be pastoralists when they pursue an adaptive strategy of intensification.

Methodology

Data about the peri-urban pastoral system were collected in a comparative study of three pastoral systems – peri-urban, agro-pastoral, and mobile pastoral – in the Far North Region of Cameroon from September 2000 to August 2001 (Moritz 2003; 2010). The goal of the study was to examine whether integration in the market economy leads to the disappearance of livestock exchanges. The data collection focused on household production and consumption (as measures of market integration) and livestock ownership and exchanges. I conducted multiple household surveys throughout the year to collect demographic, agricultural, and consumption data on individual households. I also conducted herd surveys in which data were collected on herd management, production costs, as well as ownership and exchanges of animals (for a detailed analysis of the quantitative data, see Moritz 2003; 2010).

In order to collect reliable data on livestock ownership and exchanges, which FulBe consider sensitive and private, I conducted an in-depth and detailed study of all pastoral households in three villages rather than a cross-sectional study of randomly selected pastoral households across multiple villages in the Far North Region. The villages were selected on the basis of distance from the provincial capital Maroua, the commercial centre of the region, which I used as a proxy for market integration. All three villages are located along an axis that links Maroua with the transhumance area of the Logone floodplain. Analysis of ownership and exchange data showed that the pastoral intensification and the associated increase in production costs, rather than general market integration, were responsible for the demise of livestock exchanges (Moritz 2003). Livestock exchanges were also not critical for pastoral identity or the viability of the pastoral social system, as is often assumed (e.g. Bonfiglioli 1985).

I have conducted research in different pastoral communities in the Far North Region of Cameroon for a total of thirty months over a period of seventeen years and am confident that the villages discussed here are representative of pastoral systems in the Far North Region of Cameroon.

The setting

The Far North Region of Cameroon has a semi-arid climate with one rainy season and a highly variable rainfall pattern temporally and spatially. During the eight-month dry season, cattle lose considerable weight and become more susceptible to diseases. Animal losses are the highest during this season. The primary goal of pastoralists is to overcome the difficulties of the dry season. This is achieved through a focus on animal nutrition, in particular increasing weight in the rainy season, so that animals have enough reserves to survive the long dry season, and preventing weight loss in the dry season (see Schareika 2003). Traditionally, pastoralists limited weight loss of their animals through transhumance, taking their animals to the rangelands with the highest quality and quantity of forage.

Two phytogeographic zones characterize the region: Sudanian in the southern grades and Sahelian in the Logone floodplain (see Fig. 1). Although the Sahelian zone is characterized by lower rainfall, the seasonal flooding of the Logone floodplain makes

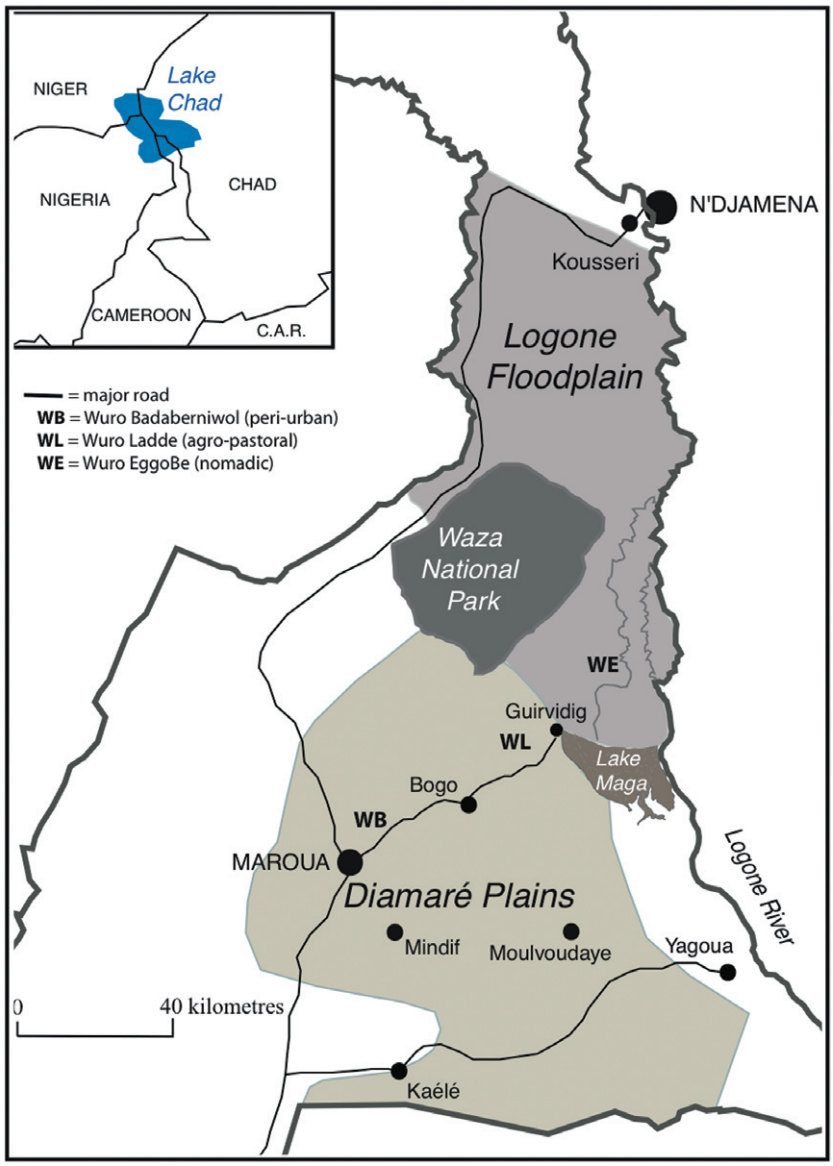

Figure 1. Location of research communities in the Far North Region of Cameroon.

this zone one of the most important dry season grazing lands in the Chad Basin. Pastoralists from Cameroon and neighboring Chad, Niger, and Nigeria trek each November to the Logone floodplain when the water retreats to exploit the excellent quantity and quality of the grasslands (Scholte, Kari, Moritz & Prins 2006). At the start of the rainy season, pastoralists return to the higher elevated dunes of the Diamaré or to their respective countries. The Diamaré plains and the Logone floodplain form complementary resources for pastoralists in the Far North; the former provide pastures in the rainy season, the latter in the dry season.

The Far North Region has one of the highest population densities in Cameroon and is characterized by a great diversity in ethno-linguistic groups and a mosaic of different agricultural and pastoral systems, which have been integrated at household, community, and regional level for centuries (Seignobos & Iyébi-Mandjek 2000). The peri-urban village of Wuro Badaberniwol is located in the Diamaré plains about 10 kilometres east of Maroua, the capital of the Far North Region. Most of the FulBe, RiimayBe, and Kanuri families have been living in the village for over a hundred years. The six pastoral FulBe households use diverse livelihood strategies, including animal husbandry (cattle, sheep, goats, chickens), subsistence agriculture (sorghum, millet, maize), cash crops (cotton), and off-farm income (mainly livestock trade, some retail). The pastoral households consisted of multiple nuclear, monogamous and polygamous, families related through patrilineal kinship ties that share sorghum and in which the married women take turns preparing meals for the household. The pastoral households were relatively wealthy; they owned most of their agricultural fields and relied heavily on hired labour for pastoral and agricultural activities.

Pastoralists in the Far North Region have been incorporated in the market economy for centuries and linked to extensive livestock trade networks that cross the Chad Basin (Kerven 1992; Moritz 2003). However, pastoral systems have basically remained subsistence-orientated rather than capitalist-orientated. Pastoralists only sell animals when they have a need; their production goal is not to maximize profits. This is true for pastoralists in all three communities.

The peri-urban FulBe households have pursued diversified livelihoods and agro-pastoralism for at least a hundred years, which is common in West Africa (Raynaut 2001). However, peri-urban FulBe have intensified their pastoral production system only in the last two decades.

The term 'peri-urban' refers not only to the location of pastoralists at the periphery of urban centres, but also to the fact that their production systems are profoundly shaped by the proximity to urban centres (e.g. access to urban markets, pressure on grazing lands). In recent years, Wuro Badaberniwol has slowly been incorporated in the conglomeration of Maroua, which has grown from approximately 50,000 to over 300,000 inhabitants in the last thirty years (Seignobos & Iyébi-Mandjek 2000). Increasing urbanization has been accompanied by an expansion of agriculture at the expense of the bush around Maroua as many urban dwellers continue to farm. Consequently, there are practically no grazing lands in the immediate surroundings of the village and cattle simply cannot survive on the natural forage in the peri-urban area.

Wuro Badaberniwol: an intensive pastoral system

Peri-urban pastoralists in the village of Wuro Badaberniwol have adapted to the lack of natural forage in two ways. First, they entrust part of their animals, the bush herd, to mobile pastoralists or hired herders who are permanently on transhumance between the Logone floodplain and the Mindif-Moulvoudaye region. Second, in the dry season, the animals remaining in the village herd are fed cottonseed cakes, cottonseed hulls, and sorghum stalks to compensate for the lack of natural forage. Animals are continually exchanged between the bush and the village herds depending on milk and cash needs of the household, labour availability, and the health and condition of the animals in the bush herd. The autonomous development of the peri-urban pastoralists thus involves a combination of intensive and extensive strategies that are fully integrated.

Until the late 1970s, peri-urban pastoralists used to split their herds in the dry season. They would keep a few milk cows in the village and send their other animals with a herder from the household on transhumance to the Logone floodplain together with herds from neighbouring villages. Because of the disappearance of pastures around the village, the herds were split permanently in the early 1980s: one part was kept in the village, the other in the bush. Some peri-urban pastoralists entrusted their bush herd to mobile pastoralists in a form of entrustment that involved the appointment of a guardian or *kaliifa*, who is responsible for the cattle and supervises the herder. Other peri-urban pastoralists entrusted their cattle to herders whom they directly hire and supervise themselves. The advantages of entrusting the bush herd is that cattle are taken to excellent grazing areas at relatively low costs. The main disadvantage is the risk of livestock losses owing to theft and/or herder negligence.

In the village, peri-urban pastoralists changed from a production system that relies on free natural forage to a capital-intensive system that relies on purchased cottonseed cakes, cottonseed hulls, sorghum stalks, and other commoditized inputs. They did not intensify their production system to increase production for household subsistence or to meet increased expenses for education, health care, or consumer goods; the offtake rate or the percentage of animals sold at the market was the lowest for the peri-urban pastoralists. The foremost goal of peri-urban pastoralists was to get their cattle through the dry season and prevent a decline in animal production and reproduction. The majority of the peri-urban pastoralists fed their cattle enough cottonseed cakes to survive, and their animals were not in a better condition than those in the agro-pastoral and mobile pastoral systems.

Cottonseed cakes are not an alternative to transhumance; they complement each other. In fact, the intensification of the peri-urban pastoral system in the dry season is possible only because the village herd also goes on transhumance in the rainy season. The increased milk production and higher reproductive rates could not compensate for the higher production costs if cattle were fed cottonseed cakes throughout the year.

The use of cottonseed cakes has resulted in a more capital-intensive system (see below) as well as a more labour-intensive production system. Cattle are fed cakes twice daily: once in the morning before they go to pasture and once in the evening upon return. Because cakes are expensive, cattle are fed individually, one by one, rather than from a common trough. One person feeds the animals, while another controls the waiting animals, and as a result, feeding can take more than three hours a day.

The use of cottonseed cakes in the peri-urban pastoral system is not unprecedented. FulBe pastoralists in West Africa have supplemented natural forage with sorghum and millet stalks and cottonseed (not cakes) for centuries (Denham, Clapperton & Oudney 1826: 192). And the use of cottonseed cakes is not limited to the Far North Region of Cameroon: today pastoralists across West Africa use it (Buhl 1999; Demirag 2004; Ramisch 1998). Cottonseed cakes have been produced locally by the Société de Développement du Coton du Cameroun (Sodecoton) since the late 1960s. Cottonseed cakes and hulls were not widely used as animal feed until the droughts of the early 1980s, when many pastoralists were exposed for the first time to their nutritional advantages. Since then, pastoralists, including mobile pastoralists who go on transhumance, have used cottonseed cakes primarily as supplementary feed for animals in the herd that were exhausted (*tampi*) towards the end of the dry season. However, the recent increase in use and dependence on cottonseed cakes in the peri-urban area of Maroua is new. Although sorghum, millet, and corn stalks continue to provide an important source

of nutrition and roughage, cottonseed cakes and hulls are now the primary source of nutrients and roughage for cattle, in that they substitute rather than supplement natural forage.

The process of pastoral intensification is different from agricultural intensification, even though the crop-livestock interactions may appear similar (Moritz 2010). For example, peri-urban pastoralists cultivate cotton primarily for cottonseed cakes rather than for cash. Similarly, they do not keep cattle to increase agricultural production as manure is relatively little used on agricultural fields; instead, it accumulates in large mounds within pastoral compounds. Thus, agricultural production supports pastoral production, rather than the other way around as in agricultural intensification.

Comparing economic performance

The use of cottonseed cakes has considerable advantages aside from securing cattle's survival through the dry season crunch. The nutritional value of cottonseed cakes and its effect on milk production and reproduction have been demonstrated in several experimental studies in Cameroon (Njoya, Bouchel, Ngo Tama, Moussa & Martrenchar 1997) and attested by FulBe pastoralists (Moritz 2003). Overall, the herd data, collected in a drought year, suggest that intensification leads to greater herd growth through higher fecundity rates and is thus an adaptive strategy in reproductive terms (for detailed discussion, see Moritz 2003; 2010), particularly in drought years, when natural forage is a problem.

But the intensification has led to a significant increase in production costs. In the past, the use of capital inputs was minimal, but now use and costs have increased significantly. The biggest cost increase is due to the use of cottonseed cakes and hulls; they represent more than 60 per cent of the total costs. Consequently, the overall average annual production costs per animal are significantly higher in the peri-urban village than in the agro-pastoral and mobile pastoral villages, respectively 12,371 FCFA ($16.50), 1,581 FCFA ($2.10), and 2,344 FCFA ($3.15). The annual production costs of the bush herds were also much lower than the village herds: 2,984 FCFA ($4.00). The commoditization of pastoral production inputs is common in other areas in Cameroon (Boutrais 1999: 65; Requier-Desjardins 2001: 51-64) and West Africa (Buhl 1999; Demirag 2004; Ramisch 1998), although the costs in the peri-urban area of Maroua are comparatively high.

I compared the economic performance of households in the three pastoral systems over the year 2000-1 in terms of overall herd growth as well as financial returns. Economic performance was calculated using a Chayanovian 'returns to labour' approach, which subtracts from the financial output only the financial costs and not the labour input of household members (Chayanov 1986; Netting 1993: 297). The comparative analysis of three pastoral systems shows that intensification is a financially sustainable adaptation to population pressures on grazing lands for peri-urban pastoralists (Moritz 2010). The higher fecundity rates resulting from the use of cottonseed cakes and the higher prices at the local livestock market of Maroua outweigh the considerable financial costs. However, the peri-urban pastoral system is not the most profitable strategy; the agro-pastoral and mobile pastoral systems are much more efficient in terms of financial returns (Moritz 2003).

Why do peri-urban pastoralists opt for intensification when this leads to diminishing returns on capital investment? Why do they not opt for sending all their animals permanently on transhumance? The data suggest that risk reduction is the

main reason. That is, annual reported losses owing to death, theft, and lost animals are twice as high in the bush (9.2 per cent) as in the village (4.5 per cent). Some of the losses in the bush herd may be attributed to hired herders who were selling the animals without permission. To minimize this risk, all peri-urban pastoralists frequently visited their bush herds, although they used different strategies with their herders. One owner kept his four herders under close supervision, and asked them to account for every animal and every FCFA that they had spent and were seeking reimbursement for, which resulted in a high turnover of herders. Another owner more or less adopted his herder as a fictive son and no longer paid him a wage; instead the herder could sell animals from the bush herd to cover his household needs (see also Ensminger 2001). The owner had greater trust in his herder than his sons, who took the village herd on transhumance in the rainy season and would sell animals without permission to cover their personal expenses.

Sustainability

Pastoral intensification appears to be a successful adaptation to population pressures on grazing resources in the peri-urban area despite the high financial costs and the lower marginal returns on investment. But peri-urban pastoralists expressed concerns about the long-term sustainability. They were not sure whether they would be able to make ends meet and continue to feed household and herd. Stories were told about other pastoralists in the area who sold so many animals to buy cottonseed cakes that their herds steadily diminished over time. Here I will examine the sustainability of pastoral intensification, examining social, economic, and ecological dimensions that have been recognized in the literature on sustainable livelihoods (F. Ellis 1998; McCabe 2003*b*; Scoones 1998), the political ecology of vulnerability (Watts & Bohle 1993), and the sustainability science of social-ecological systems (NRC 1999; B.L. Turner *et al.* 2003).

Sustainable livelihoods

One approach to measure sustainability is that of sustainable livelihoods (McCabe 2003*b*; Scoones 1998). Scoones defines livelihoods and sustainable livelihoods as follows: 'A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base' (1998: 5). This approach includes an assessment of sustainability by analysing livelihood resources, such as natural, physical, financial, human, and social capital, and examining how households use these resources to cope with and recover from stresses and shocks. In addition, the sustainable livelihoods approach involves a contextual analysis of the historical, political, economic, climatic, ecological, demographic, and social conditions (Scoones 1998). Although households have been used as the unit of adaptation in the anthropological study of rural transformations (Netting 1993; Wilk 1991), anthropologists have been critical of the sustainability concept and have argued for a definition of sustainability that considers specific ways of living in contexts (see McCabe 2003*b*): for example, 'the ability of a people to preserve and defend its way of life' (Fratkin & Mearns 2003: 113).

The FulBe concept of 'a full house' (*saare hee'nde*) captures much of Scoones's definition of sustainable livelihoods (Scoones 1998). A full house is an independent and

self-sufficient household that can perform all its functions and accomplish all its needs – for example, lifting exhausted cattle out of the mud or burying the dead – without requiring any assistance from others. Ideally, according to peri-urban pastoralists, one would find a farmer, a herder, a trader, and an Islamic scholar in each household. This ideal of independence and self-sufficiency is expressed in the saying 'an independent household owns ten head of cattle, ten thousand FCFA, ten sacks of sorghum, and has ten children' (*saare hee'nde: mara na'i sappo, mara booro sappo, mara dimle sappo, mara bikkon sappo*) (in which 'ten' is used figuratively rather than literally to indicate 'many').

Most peri-urban pastoralists had achieved this ideal through livelihood diversification (see F. Ellis 1998). Members of the pastoral households were involved in a wide range of economic activities, including animal husbandry, subsistence agriculture, cultivation of cash crops, and commerce. Peri-urban pastoralists had the human and economic capital to cope with shocks and stresses. Households were polygynous, consisted of multiple nuclear families, and were relatively large. They also owned their homes, most of their agricultural land, and lots of livestock. So when the sorghum harvest failed miserably in 2000, peri-urban pastoralists could easily shift resources from one activity to another to cope with the loss of grains. The importance of livelihood diversification and cross-subsidy of different livelihood activities for pastoral intensification is underscored by the fact that the only peri-urban pastoralist who saw his herd diminish slightly in size in 2000-1 was the one without off-farm income.

Economies of scale and economic differentiation

The process of intensification – in particular, the use of cottonseed cakes and the associated increase in production costs – is co-occurring with a process of individualization in herd and household management in the peri-urban village that has been driven by a movement of Islamic renewal (for details, see Moritz 2003). FulBe family herds generally consist of cattle from multiple owners from inside and outside the household who have multiple and overlapping rights over animals in the herd (see also Goldschmidt 1986). Family herds used to be managed for the collective good of the household by the household head/herd manager (*baaba saare*), but, recently, individual owners of animals in the family herd have been asserting their rights of disposal over their own animals: that is, the right to sell and keep the revenues. In response, herd managers have redistributed production costs to these individual owners (e.g. sons, wives, brothers, neighbours). This concerns mainly the costs for cottonseed cakes; other costs remain the collective responsibility of the herd manager (e.g. herder salaries). For individual owners with a sufficient number of animals and/or other sources of income, this redistribution of costs is not a problem. However, for owners with a few animals and without other sources of income, this poses serious problems; they have to sell animals to cover the costs and so endanger their capital. In fact, FulBe joked it was cheaper to buy milk on the market than have one milk cow at home. Pastoral intensification is an economically viable strategy for someone with thirty cattle but not for someone with only three cattle. The economy of scale thus leads to greater differentiation within and between households, which is a pattern also found in more extensive pastoral systems (Bradburd 1982; Dahl & Hjort 1976; Fratkin & Roth 1990).

Market vulnerability

The asset bundles and livelihood diversification prepare peri-urban pastoralists for coping with and recovering from shocks and stresses. However, an assessment of the

sustainability of pastoral intensification must also include an examination of the larger political and economic context (Scoones 1998; Watts & Bohle 1993). The reliance on external capital inputs has made peri-urban pastoralists more vulnerable to the whims of the market – in particular, fluctuations in availability and prices of cottonseed cakes – more so than pastoralists who pursue less capital-intensive strategies. This raises questions about the sustainability of pastoral intensification in the peri-urban village. Some researchers have warned that rural development that relies on external commoditized inputs is uneconomic and unsustainable in dryland conditions (e.g. Toulmin 1995). They favour the use of local inputs because of the risks of high prices and unreliable supplies associated with external inputs. However, the source of inputs, locally produced or imported, does not *a priori* mean that one is more or less economical or sustainable than the other. Cottonseed cakes were locally produced in the Far North of Cameroon, 15 kilometres from the peri-urban village, but supply was unreliable and prices extraordinarily high. Salt used for cattle, by contrast, was imported from Senegal, never in short supply, and not subject to major price fluctuations. It is thus not only a question of whether local or external inputs are more sustainable – leaving aside the question of what is local or external – but also one of market infrastructure and efficiency (Bates 1981; Hydén, Kates & Turner 1993). Some inputs, like cottonseed cakes in Cameroon, are locally produced but distributed through very inefficient markets; others, like salt from Senegal, are produced internationally but distributed through more efficient market channels.

Peri-urban pastoralists felt vulnerable to the whims of the cottonseed cakes market, which they experienced as a threat to their pastoral system. They believed that the market was manipulated and that high prices were the result of speculation by wealthy traders and politicians with connections to the Sodecoton. Peri-urban pastoralists devised different strategies to minimize their market vulnerability and increase their access to cottonseed cakes: they cultivated cotton and got partly paid in kind by the Sodecoton; they organized themselves in pastoral associations and negotiated with the Sodecoton over access to cheaper cottonseed cakes; they developed connections with traders; and some tried to buy cottonseed cakes on markets in neighbouring Chad.

The reliance on cottonseed cakes can also be problematic because of co-variant risks of drought and crop failure. In 2000, for example, the rains stopped early in the Far North of Cameroon and this led to lower cotton production and much higher cottonseed cakes prices. The reliance on capital inputs thus does not necessarily mitigate the risks of climate variability. When those capital inputs are locally produced, it may actually increase the vulnerability to those risks. This makes market vulnerability a potential threat to pastoral intensification in the peri-urban village. However, in 2010, pastoralists were able to manage prices of 14,000 FCFA for one 60 kilo sack of cottonseed cakes (a doubling in price compared to 2001), which suggests that the peri-urban pastoral system is quite resilient as herds continue to grow.

Ecological sustainability

One question that remains in terms of sustainable livelihoods is whether pastoral intensification is undermining the natural resource base. This is difficult to assess, and I have no data to evaluate directly the ecological sustainability of pastoral intensification. However, herd management data suggest that peri-urban pastoralists are not undermining the resource base. First, the grazing pressure is minimal in the peri-urban

area. There are practically no grazing lands in the immediate surroundings of the village and animals get virtually all their forage from cottonseed cakes and other inputs in the dry season. The animals go to harvested fields and simply 'walk in place without grazing' (*Di damdamti non*). Second, the village herd and the bush herd go on transhumance and follow similar patterns of mobility and resource exploitation to mobile pastoralists in the region. Research conducted within the new rangeland ecology paradigm shows that opportunistic grazing strategies that closely track resources are highly appropriate and effective ways to cope with the variable, unpredictable, and heterogeneous environments of Africa's drylands (Behnke, Scoones & Kerven 1993; J.E. Ellis & Swift 1988). This means that the mobility patterns of the peri-urban herds on transhumance are highly sustainable pastoral adaptations (Niamir-Fuller 1999).

However, there are concerns about the sustainability of use of cottonseed cakes because of the environmental impacts of cotton production in Africa, in particular the use of chemical inputs, the high nutrient demands of the cotton crop, and the effects on the cultivation of other crops (Moseley 2005: 53). Overall cotton production has grown in Cameroon and the Chad Basin in terms of area cultivated and yield per hectare over recent decades (Jamin, Gounel & Bois 2003: 57; Seignobos & Iyébi-Mandjek 2000), but locally yields have dropped and the northern boundary of the cotton production zone is slowly moving southwards. This may be due to the effects of climate change and/or it may be that cotton production practices are currently not sustainable in the Far North Region. However, Benjaminsen (2001) is critical of this view and argues that the changes in cotton production may also result from farmer responses to market prices, rather than environmental degradation. It thus remains unclear whether cotton production is sustainable in the Far North Region.

The process of pastoral intensification in the Far North Region of Cameroon is an autonomous development that has been initiated by pastoralists themselves. The state has been relatively absent in terms of economic and institutional support for pastoral and agricultural development. In the current political and institutional context of Cameroon, it is NGOs and other associations that take the initiative in developing a Pastoral Code that regulates the use of common-pool grazing resources. Thus, the autonomous process of intensification occurs in a context without strong legislative and developmental infrastructural incentives and support.

A model for other African pastoralists?

The process of pastoral intensification in the peri-urban village of Wuro Badaberniwol follows a Boserupian model of intensification in a number of ways. First, the intensification was a response to increasing population pressures on grazing lands, which resulted in lower productivity. Second, the innovation of cottonseed cakes was only adopted when peri-urban pastoralists saw no other options. Third, the increase in capital investments led to an increase in herd production and reproduction but a decline in marginal returns on financial investments. But as in other agricultural transitions (Murton 1999; Williams, Hiernaux & Fernández-Rivera 1999), proximity to an urban centre – in this case, Maroua – played a critical role as a source of off-farm income in the process of pastoral intensification.

The question is under what conditions can other African pastoralists who face similar population pressures on grazing lands follow this model of pastoral intensification? Recent studies of other pastoral systems show that the process of pastoral intensification in the Far North of Cameroon, in particular the use of capital inputs, is

part of larger trend across West Africa (Buhl 1999; Demirag 2004; Ramisch 1998). There are a number of reasons why Boserupian processes of pastoral intensification are more common in West Africa than in the Greater Horn of Africa, where Sandford (2006*a*; 2006*b*) and Spencer (1998) saw only a neo-Malthusian trajectory for pastoralists.

First, bioclimatic conditions make the integration of agriculture and pastoralism more feasible in West Africa than in the Greater Horn of Africa (J.E. Ellis & Galvin 1994: 341-2). Jim Ellis and Kathleen Galvin argue that variation in precipitation patterns – in particular, seasonality and inter-annual variability – are responsible for the different land-use patterns in West and East Africa. Whereas the Sudanian and Sahelian zones of West Africa are characterized by a monomodal rainfall pattern, the Greater Horn of Africa has a bimodal rainfall pattern and greater inter-annual variability in rainfall. This makes rainfed agriculture feasible in the drylands of West Africa but less so in the Horn of Africa (J.E. Ellis & Galvin 1994: 344). This means that West African pastoralists can more readily integrate and intensify agricultural and pastoral production systems and thus have better access to supplementary feeds such as cottonseed cakes.

Second, differences in precipitation patterns between the Horn of Africa and West Africa also have implications for pastoral production systems. Because of the monomodal rainfall pattern in West Africa, there is a greater seasonality in forage availability and milk production than in the Horn of Africa, where milk production continues for a longer period during the year (J.E. Ellis & Galvin 1994: 345-6). Consequently, West African pastoralists rely more on cereals in the dry season, and this has favoured integrated crop-livestock systems and livelihood diversification of pastoral households (J.E. Ellis & Galvin 1994: 345).

Third, West African pastoralists make longer transhumance movements to exploit the more predictable spatio-temporal rainfall patterns, whereas pastoralists in the Horn of Africa make much shorter nomadic movements to exploit less predictable spatio-temporal variability in these patterns (J.E. Ellis & Galvin 1994: 346). The practice of long-distance transhumance facilitates the movements to and exploitation of new grazing areas, as West African pastoralists have the habitus of opportunistically seeking new grazing lands (Bassett & Turner 2007). Pastoralists in the Greater Horn of Africa are more circumscribed by other pastoral groups (Spencer 1998).

Fourth, higher population densities in West Africa drylands may be a necessary condition for pastoral intensification (Mortimore 2005; Tiffen 2004). Higher population densities and growth not only necessitate intensification, they also provide a larger pool of labour, which allows pastoralists to diversify their livelihood strategies and create larger networks of people and resources (Hampshire & Randall 2005).

Fifth, higher population densities and/or proximity to large urban centres also means a greater demand and higher prices for pastoral products. Pastoralists can use these revenues for capital investments in their production system. Not only do the drylands in West Africa have larger urban populations and thus greater demand for pastoral products, but the livestock marketing system has also been more developed than in the Greater Horn of Africa (Kerven 1992; McPeak & Little 2006). In the near future, population growth and economic development will continue to fuel a growing demand for livestock products in the developing world. This demand will drive major changes in livestock systems and has been referred to as the 'livestock revolution' (Delgado, Rosengrant, Steinfeld, Ehui & Courbois 1999). The high demand for livestock products will allow pastoralists to finance the transition to more capital-intensive pastoral systems.

Finally, despite a general trend towards high population densities and growth, there is much variation across West Africa. Raynaut (2001) has described this variation as a mosaic of different combinations of population density and growth, zones of economic development, agricultural systems, and social-cultural systems. This mosaic allows pastoralists in West Africa to pursue simultaneous processes of intensification and extensification (M.D. Turner & Hiernaux 2008). The Far North Region in Cameroon, for example, has population densities of 100 to 150 inhabitants per square kilometre in the peri-urban zone, but the transhumance areas, which are only 50 kilometres away, have much lower population densities of less than 4 per square kilometre (Seignobos & Iyébi-Mandjek 2000). Pastoralists are able to exploit this spatial variation because the Lake Chad Basin Commission has protected pastoral mobility within and between the member states (Cameroon, Central African Republic, Chad, Niger, and Nigeria) in international treaties. And although population growth and agricultural expansion have led to a fragmentation of grazing areas (see also Galvin 2009), existing transhumance routes are being protected and serve as corridors that connect grazing areas with low population densities.

The complex relationship between population growth, bioclimatic conditions, and historical trajectories offers opportunities for successful Boserupian intensification of pastoral systems in Africa. The conditions outlined above – a mosaic of high and low population densities, integration of agricultural and pastoralism at local and regional levels, access to markets and high market values for pastoral products, and freedom of movement – appear to be necessary conditions for pastoral intensification. These conditions can be found across Africa, but more often in the drylands of West Africa.

Pastoral intensification: a contradiction in terms?

At first glance, the FulBe in the peri-urban village of Wuro Badaberniwol do not seem to conform to the typical image of African pastoralists. The question is whether they can still be considered pastoralists now that they have intensified their livestock production system and rely so heavily on industrially produced forage. Several authors have argued that intensification is not compatible with pastoral systems and that the integration in agriculture and the intensification of pastoral systems transforms them into mixed-farming systems (Spencer 1998; Swift 1977). In this view, people cease to be pastoralists when livestock production is intensified or integrated in agricultural systems.

One problem here is the use of the term 'intensification', which is often used in the literature to refer to the transition from pastoralism to agro-pastoralism (Homewood 2008: 244-5; McCabe 2003*a*; Spencer 1998), rather than pastoral intensification. But the other problem is the definition of pastoralism. Traditionally, pastoralists have been defined as mobile people who are subsistence-orientated and specialized in pastoral production (Dyson-Hudson & Dyson-Hudson 1980; Goldschmidt 1979; Spooner 1973). For example, in their working definition of nomadic pastoralism, Dyson-Hudson and Dyson-Hudson focus on the exploitation of natural forage through mobility: that is, taking the animals to the feed rather than vice versa (1980: 17-18). This definition would exclude peri-urban pastoralists because of their use of capital inputs in the dry season. But such a narrow definition ignores the enormous variation within and across pastoral systems (Homewood 2008).

Chang and Koster have proposed a definition of pastoralists that captures the diversity and dynamics of contemporary pastoral systems. They define pastoralists as

'those who keep herd animals and who define themselves and are defined by others as pastoralists' (1994: 9). I would add 'or' to include those pastoralists who are temporarily without animals but still define themselves as pastoralists. Chang and Koster write that 'keeping herd animals requires human beings to shape their lives – socially, culturally, economically, and ideologically – in ways that are structured by an interdependence with their animals. The husbandry of animals represents a commitment to a way of life' (1994: 9; see also Barfield 1993: 4; Galaty & Johnson 1990: 5). Chang and Koster's definition is broad enough to include peri-urban FulBe who rely on sorghum cultivation and off-farm income for subsistence and whose cattle live off cottonseed cakes throughout the dry season. It is also narrow enough to exclude the Kanuri farmer in the same village who owns three head of cattle that are entrusted to FulBe pastoralists in the neighbouring village but who is not considered a pastoralist by others or himself.

And even though the pastoral production system in Wuro Badaberniwol has undergone major changes, the interdependence with cattle continues to shape the lives of peri-urban FulBe who still define themselves as pastoralists who are raising cattle not for the market, but for the next generation, which is what gives them cultural meaning and social status (Baroin & Boutrais 2008: 13). FulBe strive to pass on herds to their sons; if a man dies without either, it is as if he has never lived. And even though the bush herd is out of sight, it is not out of mind. Peri-urban pastoralists knew the genealogies of all the animals in their bush herds, whether they owned twenty or two hundred animals. The only question is whether the next generation will be as committed to pastoral values as the current generation of peri-urban pastoralists as they grow up in an increasingly urban environment where commerce and religion are valued more than cattle.

Definitions and perceptions matter. If intensification is interpreted as the end of pastoralism, policy-makers may see no need to support pastoral mobility. It would confirm mainstream views that there is no future for pastoralism and that the integration of livestock production in mixed-farming systems is the only viable model for livestock husbandry in the drylands of Africa. It is not. Quite the contrary, this study suggests that pastoralism has a future in Africa, even if that future does not look like traditional pastoral systems.

NOTE

This research has been supported by the National Science Foundation (BCS-9910557), the Wenner-Gren Foundation (Gr. 6661), the International Studies and Overseas Program (UCLA), the Anthropology Department (UCLA), and the James S. Coleman African Studies Center (UCLA). I thank the University of Ngaoundére, Cameroon, for granting research permission and research affiliation during my study in 2000-1. I also want to thank Judith Carney, Robert Edgerton, Alan Fiske, Walter Goldschmidt, Clark Larsen, Nancy Levine, Leslie Moore, Colin West, and the anonymous reviewers for their critical feedback on earlier versions of this article.

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L'intensification du pastoralisme en Afrique occidentale et ses implications pour la durabilité

Résumé

La croissance démographique et l'empiètement de l'agriculture sur les pâturages exercent une forte pression sur les systèmes pastoraux africains. Certains ont vu dans ce problème néomalthusien le début de la fin pour le pastoralisme en Afrique. L'auteur décrit comment les pasteurs FulBe périurbains de la région du Nord-Cameroun se sont adaptés à la pression démographique sur les pâturages en combinant des stratégies pastorales extensives et intensives, confiant une partie de leur cheptel à des pasteurs itinérants tout en utilisant des tourteaux de coton industriels pour nourrir le bétail resté au village. La dépendance envers les tourteaux de coton a donné naissance à un système de production plus capitalistique. Le présent article examine l'éventualité que l'intensification du pastoralisme, visant à accroître la productivité animale par des entrées de capital, puisse constituer un modèle boserupien alternatif pour les pasteurs africains.

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Journal of the Royal Anthropological Institute (N.S.) **18**, *418-438*