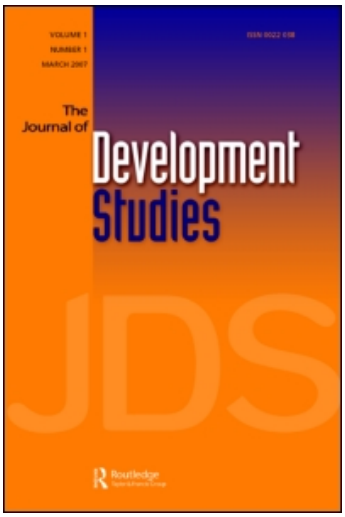

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Too Many People and Too Few Livestock in West Africa? An Evaluation of Sandford's Thesis

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Too Many People and Too Few Livestock in West Africa? An Evaluation of Sandford's Thesis

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ABSTRACT *We examine whether Stephen Sandford's (2006b) 'too many people, too few livestock' thesis for the Greater Horn of Africa applies to West Africa. In a comparative study of seven pastoral systems across West Africa we found that pastoralists have generally successfully adapted to pressures on grazing resources. We describe three adaptive strategies: 1) integration and intensification in the Sudanian zone; 2) movement to the Sub-Humid zone; and 3) extensification in the Sahelian zone. We end by proposing four interrelated factors that account for the differences in pastoral systems between West Africa and the Greater Horn of Africa.*

I. Introduction

> Pastoralism as a mode of production and a way of life has entered a phase of decline that may well prove terminal. This is a global trend, not limited to eastern Africa and the Horn (Markakis, 2004: 30).

There is great concern that African pastoral systems are in a severe and irreversible crisis (Markakis, 2004). Last year, the Future Agricultures Consortium organised an online debate entitled *Pastoralism in Crisis?* to examine the future of pastoral systems in the Horn of Africa (ALIVE/LEAD, 2006; Future Agricultures Consortium, 2006; see also the e-conference, Maintaining Mobility and Managing Drought). Stephen Sandford, who has worked in pastoral development for more than 25 years and written a seminal book on the topic (1983), was invited to open the debate. In his opening statement, Sandford argues that there is a fundamental imbalance in the Greater Horn of Africa, which is aptly summarised in his thesis *Too many people, too few livestock* (Sandford, 2006b).

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Sandford 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 pastoral societies (Sandford, 2006a, b). Sandford's thesis consists of 11 strands of arguments that can be summarised as follows. The pastoral population is growing steadily despite emigration but there is no increase in livestock numbers because of the decrease in grazing lands resulting from an expansion of cultivation and wildlife conservation areas. The possibilities to increase livestock productivity are limited and so are the possibilities to improve household incomes, either through livestock marketing or through diversification. In short, there are too many people and too few resources, and the technical or market solutions to solve the disastrous imbalance within pastoral systems are limited (for all 11 strands of argument see Sandford, 2006b) (see also Panel 1).

A similar neo-Malthusian argument was outlined 20 years ago by Richard Hogg, who described the effects of the 1984–1985 droughts on pastoralists in Kenya (1986). He argued that wealthy pastoralists in northern Kenya were well prepared to cope with the droughts because they had non-pastoral income to support themselves and recover from their losses (1986: 323). Poorer pastoralists, on the other hand, did not fare well and had to sell their animals to survive. This led to a growing pauperisation of poor pastoralists, which Hogg called the 'new pastoralism' (1986: 330). Hogg emphasised that 'the crisis of pastoralism is not a crisis brought on by pastoralists themselves nor does it lie in the nature of pastoralism. It lies, rather, in the changing context in which pastoralists operate' (Hogg, 1992: 133). In the context of the nation state, pastoralists have steadily lost access to grazing lands and have been limited in their mobility. As a result, the growing human and livestock populations can no longer be sustained by the declining resource base (Hogg, 1992).

The fact that 20 years ago Hogg formulated a similar crisis narrative for the same area that Sandford writes about, and that pastoral systems continue to persist, raises the question whether the current 'crisis' is different from the regular crashes found in persistent pastoral systems in Africa's drylands (Ellis and Swift, 1988). African pastoralists regularly cope with droughts and have been through multiple crises. In addition, other participants in the *Pastoralism in Crisis?* debate noted that there is considerable variation in pastoral systems in the Greater Horn of Africa and challenged the notion that pastoralism is in a crisis. It thus remains unclear if pastoralists in the Greater Horn of Africa are experiencing an unprecedented crisis.

Another question is whether Sandford's thesis applies to the millions of pastoralists elsewhere in Africa. There are, for example, many similarities between pastoral systems in the greater Horn of Africa and West Africa. West African pastoralists have also suffered major droughts in 1973–1974, 1984–1985 and multiple minor droughts, one as recently as 2005. They face similar, interrelated pressures on their production system: loss of grazing lands due to encroachment of agriculture, competition and conflict over natural resources, insecure tenure rights over grazing lands, and political insecurity. Similarly, crisis narratives are a continuing thread in the literature on West African pastoral systems (see Swift, 1977; Sinclair and Fryxell, 1985; Hoffmann, 1998; Thébaud and Batterbury, 2001). We examine seven pastoral systems against Sandford's thesis to determine whether there are too many people and too few livestock in West Africa (see Figure 1).

Panel 1. Sandford's Thesis

Sandford argues that there is a fundamental imbalance in the Greater Horn of Africa, which is aptly summarised in his thesis *Too many people, too few livestock* (Sandford, 2006b). There are two parts to Sandford's argument: (1) the Malthusian argument that there are too many people and too few resources; and (2) the options to solve the imbalance within pastoral systems are limited. Sandford's thesis is based on the following strands of argument:

1. The pastoral human population is growing at about 2.5 per cent per year (despite steady out-migration);
2. A certain minimum number of livestock are needed to support these humans as pastoralists (5–6 tropical livestock units (TLU) per person in pure pastoral systems, three in agropastoral systems);
3. The number of animals is not equitably distributed among pastoralists, which means poverty is persistent;
4. The maximum number of animals (and therefore the maximum number of people) is limited by the amount of livestock feed available;
5. The area of grazing land accessible for pastoral use is shrinking as a result of the expansion of cultivation and wildlife conservation areas;
6. There are no known technologies for significantly increasing primary production on grazing lands;
7. Overall herd productivity cannot substantially improve unless the quantity and quality of feed is improved;
8. The prospects for increasing the market value of livestock (thereby, decreasing the number of livestock required per person) are limited;
9. The prospects for income diversification *within* the pastoral areas are unfavourable because there is little local demand for the increased amounts of goods and services supplied;
10. Finally, in some parts of pastoral areas there is greater potential for agricultural development than pastoral development.[1]

Sandford also outlines several strategies to solve the fundamental imbalance between population and natural resources:

1. The emigration of pastoralists to areas where they can pursue other livelihoods;
2. Reducing or reversing population growth;
3. Diversification of livelihoods, including the development of more productive and more sustainable rain-fed or irrigated agriculture in pastoral areas;
4. Improving range productivity, thereby allowing more livestock to be kept, coupled with efforts to increase animal productivity;
5. Improve market conditions and infrastructure of livestock products;
6. Other policy reforms such as land tenure reform that will facilitate the strategies outlined above.

The first two strategies are aimed at reducing the number of people dependent on pastoralism. The other strategies are aimed at improving the productivity of the pastoral systems, diversifying livelihoods, and improving the markets for livestock products, and thus aiming to ensure sustainable livelihoods for people who continue to pursue pastoral lives (Sandford, 2006b).

Note: [1]We paraphrased and changed the order of Sandford's strands of argument in order to save space, as well as to clarify his argument.

Sustainable development of African pastoral systems is critical not only for the millions of pastoralists whose livelihoods directly depend on it, but also for rural and urban populations for whom it provides the main source of animal protein

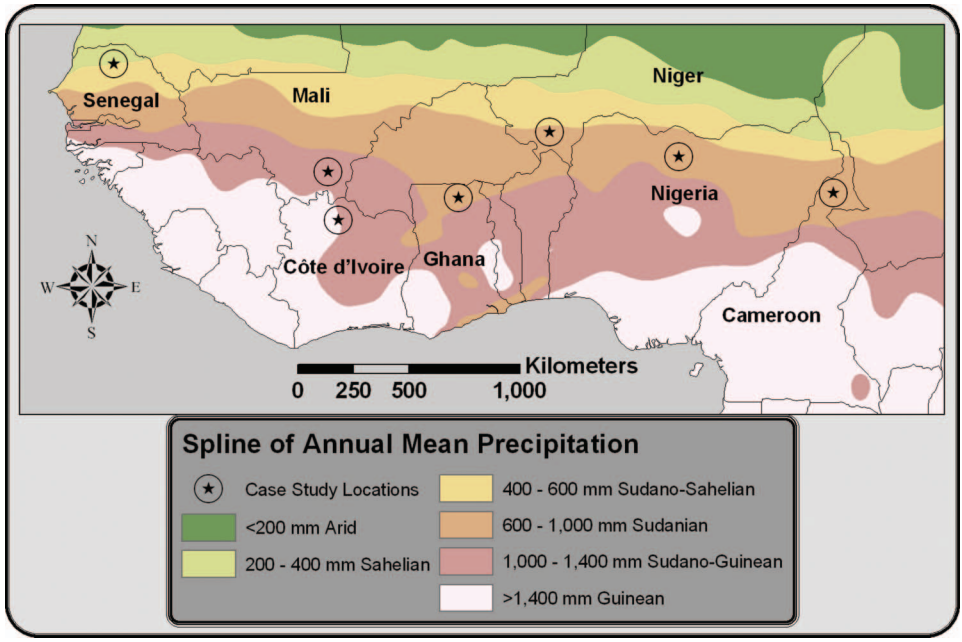

Figure 1. Location of case studies and bioclimatic zones of West Africa. *Notes*: Precipitation data is from Nichols et al. (1988), accessed at: http://www.geog.umd.edu/carpe/gisthemes.html#Climate (accessed 3 August 2007). The map is modelled after Bassett and Turner (2007: Figure 1) and created in ArcMap 8.3 by Kevin C. Nolan.

(Sandford, 1983; Galaty and Johnson, 1990; Swallow and Bromley, 1995: 99). Moreover, the export of livestock and livestock products makes a significant contribution to national economies (Delgado et al., 1999), even though it is not always reflected in the gross domestic product (GDP) and other statistics (Hesse and MacGregor, 2006).

II. The Case Studies

To evaluate whether Sandford's thesis also applies to pastoral systems in West Africa, we conducted a comparative literature study of pastoral systems. Non-randomly, we selected studies of pastoral systems from different countries across West Africa that were comprehensively described in the literature or in a dissertation. We sought studies that contained empirical data on population growth, population density, livestock holdings, natural resources, technology, and livestock marketing in order to evaluate Sandford's thesis (although this was not always possible – see discussion below). The studies also had to describe and analyse pastoral systems holistically, taking all aspects of pastoral households into consideration, and studying them in the wider ecological and political economic context (see Fratkin et al., 1994: 5; Mortimore and Adams, 1999). We did not limit our study to 'pure' pastoral systems, but also included agropastoral and peri-urban pastoral systems. For each region we briefly describe the main features of the pastoral system.

All case studies concern Fulani pastoralists, also known as FulBe, Peul, or WoDaaBe, who are part of the large and diverse ethno-linguistic group of Fulfulde speakers that can be found throughout West Africa from Senegal in the west to Sudan in the east (Boutrais, 1994; Azarya et al., 1999; Diallo and Schlee, 2000).

Northern Senegal

In the past decades, political upheaval, population growth and agricultural encroachment in the Senegal Valley have pushed Fulani pastoralists south into the Ferlo region, where they have pursued a strategy of extensification opening up new grazing lands for exploitation using boreholes and watering tubes (Juul, 1996; Adriansen and Nielsen, 2002; Adriansen, 2006). The boreholes, introduced by the French in the 1950s, allowed pastoralists to graze their cattle within a 15 km radius, while the watering tubes carried on horse and donkey carts are used to bring water to cattle at pastures beyond that radius. The combined use of boreholes and watering tubes has extended the range, increased mobility, and led to a better distribution of the grazing pressure (Adriansen, 2006: 221).

Fulani pastoralists in the Ferlo region are multi-resource pastoralists. In addition to raising livestock, they practise some agriculture, and engage in livestock trade and migrant labour. The success of pastoralism in the Ferlo region of Senegal can be credited, in part, to their opportunistic pursuit of diversification of livelihood strategies and specialised production for the market (Adriansen, 2006). Adriansen (2006) refers to the set of strategies that Fulani pursue as the 'dialectic of diversification and specialization', as pastoralists diversify their livelihood portfolio while simultaneously specialising in pastoral production for the market, for example, the raising of rams for the Muslim feast called Tabaski in Senegal (id-al-adha in Arabic). The production for the market has led to significant changes in herd composition; goats and sheep numbers have increased greatly, and there has been a shift from milking cattle to beef cattle (Adriansen, 2006). Even though the pastoral system has gone through major changes, the Fulani interpret these changes in livelihoods as adaptations and not a decline in pastoralism (Adriansen, 2006: 226).

Southern Mali

Fulani pastoralists were absent from the Sikasso region in southern Mali prior to the 1970s, but drought conditions in the north pushed Fulani pastoralists to this region in the subhumid zone (Ramisch, 1998, 1999). The region now supports a large population of pastoralists who have been attracted by its ample water sources and productive areas for agriculture and livestock. Fulani pastoralists have successfully pursued a strategy of mixed farming, integrating livestock husbandry and agricultural production.

Ramisch (1998) studied exchanges of animal manure and traction between households with and without livestock and used soil nutrient balances to evaluate the effectiveness of the various land use practices. His research shows that the influx of Fulani pastoralists greatly facilitated agricultural intensification in the region because it allowed farmers through agropastoral exchanges to improve crop yields. Ramisch notes that Fulani agropastoralists profited even more (than local farmers) from the integration of livestock in agricultural production as their large herds fertilised the

fields and supplied the animal traction for the land. In terms of soil nutrients, Fulani agropastoralists were the ones who regularly had a positive balance.

Fulani agropastoralists in southern Mali do not appear to experience a crisis; on the contrary, they are quite successful (Ramisch 1998: 282–285). Moreover, there is great potential for improvement of livelihoods, either through marketing livestock products in nearby Sikasso or through further diversification of their production system (for example, wage labour in nearby Côte d'Ivoire). However, with the gradual increase in the Fulani population, herder-farmer conflicts have also been increasing (Ramisch, 1998: 105).

Northern Côte d'Ivoire

FulBe pastoralists initially migrated into northern Côte d'Ivoire in the 1960s and 1970s, due to increasing drought in Burkina Faso and Mali (Bernardet, 1984; Bassett, 1988; Diallo, 2001; Tonah, 2003; Bassett and Turner, 2007). The government of Côte d'Ivoire welcomed the pastoralists and set up programmes to increase cattle productivity and encourage pastoralists to settle in the northern parts of the country. This effort institutionalised in the Société pour le Développement des Productions Animales (SODEPRA), offered pastoralists free veterinary care and attempted to resolve conflicts between FulBe pastoralists and neighbouring agriculturalists (Diallo, 2001). The programme was dissolved in 1994.

Most FulBe pastoralists in Côte d'Ivoire are multi-resource pastoralists. They cultivate food crops (using manure and animal traction to increase production) and some work as herders for local farmers who own cattle (Diallo, 2001: 10; Tonah, 2003). Due to the limited integration of the agricultural and pastoral production systems at community level, competition rather than cooperation characterises the relationships between FulBe and the host populations (Tonah, 2003).

In the 1960s and 1970s, grazing land was plentiful in the northern areas of Côte d'Ivoire but, recently, land has become increasingly scarce (Diallo, 2001). This is partly due to increasing herd sizes but also due to the growth of agricultural populations and changes in agricultural practices. As FulBe pastoralists do not have secure land rights, there is continuous competition and conflict with local agriculturalists (Bassett, 1988; Diallo, 2001). After the death of President Houphouët-Boigny a staunch supporter of FulBe pastoralists, in 1993, these conflicts have escalated into widespread violence. In a context of ethnicisation and regionalisation of national politics, 'strangers' such as FulBe pastoralists suffer the brunt of increasing xenophobia (Diallo, 2001; Tonah, 2003: 106; Bassett and Koné, 2006).

Northern Ghana

As in the Côte d'Ivoire, pastoralists migrated to Ghana in the 1960s and 1970s due to droughts in their northern homelands. However, unlike Côte d'Ivoire, the Ghanaian government has been hostile to the migrant populations and did not allow them to permanently settle within the country. Although Ghana's government attempted to develop the marketing of meat from domestic sources, it favoured import from overseas when livestock prices increased (Tonah, 2003). As a result, market integration is low among pastoralists in Ghana. FulBe pastoralists sell milk in local

markets and only occasionally sell cattle, as there is little demand for domestically produced beef (Tonah, 2000).

Throughout northern Ghana land is communally owned. However, as each male agriculturalist reaches maturity he is given a plot of land. This has resulted in increasingly fragmented agricultural plots (Tonah, 2003). It has also made it gradually more difficult for pastoralists to access pastoral areas without trampling crops. 'Strangers,' such as FulBe pastoralists are unable to acquire rights to land beyond usufruct rights. However, pastoralists can rent rangeland from wealthy landholders. Landholders generally make more money leasing land to pastoralists than by allowing sharecroppers to use the area. This has led to intense competition for fertile land between the pastoralists and agriculturalists. Although there is no evidence of degradation, the Ghanaian government commonly cites environmental destruction by the FulBe as their reason for siding with the agriculturalists.

FulBe pastoralists in Ghana are blamed for destroying crops, stealing cattle, and bringing cattle disease into the region (Tonah, 2002). This has resulted in multiple, short-lived, evictions of pastoralists from the country (Tonah, 2002). Successive evictions from Ghana have led to poor relations between the FulBe and neighbouring populations. Although agriculturalists and pastoralists often rely on one another, there is continual violent conflict with no retribution for the actions of the agriculturalists (Tonah, 2006). Pastoralists in Ghana have little security and there is little support for the marketing of pastoral products.

Southwestern Niger

The droughts of the 1970s and 1980s forced many impoverished FulBe in Niger to abandon pastoralism and take up farming. Simultaneously wealthy farmers have increasingly taken up livestock husbandry, and as a result there are many more mixed farmers in southwestern Niger today than before. By taking up agriculture, pastoralists in southwestern Niger have been able to increase herd productivity despite the growth of population and the expansion of agriculture (Ayantunde et al., 2000; La Rovere et al., 2005). The bio-economic modelling of La Rovere and colleagues (2005) illustrates the benefits of integrating the two production systems in the region; by allowing herds to utilise croplands as pasture increases both pastoral and agricultural productivity and increases food security for herders. In addition to pursuing agricultural activities, FulBe have also intensified their pastoral production by pursuing a strategy of night grazing (Ayantunde et al., 2000).

However, because of increasing pressures on grazing lands due to population growth and agricultural encroachment, pastoralists are going on long distance transhumance to the subhumid zones. They send a portion of their family's herd to take advantage of better grazing conditions further south (Bassett and Turner, 2007). There is also much potential for diversification and livestock marketing in the region as these pastoralists live close to Niamey.

Northern Nigeria

Agropastoralists, in the further Kano region of northern Nigeria, have practised intensive agriculture in this area for the past 150 years (Mortimore, 1993, 2003;

Mortimore and Adams, 1999). Not only have the agricultural practices been a success in the region, but the inhabitants have also devised ways to increase the productivity of the land. These practices include the application of large amounts of manure to the fields, use of animal traction, efficient nutrient cycling, soil moisture control methods, increasing farm biodiversity, and hindering erosion of the land (Mortimore, 2003, 2005).

Bourn and Wint (1994) have found that as the population in the area increases, so does the number of livestock, in particular the number of small stock. They expect that the autonomous intensification of agropastoral systems in northern Nigeria will lead to continuing growth in livestock productivity. However, the concern is that this autonomous intensification of agropastoral systems will eventually lead to the disappearance of grazing lands (Bourn and Wint, 1994). On the other hand, the retreat of the tsetse fly and trypanosomiasis in the sub-humid zones has allowed pastoralists from northern Nigeria to utilise lands to the south that were formerly unavailable (Blench, 1994; Bourn and Wint, 1994).

The potential for diversification and marketing of livestock products in northern Nigeria is great, as most agropastoralists live close to major cities.

The Far North of Cameroon

Peri-urban pastoralists in the Sudanian zone of Cameroon have adapted to the disappearance of grazing lands, resulting from urbanisation and expansion of agriculture, by combining extensive and intensive strategies (Moritz, 2003). First, they entrust part of their animals, the bush herd, to nomadic pastoralists or salaried herders who are permanently on transhumance between the Logone floodplain and the Mindif-Moulvoudaye region. Second, they feed the animals remaining in the village herd cottonseed cakes, hulls and sorghum stalks in the dry season to compensate for the lack of natural forage. In the dry season, the village herd gets all their food in the form of industrially produced cottonseed cakes and hulls. In the rainy season, peri-urban pastoralists send the village herd on transhumance to an area where there are fewer fields and plenty of bush.

The use of cottonseed cakes has considerable advantages aside from securing cattle survival through the dry season crunch. Cottonseed cake is an excellent feed; its nutritional value and effect on milk production and reproduction have been demonstrated in experimental studies in Cameroon (Njoya et al., 1997). FulBe pastoralists attest to these benefits of cottonseed cakes, but note that it comes with a significant increase in labour demands and production costs. The feeding is labour intensive because cattle are individually fed twice a day, while the purchase of cottonseed cakes and hulls takes much time because supplies are unreliable. The use of cottonseed cakes and hulls has led to a significant increase in production costs, which are five times higher than in more extensive systems. Peri-urban pastoralists use off farm income from commercial activities to cover these costs.

Despite the high costs, intensification is a financially sustainable adaptation to the disappearance of rangelands for peri-urban pastoralists. The higher fecundity rates resulting from using cottonseed cakes and the higher prices at the local livestock market of Maroua outweigh the considerable financial costs (Moritz, 2003). Yet the peri-urban pastoral system is not the most profitable strategy; extensive systems are much more efficient in financial terms. Moreover, intensification is not feasible for

people who own only a few animals and do not have additional sources of income, which means that the intensification of the peri-urban pastoral system is likely to increase economic differentiation.

III. Evaluating Sandford's Thesis

To examine whether Sandford's thesis applies to West African pastoral systems we have attempted to quantify his strands of argument. In most case studies we could not find enough quantitative data to operationalise Sandford's variables. There is a scarcity of empirical data, for example, on human demography and livestock ownership. Yet it is not simply a problem of finding quantitative data. The quantification of the variables in Sandford's strands of arguments posed its own set of problems. We were, for example, unable to quantify the variable 'potential for increasing herd productivity', though we found that in all case studies pastoralists could increase herd productivity through further integration in agricultural systems or the use of industrially produced feeds like cottonseed cakes.

Some of Sandford's variables are abstractions of a much more complex reality. The minimum number of tropical livestock units (TLU) per person, for example, has limited predictive value, as most pastoralists in our sample were multi-resource pastoralists who draw income from a number of different economic activities. Even if we halve the number, as Sandford suggests, the variable ignores the question of livestock ownership. In many cases, it is unclear whether the livestock is owned by the households who manage them or by absentee owners. The answer, of course, has major implications for household viability (Stenning, 1958; Moritz, 2003).

Similarly, it was impossible to determine 'land available for pastoral use', let alone quantify it. Sandford's underlying assumption seems to be that pastoral systems are bounded, which they are not. Many pastoralists do not remain in the village territory throughout the year; they go on transhumance. Instead, we have used the range of human and livestock population densities per square kilometre (for an area of approximately 100 km by 100 km) as a proxy for grazing land availability. However, this has limited predictive value in West Africa as Bourn and Wint (1994) found that livestock densities in northern Nigeria are highest where human population densities are highest. In those areas, livestock production is decoupled from grazing lands as livestock receive agricultural rest products as supplementary feed. In those cases, there is no direct link between land available for pastoral use and herd productivity. Proxies for other variables were also used, for example, annual population growth in the region as a proxy for pastoral population growth and proximity and size of urban centres as a proxy for marketing potential and diversification potential.

Table 1 shows that population growth for the regions of our case studies ranges between 2.0 per cent and 3.4 per cent per year, which is both lower and higher than in Sandford's model (2.5%). However, there is no correlation with the success or failure of local pastoral systems. The densities of human and livestock populations vary greatly within and between the case studies, from 5–10 people per km^2 in northeast Senegal to 100–150 per km^2 in northern Nigeria, and from 6–20 cattle per km^2 in northern Ghana to more than 50 per km^2 in the far north of Cameroon. We find that pastoral systems do well in areas with low and high densities. This is evidenced by the fact that the average TLU is approximately 5–6 per person, which is twice as much as needed for multi-resource pastoralists according to Sandford (2006b).

Table 1. Characteristics of case study regions

	Population growth (%)	Population density	Cattle density	TLU per person	Proximity and size of closest urban centre
Northeast Senegal	2.4	5–10	10–50	No data	Louga (70,000, 125 km)
Southern Mali	2.0	10–15	10–50	5.8	Sikasso (1.8 million, 67 km)
Northern Côte d'Ivoire	2.0	5–35	1–50	No data	Korhogo (165,000)
Northern Ghana	2.0	5–50	1–50	No data	Bolgatanga (50,000)
Northern Nigeria	2.3	100–150	10–50	No data	Kano (3.9 million, 35 km)
Southwestern Niger	3.4	25–50	5–50	5.5	Niamey (675,000, 75 km)
Far North Cameroon	3.0	50–75	20–50	5.6	Maroua (300,000, 10 km)

Notes: Annual *population growth* is for the region (not pastoral populations) and is derived from the case studies or from the Web Atlas on Regional Integration in West Africa (Côte d'Ivoire, Ghana, and Mali cases), which integrates recent data from multiple sources (ECOWAS and SWAC, 2007). Data on *population density* per km^2 reflects the range within the region and is derived from the Web Atlas on Regional Integration in West Africa (ECOWAS and SWAC, 2007). Data on *cattle density* per km^2 reflects the range within the region and is derived from the gridded livestock of the world database (Food and Agriculture Organization's Animal Production and Health Division, Wint and Robinson, 2007). *TLU per person* is the average for pastoral households and data is derived from the case studies. The *urban centres* are those that have over 50,000 inhabitants and are closest to the pastoral system described in the case study. In some cases, there are much larger urban centres close by (peri-urban pastoralists in the Far North of Cameroon are only 120 km away from Maiduguri, Nigeria, which has a population of 1.2 million). The case studies of pastoral systems in Ghana and Côte d'Ivoire are not linked to a specific village but refer to the entire region, therefore we have selected the largest and most centrally located urban centre.

The relatively high population growth rates and densities suggest that rangelands are indeed decreasing due to agricultural encroachment. However, despite a decrease in grazing lands, pastoralists have increased herd productivity, either through use of supplementary feed, movement to the sub-humid zone, night grazing, exploitation of new pastures using water tubes, or a combination of these strategies. Because many pastoralists live fairly close to major urban centres, the potential for diversification and livestock marketing in the region is great. In fact, many have already diversified their household economy and are marketing their animals to consumers in these urban centres (see Amanor, 1995).

Overall, our comparative analysis of seven case studies shows that West African pastoral systems are not in a crisis, despite higher population growth and densities than in the Horn of Africa. Evidence of successful adaptation is not only that pastoral systems continue to exist and adapt to changing circumstances in West Africa but also the increases in agricultural and pastoral production, as well as the market value of pastoral products. In the following section we will examine how West African pastoralists have successfully adapted to the pressures on their grazing lands.

IV. Pastoralists' Adaptive Strategies in West Africa

Despite the great variation in our case studies, it is possible to discern three adaptive strategies that West African pastoralists have used to cope with the pressures on pastoral systems: (1) integration and intensification in the Sudanian zone (Mali, Niger, Nigeria, and Cameroon); (2) movement to the subhumid zone (Ghana and Côte d'Ivoire); and (3) extensification in the Sahelian zone (Senegal). These categories represent ideal types, as there is some overlap in the patterns. Pastoralists in southwestern Niger, for example, are intensifying their production system while simultaneously sending part of their herd on transhumance to the sub-humid zone, while pastoralists in southern Mali are pursuing a strategy of integration and intensification in the sub-humid zone, and pastoralists in northern Côte d'Ivoire practise agropastoralism.

Integration and Intensification in the Sudanian Zone

Pastoralists in the densely populated areas of the Sudanian zone are pursuing the coupled strategies of integration with agriculture and intensification of agricultural and pastoral production. Intensification refers to increasing yield per unit of production (land, animal) by increasing the labour and/or capital inputs per unit of production, which can take multiple forms, for example, use of manure and animal traction to improve agricultural productivity or the use of crop residues and cottonseed cakes to increase herd productivity. The increasing integration of agriculture and pastoralism has the potential to successfully provide for growing and increasingly densely packed rural and peri-urban populations in West Africa (Mortimore, 2005).

Mortimore (2003: 464–469) reports that the outputs of both pastoral and agricultural systems per capita have increased as land has decreased in several areas of West Africa. The empirical successes of intensification and diversification strategies are supported by the modelling exercises by La Rovere et al. (2005). Their bio-economic models illustrate the benefits of integrating agricultural and pastoral production systems. By allowing herds to utilise croplands as pasture, pastoralists increase both herd productivity and agricultural productivity, which increases food security for farmers and herders.

In the past, the agricultural and pastoral production systems were integrated at a regional level through exchanges between herders and farmers, while each group continued to specialise in their respective economic activity. Today, herders and farmers are increasingly integrating agriculture and pastoralism at the household level (Toulmin, 1983). The integration at the household level has some negative consequences as both herders and farmers are increasingly competing for the same resources (for example, fields, crop residues, and grazing land) (Landais and Lhoste, 1990; van Driel, 1999).

Movements to the Sudano-Guinean Zone

One response to greater competition over grazing lands in the Sudanian zone is migration into southern sub-humid climatic regions (Bassett and Turner, 2007).

Since the 1960s and 1970s, FulBe pastoralists have increasingly moved into the sub-humid Sudano-Guinean regions of Nigeria, northern Côte d'Ivoire, Ghana, and Cameroon. These migrations are commonly attributed to recent droughts and the southern shift of the tsetse fly belt (Bassett, 1988; Boutrais, 1986, 1996; Blench, 1994; Tonah, 2003). Bassett and Turner (2007) posit that this migration occurred slowly as the result of a variety of cultural, political, and historical pressures in addition to the traditionally accepted climatic explanation (Diallo, 2001). FulBe migration is facilitated by improvements in veterinary medicine and pro-pastoralism government policies.

As FulBe pastoralists move south to the sub-humid zone, they have adapted to the new social-ecological context in a number of ways. First, they crossbreed or replace their herds with local breeds that are trypanosomiasis resistant (Bassett and Turner, 2007; Boutrais, 2007). Second, they have shifted from multi-species herds to herds that consist solely of cattle (Blench, 1994). Third, they have moved away from subsistence pastoralism to more commercial pastoralism, which is reflected in the shift from milk sales to sales of beef cattle, fattening stock and/or reproductive stock (Blench, 1994; Amanor, 1995). Since milk is no longer a demand commodity, milk is left for the calves. This has improved calf survival and increased herd productivity (Blench, 1994; Amanor, 1995). The ability to expand their range has allowed FulBe pastoralists to adapt to pressures on rangelands further north.

Extensification in the Sahelian zone

Population growth and agricultural encroachment in the Senegal Valley has pushed Fulani pastoralists to the Ferlo region where there are abundant pastures. There, they have pursued a strategy of extensification, opening up new rangelands for exploitation through the use of boreholes and watering tubes (Juul, 1996). Fulani pastoralists have also pursued dialectical strategies of diversification and specialisation. They engage in multiple economic activities in addition to pastoralism and have invested income from these activities in their pastoral production system, in particular horse and donkey carts to carry the watering tubes. Simultaneously, Fulani pastoralists have pursued a strategy of specialisation, in which they focus on a particular segment of the market for livestock products. A number of them have shifted from cattle to sheep and are raising these for the Muslim feast Tabaski. This particular form of pastoral production is labour-intensive as herds are split and moved frequently to find the best pastures.

The strategy of extensification is also pursued by pastoralists in West Africa that are not in our sample, for example, WoDaaBe pastoralists in southeastern Niger aim to increase herd productivity by being highly mobile (Schareika, 2003). However, WoDaaBe pastoralists in southeastern Niger are more subsistence oriented than the Fulani in Senegal. It is remarkable that pastoralists have been able to adapt to pressures on rangeland in the Sahelian zone, as there has been a significant decline in rainfall in the Sahel during recent decades (IPCC, 2001).

Our sample does not cover all the adaptive strategies that are used in West Africa. Wealthy businessmen, politicians, and government officials (both FulBe and non-FulBe), for example, own large private ranches on the high plateau of the Adamaoua in Cameroon (Boutrais, 1990). They hire herders to watch their thousands of cattle,

which are raised for the urban markets of Yaoundé and Douala. Other strategies that are used by pastoralists, livestock traders, and farmers are keeping peri-urban milk herds and fattening of beef cattle for the market (Amanor, 1995: 380–383). While ours is not a random nor a complete sample of pastoral systems in West Africa, we believe that the case studies represent a wide range of adaptive strategies and represents well the dynamism of West African pastoral systems.

V. Comparing West Africa with the Greater Horn of Africa

Despite similar pressures – loss of grazing lands due to encroachment of agriculture, competition and conflict over natural resources, insecure tenure rights over grazing lands, political insecurity – and higher population growth and densities than in the Greater Horn of Africa, West African pastoral systems do not seem to be in crisis. The question is what variables are responsible for these different outcomes – why are West African pastoral systems not in crisis?

We hypothesise that there are four interrelated factors that facilitate pastoralists' adaptations in West Africa:

1. Bioclimatic conditions make it easier to practise agriculture in West Africa than in the Horn of Africa, and this allows pastoralists to integrate agricultural and pastoral production.
2. Integration and intensification allow West African pastoralists to increase agricultural and pastoral productivity despite a decrease of grazing lands (for example, through the use of agricultural rest products, cottonseed cakes).
3. Proximity to large urban centres and historically well-developed cattle markets across West Africa, in particular in the Sahelian and Sudanian zones, allows pastoralists to receive higher returns for their pastoral products than pastoralists in the Horn of Africa. Some of the revenues may be reinvested in technology.
4. Technology allows West African pastoralists to exploit new pastures in areas with relatively low population densities in the Sahelian and sub-humid zones (for example, through the use of boreholes, donkey carts with watering tubes, trypanosomiases treatments, crossbreeding with trypanosomiases-resistant breeds).

These factors are interrelated – for example, proximity to urban centres allows pastoralists to market their products and invest the revenues in new technology.

The bioclimatic differences between West Africa and the Horn of Africa are one important explanation for why West African pastoralists are not in a crisis. Ellis and Galvin (1994) explain why land use patterns in the drylands of East and West Africa differ considerably despite broad similarities in climate and ecology. Whereas West Africa has a tradition of integrating agriculture and pastoralism, this is mostly absent in East Africa (including the Horn of Africa) (Ellis and Galvin, 1994: 341–342). Ellis and Galvin argue that variation in precipitation patterns, in particular seasonality and inter-annual variability, are responsible for the different land use patterns. Whereas the Sudanian and Sahelian zone of West Africa is characterised 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 (Ellis and Galvin, 1994: 344). This means that West African pastoralists can more readily integrate and intensify agricultural and pastoral production systems.

The difference in precipitation patterns between the Horn of Africa and West Africa also has other implications for pastoral production systems. First, 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 (Ellis and Galvin, 1994: 345–346). Consequently, West African pastoralists rely more on cereals in the dry season and this favours an integrated crop-livestock system (1994: 345). Second, 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 rainfall patterns (Ellis and Galvin, 1994: 346). The practice of long distance transhumance facilitates the movements to and exploitation of new grazing areas (for example, the sub-humid zone), as West African pastoralists have the habitus of opportunistically seeking new grazing lands (Stenning, 1960; Bassett and Turner, 2007).

The relationship between population growth and the development of pastoral systems in West Africa is more complex than Sandford suggests in his thesis and, in some ways, may contribute to the relative success of West African pastoral systems.

In his seminal synthesis of human-environment interactions in the Sahel, Claude Raynaut and his colleagues (Raynaut, 1997) argue that there is a general tendency towards high population densities and growth, but also that there is much variation. Raynaut (1997, 2001) describes it as a mosaic of combinations of population density and growth across the Francophone countries of the Sahel (Mauritania, Senegal, Mali, Burkina Faso, Niger). He argues that demographic patterns have more to do with history than with environmental variables – for example, the development of ancient states and colonial areas of specialisation rather than soil or rainfall. To better understand the relationships between societies and nature in the Sahel, Raynaut and colleagues overlay maps with demographic data, bioclimatic zones, land use patterns, and social systems across the Sahel (Raynaut, 1997, 2001). He concludes that population growth alone cannot be blamed for environmental problems in the Sahel as the relationship between population and environment is much more complex. The intensity of the stress from population growth on pastoralism also depends on other factors discussed by Raynaut (2001), such as the nature of resource exploitation, the large scale geographical specialisations, the presence of commercial outlets, the structure of transport systems, and the extent to which production is for the external market rather than subsistence needs. Therefore, the impact of population growth on pastoralism depends primarily on the socio-politico-economic context.

Michael Mortimore and Mary Tiffen have argued that population growth and market incorporation are necessary conditions for sustainable development of African drylands (Tiffen, 2004; Mortimore, 2005). They have shown that African farmers have successfully adapted to increasing demographic pressures on natural resources in their interdisciplinary and comparative research across Africa (Nigeria, Niger, Senegal and Kenya) and longitudinal research in the Closed Settled Zone of

Kano, Nigeria, and the Machakos District, Kenya (Mortimore, 2005). Farmers have done this by intensifying their production system, investing in water and soil conservation techniques, and integrating livestock in mixed farming systems. The integration of livestock in intensive mixed farming systems serves several purposes: the manure can be used as fertiliser; animals can be used for draught and transport; and animals can be marketed and the revenues can be re-invested in agriculture (Mortimore, 2005: 14). One of the factors contributing to the success is proximity to urban centres, which allowed farmers to market their products and offered non-farm incomes, the revenues of which could be invested in the farms.

This model of dryland development also explains why pastoralists in Mali, Niger, Nigeria and Cameroon have been able to successfully adapt to the pressures on their grazing lands. Population growth means a larger pool of labour, which allows pastoralists to diversify their livelihood strategies and create larger networks of people and resources (Hampshire and Randall, 2005). Proximity to large urban centres also allows pastoralists to get higher prices for livestock and use the revenues for reinvestment in the production system.

West Africa has not only larger urban populations and thus greater demand for pastoral products, but the livestock marketing system has been more developed than in the Horn of Africa (Kerven, 1992; McPeak and Little, 2006). This means that West African pastoralists get better returns on their livestock sales. Research has shown that West African pastoralists are responsive to market forces and adjust their herd structures to environmental factors and market opportunities (Amanor, 1995: 387). In a comparative study of livestock marketing in East and West Africa, Kerven (1992) argues that there are several historical reasons why livestock marketing has been more developed in West Africa than in the Horn of Africa. In particular, colonial policies had a major impact on the development of livestock marketing systems, especially the provision of veterinary services, taxation policies, development of infrastructure, and interference in indigenous marketing systems. The colonial government in Nigeria, for example, provided veterinary care; it built roads and railways to connect the pastoral zones with the cities in the south; and it did not interfere with the indigenous marketing system. The colonial government in Kenya did almost the opposite (Kerven, 1992: 7–13).

Finally, pastoralists are not passive subjects; they are actively pursuing adaptive strategies to secure and improve their livelihoods. Crossbreeding of 'traditional' cattle breeds and new breeds is an example of how the Fulani adapt to new ecological and economic contexts (Amanor, 1995: 387; Boutrais, 2007). It is pastoralists' opportunism that plays a critical role in their successful adaptation to changing circumstances.

VI. Discussion

Our analysis of the case studies presented above shows that West African pastoral systems are adaptive, sustainable and economically viable. However, we have a few notes of caution regarding the conclusion that West African pastoral systems are not in crisis.

First, the cases of Côte d'Ivoire and Ghana show that insecurity is a serious threat to the sustainable development of pastoral systems. One could argue that the

pastoral systems in these countries are not successful, even though it is not because of pastoralists' strategies, but because of the larger political insecurity in these respective countries. Just as insecurity is one of the main threats to pastoral systems in the Horn of Africa, insecurity and civil war remain a threat in West Africa. This is also true for the impact of herder-farmer conflicts that escalate into widespread ethnic, religious and political conflicts (Moritz, 2006).

Second, studies on climate change warn that Africa, in general, and the Sahelian region, in particular, will experience warmer climates due to the increased temperatures in the Indian Ocean (Simms, 2005). The Sahel is projected to become drier. Global warming could have a significant negative effect on pastoral societies. Although Sahelian societies are adapted to dealing with droughts in their environment, longer and more frequent droughts could make it difficult for pastoralists to recover from them (Simms, 2005: 32). Although the threat from global warming seems severe for Sahelian pastoralists, these effects can be alleviated through appropriate land reforms and economic policies that ensure pastoralists' mobility and access to urban markets.

Third, the majority of the pastoral systems that we sampled were described as adaptive, and although that is not something we purposefully sought, our sampling may have skewed our conclusion that West African pastoral systems are not in crisis. It may also be the result of a sampling bias on the part of the authors who conducted the original studies; they may have selected pastoral systems that were successful, ignoring others that failed (de Bruin and van Dijk, 1995) (or ignoring the sections that were less successful, as in each system there are households that are more and less successful). Also, unsuccessful systems cease to exist. A number of the case studies in our sample of successful adaptive strategies are mirrored by the failure of pastoral systems. The collapse of pastoral systems in the Senegal Valley in the 1970s and 1980s (Schmitz, 1999), for example, was the impetus that led to the adaptive strategies of extensification and specialisation in the Ferlo region of Senegal (Adriansen, 2006). Thus, failure and success of pastoral systems are intrinsically linked as pressures on pastoral production systems force pastoralists to pursue other strategies and seek new opportunities.

Fourth, in a number of the case studies, the pursuit of new adaptive strategies has led to a growing socioeconomic differentiation between wealthy and poor pastoralists. For example, the intensification of pastoral production in the far north of Cameroon is only an option for relatively wealthy households that have the means to purchase costly cottonseed cakes (Moritz, 2003). Similarly, the opportunities for marketing livestock are also not the same for all pastoralists. Poorer pastoralists are more likely to receive lower prices for their livestock and are thus unable to fully exploit market opportunities (Turner and Williams, 2002). The growing socioeconomic differentiation is also occurring among pastoralists who have moved to the sub-humid zones; herd sizes have increased significantly but so has the number of hired herders (Bassett 1988). Due to the general lack of data on herd ownership and socioeconomic differentiation, particularly longitudinal data, it remains unclear what exactly the trends towards greater socioeconomic differentiation are across West Africa. Sutter (1987), for example, documented an increasing inequality in cattle ownership in the Ferlo region of Senegal but almost 20 years later, Adriansen (2006) found that despite social and economic differences, only a few families were struggling to rebuild their cattle herds

and that none has been forced to leave the area out of poverty. A comparison of Sutter's and Adriansen's studies of pastoralists in the Ferlo region also show that the difficulty of discerning trends towards socioeconomic differentiation is not only a problem of data availability, but also one of data interpretation.

The outcomes of these adaptive strategies are thus not unequivocally positive for all pastoralists, but does that mean that pastoral systems are in crisis? Sandford (2006b) and Hogg (1986) argue that impoverishment of large segments of the pastoral population is an indicator that pastoral systems are in a crisis. However, one could make an analytical distinction between the sustainability of pastoral systems and the livelihoods of individual pastoralists, and argue that 'sloughing off' impoverished pastoralists is an inherent dynamic of pastoral systems and not necessarily an indication that pastoral systems are in a crisis (Barth, 1986 [1961]; see also, Chang and Koster, 1994: 11; McCabe, 2004). In this perspective, the issue of impoverished pastoralists becomes one of economic justice (or moral economy) that is separate from sustainability of the system. In short, the question whether pastoral systems are in crisis depends in part on the level of analysis that is employed. However, one cannot entirely separate people from systems (if absentee owners owned all cattle we probably would write about pastoral industries and no longer about pastoral societies). The question is thus: when does the sloughing off of impoverished pastoralists become a crisis for the persistence of pastoral systems? What percentage of people need to lose their pastoral livelihood before we write about a crisis of pastoral systems? Sandford (2006a, b) argues that in the greater Horn of Africa, the numbers are such that pastoral systems are in a crisis. We argue that this does not seem to be the case in West Africa; there is no visible evidence of impoverishment of large segments of the pastoral population (as in the famine relief camps in the Greater Horn of Africa).

Fifth, some may argue that some of the adaptive strategies that West African pastoralists are pursuing makes them farmers raising livestock, rather than pastoralists (Azarya, 1999). In this view, people cease to be pastoralists or agropastoralists when the contribution from livestock products to a household's diet and income falls below a certain percentage. Adaptive strategies, like integration and intensification, then transform pastoral systems in mixed farming systems. Mortimore and Adams, and Tiffen, for example, argue that there is no future for mobile pastoralism in West Africa but that there is a future for the integration of livestock in agricultural systems (Mortimore and Adams, 1998: 272; Tiffen, 2004: 15). In doing so, they make a distinction between the economic activity of raising livestock and the cultural commitment to raising livestock. The problem is that this distinction is often difficult to make on the ground. Moreover, it ignores the enormous variation in pastoral systems and interferes with understanding the dynamics of pastoral systems.

We believe that the economic activity of, and cultural commitment to, raising livestock are intertwined. Following Chang and Koster (1994), we argue for a broad definition of pastoralists that captures the variation and dynamics of contemporary pastoral systems: 'those who keep herd animals and who define themselves and are defined by others as pastoralists … The point is 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' (Chang and Koster, 1994: 8–9). We argue that the changes in West African

pastoralism do not signal the end but a moment in continuous change in pastoral systems. Pastoralism is a dynamic and flexible subsistence strategy with a more than thousand year history of successfully exploiting variable dryland environments in sub-Saharan Africa (Smith, 2005). Pastoralists have successfully adapted to changing conditions in the past and our analysis of these seven case studies indicate that they continue to successfully adapt to changing circumstances.

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