Hum Ecol (2007) 35:33–49
DOI 10.1007/s10745-006-9067-4

Sudden Shift or Migratory Drift? FulBe Herd Movements to the Sudano-Guinean Region of West Africa

Thomas J. Bassett · Matthew D. Turner

Published online: 20 December 2006

Abstract A significant change in the geography of livestock raising over the past 30 years is the southerly movement of FulBe herds into the humid Sudanian and Guinean savannas of West Africa. The literature suggests that the severe droughts of the early 1970s and mid-1980s were the driving force behind this southern expansion of mobile livestock raising. The conventional view is that drought forced herders to seek greener pastures to the south, an area that zebu cattle have previously avoided because of the presence of tsetse flies, the vector of animal sleeping sickness (*trypanosomiasis*). This "sudden push" hypothesis places Sahelian herds in savanna pastures in a matter of a 1–3 years. This stimulus-response model runs counter to our observations and understanding of the social and ecological processes influencing FulBe herd movements. We challenge the "sudden shift" thesis at the regional scale by arguing that the southerly expansion of FulBe herds has proceeded according to a more complex temporal frame that includes generational, biological, and social historical timeframes and periodicities. We distinguish between short-term shifts ("test movements") and more permanent shifts ("migration movements"). These mobility patterns are linked to contingent factors such as cattle diseases, drought, and political instability, as well as to more structural and adaptive features such as the establishment of social networks, herding contracts, and cattle cross-breeding. Shifts in livestock ownership and the social differentiation among herders are important variables for understanding changes in herd movements. We conclude that the permanent shift of herds to the humid savannas of West Africa has been preceded by a series of social and agroecological adjustments that operate on decadal and generational time scales.

Key words Pastoralism · historical political ecology · Niger · Ivory Coast · migration · transhumance · Fulani · climate change · pastoral mobility

T. J. Bassett (✉)
Department of Geography, University of Illinois,
607 S. Mathews Ave, #220,
Urbana, IL 61801, USA
e-mail: bassett@uiuc.edu

M. D. Turner
Department of Geography, University of Wisconsin,
160 Science Hall, 550 Park Street,
Madison, WI 53711, USA
e-mail: turner@geography.wisc.edu

Introduction

One of the most significant developments in the geography of livestock raising over the past 30 years is the southerly movement of FulBe herds from the Sudano-Sahelian zone to the more humid Sudanian and Guinean savannas of West Africa (Gallais, 1979; Blench, 1994; Boutrais, 1994). The large numbers of humpbacked zebu cattle appearing in areas where they were formerly absent has been popularly viewed as an "invasion" by peoples of the southern savanna (Institut d' Ethno-Sociologie, 1975, p. 58; Coulibaly, 1980, p. 12; Bernardet, 1984; Arditi, 1990, p. 140). The literature suggests that the severe droughts of the early 1970s and mid-1980s were the driving force behind this southerly expansion of FulBe pastoralism (Barry, 1975; Gallais, 1979, p. 117; Delgado and Staatz, 1980, p. 21; Frelastre, 1986; Arditi, 1990, p. 139; Benoit, 1999; Bernardet, 1999, p. 416; Diallo, 2000). Observations of emigration from the northern Sahel and increased presence of herders and livestock in the

southern Sudanian and Guinean zones are the major pieces of evidence supporting a sudden migration of pastoralists and livestock to new areas. The particularly harsh droughts of 1973 and 1984 are seen to have *pushed* herders to greener pastures in areas that they had previously avoided because of the presence of tsetse flies, the vector of animal sleeping sickness (trypanosomiasis). The droughts not only stimulated this southerly movement but also made it possible by displacing the ecological barrier of the tsetse fly belt further south (Delgado and Staatz, 1980, p. 28).

This stimulus-response model runs counter to our observations and understanding of the dynamic political and ecological processes influencing FulBe herd movements since the first half of the twentieth century. First, it tends to naturalize FulBe herding practices by emphasizing rainfall as the most important influence on livestock movements. Thus, it diminishes the importance of the social processes structuring livestock movements that are everywhere socially mediated. Second, the sudden shift hypothesis places Sudano-Sahelian herds in savanna pastures in a 1–3 year time frame. It is notably silent on the migration process, especially on the roles played by social networks, reconnaissance herding, and transhumance in the selection of new rangelands. These practices commonly take place over decadal if not generational time frames. Third, the sudden shift thesis overlooks the importance of FulBe herd management practices, especially cattle breeding, in environments with high disease hazards. Yet a common strategy of the FulBe is to crossbreed their zebu animals with the hardier taurin breeds of the Sudano-Guinean zone to maintain herd health and productivity in the humid savannas. The fact that many of the FulBe herds crossing into Côte d'Ivoire and Benin in the 1970s and 1980s were composed of crossbreeds indicates that biological reproduction rhythms influenced the timing of FulBe migration to the Sudano-Guinean zone.

In this paper we challenge the sudden shift thesis at the regional scale by arguing that the southerly expansion of FulBe herds has proceeded according to a more complex sociospatial and temporal frame that includes generational, biological, and social historical time. This pattern of movement resembles Stenning's "migratory drift" category of FulBe population movement, defined as a "gradual displacement of the transhumance routes that results eventually in a completely new geographical setting for a particular group" (Stenning, 1960, p. 139). Our review of the FulBe pastoralism literature combined with two case studies lend support to this alternative hypothesis. As our cases illustrate, these strategies have temporal periodicities and lags linked to the geography, demography, and sociology of herds and people. Understanding these temporal heterogeneities will not only improve our understanding of recent southerly migrations but also shed light on the prospects for changing patterns of pastoral mobility in the future.

Historical Geography of FulBe Movements in Sudano-Sahelian West Africa

Vegetative communities, pasture characteristics, and cropping potentials change along a steep gradient of declining annual rainfall and growing season length from the rainforests along the West African coast in the south to the Sahara desert in the north. This ecotone is typically divided into a number of bioclimatic zones variously defined by mean rainfall (Chevalier, 1900; White, 1983; Le Houérou, 1989). For the purposes of this paper, we will distinguish four bioclimatic zones based on long-term annual mean rainfall: Sahelian (200–400 mm/year); Sudano-Sahelian (400–600 mm/year); Sudanian (600–1,000 mm/year) and Sudano-Guinean zones (1,000–1,400 mm/year) (Fig. 1).

The major features of the livestock movements reflect the region's climate and biogeography. Animal disease challenge, particularly that of trypanosomiasis, declines as one moves north from the Sudano-Guinean zone into the Sudanian zone (Bourn, 1978). Range productivity declines but forage quality increases as one moves north from the Sudanian zone through the Sahelian zone (Penning de Vries and Djitèye, 1982; Amanor, 1995). Historically, livestock and human population densities were highest in the northern Sudanian and Sudano-Sahelian zones. The FulBe took advantage of higher forage quality to the north by moving their herds into the northern Sahel during the summer rainy season, generally remaining there until ephemeral surface water bodies were depleted before returning to their "home" territories during the dry season. In this way, long-distance grazing movements were oriented along a North–South axis to seasonally take advantage of different rangeland ecologies (Doutressoulle, 1924).

FulBe oral history of precolonial West Africa is a history of eastward expansion (Hama, 1968). Unlike the seasonal transhumance routes, which generally ran parallel to the dominant North–South ecological gradient, precolonial migratory movements were oriented perpendicular with new FulBe settlements often established to the east as families and clans split (Loyance, 1947; Dupire, 1970; Gallais, 1975; Ba and Daget, 1984; de Bruijn and van Dijk, 1995). To maintain long-distance grazing movements after migration, new transhumance corridors had to be established. This was often made difficult due to problems of security. FulBe were best able to establish transhumance movements if they allied themselves with powerful local patrons and precolonial states which had the ability to protect the movements of animals across a sizable region.

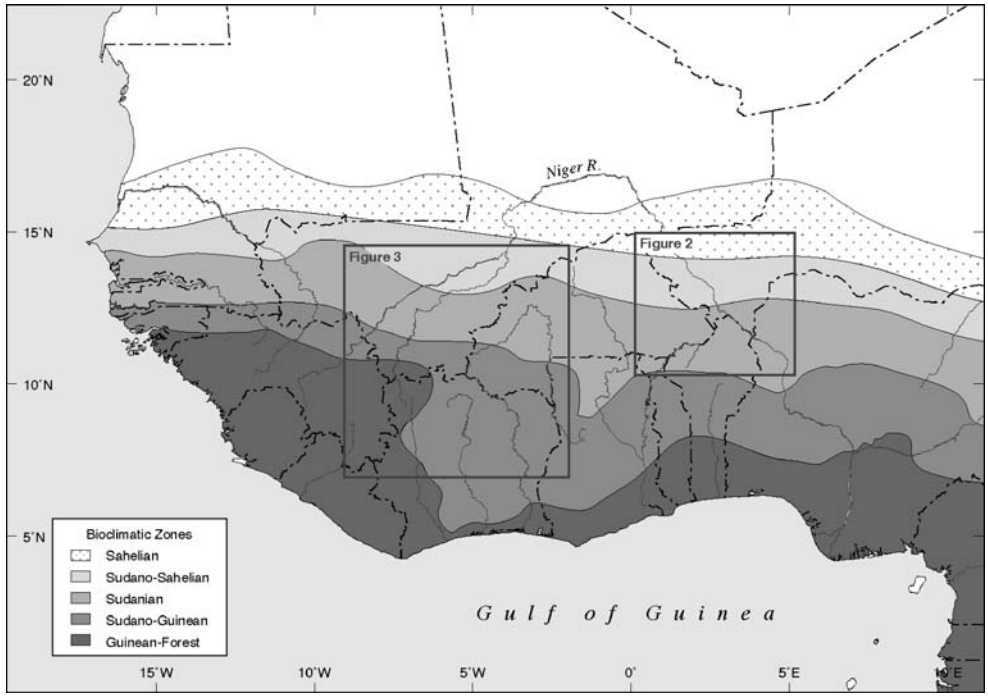

Fig. 1 Major bioclimatic zones in West Africa. Bioclimatic zones are defined by long-term mean rainfall: Sahelian (200–400 mm/year); Sudano-Sahelian (400–600 mm/year); Sudanian (600–1,000 mm/year) and Sudano-Guinean zones (1,000–1,400 mm/year). Map adapted from isohyetes outlined in rainfall map produced by Nicholson *et al*. (1988, p. 5). Locations of case study areas shown in Figs. 2 and 3 are outlined.

Not surprisingly, the few clan histories recorded among the FulBe show a fluctuation in the range of their grazing movements due in part to the spheres of control enjoyed by their patrons (Ba and Daget, 1984; Bonfiglioli, 1988; Laya, 1991).

Since the early colonial period, one could argue that eastward expansion has continued as FulBe populations move to Chad and as far east as Sudan (Schlee, 2000). Within West Africa however, the importance of eastward migration has declined while migrations along the North-South axis have become more prevalent. The waves of rinderpest that swept through West Africa (Aldige, 1918; Malfroy, 1926) during the early colonial period drastically decapitalized FulBe herds and led to a reduction in livestock mobility and undoubtedly led to some migration in order to gain access to cultivable land (Adebayo, 1997). Although there is evidence for earlier FulBe expansion along the North-South axis (Lombard, 1957; Stenning, 1960, pp. 149–151), once herds were reestablished, the FulBe were able to take advantage of the pasture areas to the north and to a much lesser extent, south, due to colonial pacification. In this way, a second phase of FulBe expansionism, pushing especially north of the Sudano-Sahelian middle band, began during the second half of the colonial period. The pacification of the Kel Tamashek by the French reduced the security threat facing FulBe herds in the north, with anecdotal evidence suggesting an extension of the "classic" North-South transhumance pattern into the northern Sahel as a result. Increased rainfall during the 1950s led not only to a movement of cultivating people to the north but an associated movement of agropastoral FulBe (Bonfiglioli, 1988; Heasley and Delehanty, 1996). FulBe migrations generally followed existing North-South transhumance corridors as FulBe migrants utilized social alliances established through years of transhumance to safely settle to the north (Nicolas, 1963; Gallais, 1975; Bonfiglioli, 1988). Open pasture areas also lay in the low population belt in the southern Sudanian and northern Sudano-Guinean zones. While there is ample evidence of grazing movements (largely during the dry season) into the southern Sudanian and northern Sudano-Guinean zones during the colonial period (e.g., Stenning, 1959, pp. 221–223; Benoit, 1979; Frantz, 1981, p. 80; Bassett, 1986; Boutrais, 1986; Laya, 1991; Blench, 1994; Adebayo, 1997), year-round livestock husbandry in these zones was hampered by a combination of lower forage quality, government restrictions (Boutrais, 1986; Blench, 1994), and greater threats to livestock from disease (*trypanosomias*, intestinal parasites).[1] With limited seasonal movements of livestock into these bioclimatic zones, relationships between FulBe populations to the north and agricultural populations in Côte d'Ivoire, Benin, Togo, and central Nigeria remained poorly developed, and FulBe immigration into these areas to raise livestock was uncommon (Blench, 1994).

[1] Major exceptions being upland areas which provided some protection from the tsetse fly in Adamoua of Cameroon, the Jos Plateau in Nigeria and Fuuta Djallon of Guinee (Boutrais, 1986; Blench, 1994).

Southerly Movements of Livestock Over the Past 30 years

The movements of FulBe and livestock from north to south have accelerated since the early 1970s and are often seen either as resulting from drought-induced exodus of people and livestock during serious drought years (e.g., 1973, 1984) or as an ecological adjustment to declining pasture productivity to the north. In both cases, the shift is seen as resulting from the cumulative effect of numerous decisions by pastoralists (particularly FulBe) to move south with their livestock. In questioning this view, we are not questioning the existence of drought-induced movements of herds south nor that certain pastures to the north are less productive than they have been in the past. What we argue is that the stimulus-response model of pastoralist movement ignores the social and ecological requirements for people and livestock to successfully move. Migratory movements are seen not as the result of a single decision but as the culmination of a contingent process involving numerous decisions by many people. By not seriously considering the migration *process*, analysts are prone to ignore the social and ecological changes across the North-South ecotone that have established the conditions for this movement to occur.

Regional Shifts in Livestock Ownership

Broader changes in the political economy of regional livestock markets and ownership have contributed to movements of livestock and FulBe to the south. Before we turn to the process of FulBe migration over the last 30 years, it is important to consider the various ways that increases in FulBe and livestock populations have occurred to the south. People that are easily identified as "FulBe" in the south are often seen with livestock—as herders, owners, or merchants. Given that both livestock and FulBe seemingly increased together in the south, there has been a tendency in the literature to assume that the FulBe "brought" the livestock south. This is undoubtedly true, as we will develop further below, but another major reason for the "simultaneous" movement of FulBe and livestock to the south has been a regional shift in livestock ownership and the growth of FulBe labor migration.

Over the last 30 years of recurrent drought in the north, livestock owners in the north have sold animals. Some of these animals have been butchered for meat but many others have been bought by people to the south whose incomes were less impacted by drought (Habou and Danguioua, 1991; Turner, 1993; Raynaut *et al*., 1997, pp. 153–154). Young men from decapitalized FulBe families in the north have increasingly moved south to work as hired herders (Blench, 1985; Bassett, 1994; de Bruijn and van Dijk, 1994; Tonah, 2000; van Santen, 2000). Therefore, movements of FulBe and cattle to the south have occurred for different reasons but are inextricably tied to the livestock wealth status of FulBe families. FulBe immigrants to areas such as northern Côte d'Ivoire, Togo, Ghana, and Benin are from different age and economic positions. Those arriving with cattle herds normally are older, often having established local contacts in their youth, and relatively wealthy in cattle since migratory moves are economically feasible only for those with relatively sizable herds (see cases presented in Bassett, 1986, pp. 239–245). In quite different circumstances are the young men in their late teens and twenties that have left their livestock-poor families in the north to search for work. They normally arrive with an understanding that their stay will be temporary—enough time to buildup some capital to return home. However, these labor migrants may, by establishing herds themselves, settle more permanently in the south. In this way, labor migration has played an increasingly important role in FulBe migration over the past 30 years.

Changing Conditions and New Livelihood Strategies for the FulBe

Southerly shifts in livestock ownership have played an important role in the movement of FulBe and cattle to the south, but interregional migrations of FulBe-managed herds from north to south have also contributed to this movement. Rather than the stimulus-response model, we see these movements as the result of a long process of ecological and social adjustment to the significant barriers that have limited southerly movement in the past. As described earlier, forage quality and the disease threat of tsetse have historically limited the movement of livestock into the southern Sudanian and Sudano-Guinean zones. Similarly, FulBe have lacked the social networks necessary in the south to have the security and local knowledge to move their herds there effectively. The rise of southerly migration into these areas results from a decline in the relative importance of these barriers *and* the new strategies adopted by FulBe as new opportunities have arisen.

Spread of Croplands

Over the last 30 years, the region has in general experienced an expansion of agriculture in the Sudanian and Sudano-Guinean bioclimatic zones with little change in the Sahelian zone to the north (Raynaut *et al*., 1997; Hendrickx *et al*., 2004). The loss of dry-season floodplain areas to cropping has been especially costly to livestock husbandry in the Sudano-Sahelian zone. This land use change has led not only to a loss of high-quality pasture but also to heightened labor demands for watering livestock. The combined effects of these changing conditions of

livestock raising in the north have greatly increased the attractiveness of seasonal movements to the south (van Driel, 1997). High cropping densities in many areas of the Sudano-Sahelian and northern Sudanian zones have caused herds to seek alternative pasture areas during the rainy and dry seasons (Boutrais, 1986, p. 150; Hellemans and Compere, 1990; Lericollais and Faye, 1994; Raynaut and Lavigne Delville, 1997, p. 155). While cropping densities remain lower in much of the Sudano-Guinean and southern Sudanian zones, the overall expansion of agriculture has worked to lower the threat of tstsee in these areas, making breeding and movement strategies to raise animals there more effective (Hendrickx *et al*., 2004). Northern Sahelian pastures, by having more nutritious forage and fewer agricultural fields, are still attractive destinations during the rainy season, although their attractiveness declined during the 1990s due to widespread banditry. In short, regional shifts and expansion of cropping activity have worked to increase the relative attractiveness of grazing areas lying south of the Sudano-Sahelian and northern Sudanian zones (e.g., 800–1,000 mm/year).

Despite the increased attractiveness of southern pastures for grazing of livestock, the feasibility of moving animals through these areas depends heavily on the ability of the herder to defend his herd from a range of social predations. Herders' vulnerability is qualitatively different than that of immigrant farmers. Their wealth on the hoof is both difficult to hide and is readily extractable by both illegal and state-sanctioned actions. Making personal alliances is not only critical before settling in an area, it is also important for moving safely through an area on grazing movements. While the social networks linking the Sudanian and Sahelian zones are old and well-developed, contacts in the southern Sudanian and Sudano-Guinean zones have historically been much less developed, thereby limiting FulBe immigration. Three major changes among a number of broader changes have worked to facilitate the development of these social networks over the last 30 years:[2]the expansion of interregional trade in cattle, the increased prevalence of seasonal grazing movements southward from the northern Sudanian zone, and FulBe-friendly state policies in the Sudano-Guinean zone.

Increase of Long-distance Trekking of Animals to the South

North-to-south trade in livestock has existed historically in the region since the precolonial period (Lovejoy and Baier, 1975; Tricart, 1956). The volume of this traffic has climbed exponentially since the second half of the colonial period as demand for meat has grown in the cities to the south (Okediji, 1972; Kimba, 1981; Kervan, 1992; Amanor, 1995). To meet this demand, increasing numbers of cattle were trekked by foot through the Sudanian and Sudano-Guinean zones toward urban destinations (Grégoire, 1997). While truck transport has increased, livestock trekking still remains an important method for transporting livestock.

Much work on the regional livestock trade has naturally focused on the extensive social networks established by livestock traders in order to organize movements; negotiate animals across borders; and to access urban marketing outlets (Cohen, 1965; Grégoire, 1992; Quarles van Ufford, 1999). The local contacts made by a "facilitator" and herders along the trekking routes have not been a focus of work. Trekking of a market herd requires not only moving cattle along a linear route but also finding food for animals and herders. This requires understanding the availability of pasture along the route and developing local "friends" along the way. The knowledge and contacts made by trekkers through areas to the south most certainly can help subsequent grazing movements (Boutrais, 1986, p. 147; Tonah, 2003). Moreover, we know of cases where trekking herders, either through their eventual success as traders or becoming "stranded" in the south as hired herders, find themselves settling in the south.

Increase of Seasonal Transhumance into the Southern Regions

Historically, FulBe herders have been able to redistribute their animals' grazing time along the transhumance corridor in response to changing conditions. While the "classic" North-South transhumance cycle is often seen to have its dry-season terminus in the south at the home pastures of the FulBe family or clan, extant transhumance cycles show tremendous diversity with a second transhumance southwards from the FulBe settlement not uncommon. In this way, transhumance routes followed by individual FulBe herds are best seen as having been extended and shrunk to the south or north depending on changing circumstances (Stenning, 1960). Seasonal transhumance to the south during the dry season is not uncommon Increasing cultivation pressure and livestock presence in the Sudanian zone has very much influenced these grazing movement decisions over the last 30 years. Increasingly, herders have chosen to extend their dry-season grazing movements to the southern Sudanian and Sudano-Guinean zones, sometimes remaining there to catch early grass growth in April–May before returning north. The dry season represents an opportune time to move south—problems arising from tsetse, ticks, intestinal parasites, and crop damage are less

[2] These changes may explain in part the observation that emigration rates of pastoralists were significantly higher during 1984–1985 drought than the 1972–1973 drought (Frelastre, 1986).

likely at this time. Transitions to more permanent stays to the south occur when herders choose not to return to the north and remain through the rainy season—a decision that requires effective strategies to deal with problems of disease and crop damage.

Seasonal transhumance into the more humid savanna generally precedes migration and year-round settlement in the south (Stenning, 1959, pp. 221–223; Boutrais, 1986, p. 147; Blench, 1994, Adebayo, 1997, Tonah, 2003).[3] For those FulBe herders that eventually settle more permanently to the south, the years during which these transhumance movements are extended represent important transitional periods to adjust the genetic composition of cattle and to establish the necessary social networks to ensure the security of their herds.

Pro-Pastoralist State Policies

Pro-pastoralist policies in countries like Cameroon and Côte d'Ivoire have considerably heightened FulBe interest in the Sudano-Guinean zone over the past 30 years. In Cameroon, the colonial state encouraged the migration of Mbororo FulBe herders to the Grassfields in the 1950s by establishing a livestock station at Jakiri and promoting the hardy *gudaali* cattle breed (Boutrais, 2007). The Côte d'Ivoire government established a livestock development program in 1972 with two objectives: to increase domestic livestock production and thus reduce dependency on fluctuating cattle imports from the Sahelian states, and to reduce land use conflicts between farmers and herders by regulating the movement of FulBe herds. Then President Houphouet-Boigny traveled twice to the Korhogo region in 1974, and during his second visit, met with representatives of FulBe herders and Senufo farmers to convey his government's commitment to reducing tensions between farmers and herders. The President committed the livestock development program (SODEPRA) to take the lead in "finding a definitive solution to the problem of transhumant livestock raising" (SODEPRA, 1974, p. 1). For the next two decades, SODEPRA introduced a series of livestock development projects designed to control FulBe herd mobility through an expanding network of extension agents and pastoral infrastructure (Bassett, 1993). From isolating FulBe herders in pastoral preserves to associating them with farmers in agro-pastoral microzones, the technocratic solutions proffered by SODEPRA's "Opération Zebu" generally failed because they sought to restrict rather than support herd mobility. Farmers' perception that herders were the primary beneficiaries of SODEPRA's pastoral development schemes discouraged them from fully cooperating in these social engineering initiatives.[4]

That the FulBe enjoyed the state's political support was most apparent when farmers tried to expel them from their areas. On numerous occasions during the 1970s and 1980s, violent clashes between Senufo farmers and FulBe herders led to the dramatic movement of FulBe families and cattle to frontier areas. Following these conflicts, administrative authorities held meetings with Senufo leaders at which they reminded them of the President's commitment to livestock production. Gendarmes also rounded up and imprisoned many Senufo men for their role in these uprisings against the FulBe (Bassett, 1988; Diallo, 1999). It was only after such "energetic interventions by administrative, political and technical authorities that many herders regained their former camps" (SODEPRA, 1981, p. 12).[5]

FulBe Migration as a Process

The successful transition from seasonal to year-round presence of a FulBe herd in the south requires luck, skill, and considerable investments by the immigrant herder. As discussed above, there are considerable biological and social barriers to remaining in the south where cattle disease vectors are more prevalent and the local populations may have limited experience with FulBe livestock husbandry. Unless a herder has significant amounts of cash to spend on both trypanosomiasis prophylaxis and making "friends," the risks of quickly moving south are often too high. Instead herding families with sufficiently large herds are more likely to make a series of shorter moves over a number of years using lineage ties or social connections made through prior seasonal movements through the area. Rather than an abrupt movement from the Sahel to the Sudano-Guinean zone, FulBe migration to the south is best described as a combination of grazing movement extensions to the south through "migratory drift" and sequential migration along grazing movement itineraries (Stenning, 1960). Sequential migration is more consistent with the

[3] Animal census data in Nigeria also find an increased year-round presence of cattle in the Guinean zone following a period of 10–30 years of reports of seasonal grazing from the north (Bourn and Wint, 1994, pp. 12–13).

[4] The FulBe were wary at first of the government's intentions. But the provision of free vaccinations (against peri-pneumonia, trypanosomiasis, charbon pasteurellose and brucellose), the construction of dipping tanks and small dams, and the employment of some FulBe extension agents convinced them that SODEPRA's interventions served at least some of their interests.

[5] It was common knowledge that FulBe herders gave gifts to administrative authorities to win their influence during crop damage hearings and other land use conflicts with local farmers. Some Sub-prefects in the north were known for having constituted a personal herd of cattle based on these "gifts".

necessary adjustments in herder knowledge, social contacts, and composition of the herd to be successful in the south.

A major adjustment for successful stock-rearing in the south is the cross-breeding of animals. It is rare, even for a rich herder, to genetically convert his herd by simply buying and selling animals. Instead herders will cross-breed their zebu with trypano-tolerant animals found to the south (Blench, 1994). Given the technical limits to controlled breeding in common pasture situations, breeding efforts by FulBe are generally inefficient compared to situations of fenced pastures, computerized genealogical tracking, and artificial insemination. Under such conditions, the minimum time for genetic conversion of a herd through cross-breeding would likely be on the order of 8–10 years. Although little is known about the FulBe breeding practices along the edge of tsetse zones, one would presume that these efforts begin prior to year-round settlement during the period of their use as seasonal grazing destinations (see below).

Knowledge of and social networks within southern pasture areas are largely gained by those who are with the animals to the south, so it is important to consider who within the family generally herd animals on longer-distance transhumance. Given the physical demands of transhumance and the obligations keeping household heads at home, transhumance herders are often younger brothers and sons (Turner, 1999a, 1999c). Moreover, it is generally young FulBe men in their late teens and twenties who make the necessary "friendships" that facilitate the livestock movements. These friendships include those with their herding peers, stranger–host friendships with local villagers, and, rarely, with political elites and government functionaries. These friendships are often cemented materially through the exchange of livestock, milk or cash, and often last a lifetime. The relationships developed by young men during southerly transhumance are those that facilitate later migration movements. In this way, the social relations facilitating migratory movements along the North-South axis have a periodicity that is influenced by FulBe generational cycles. Generational allocation of labor across different family herds is consistent with this periodicity. As will be described in the Say case, FulBe families going through the transition from seasonal transhumance to permanent migration south, will often split their livestock across the bioclimatic zones. The transhumance herd, under the control of younger herders, increasingly passes the whole year to the south while the herd remaining in the home territory, initially seen as a milk herd and managed by older men becomes increasingly a separate herd due to declining frequency of exchanges of animals (dry and milch cows) between it and the transhumance herd. In this way, there is a growing division of livestock management, even at the level of the family, with the southern herd managed by juniors and the northern herd by elders. The social adjustments to southern pastures are therefore made by the younger generation and in this way, one could argue that migration is an intergenerational phenomena contributing to more delayed responses to climatic variability than predicted by the sudden shift model.

Conceptualizing North-South migration as a process involving a series of adjustments by the FulBe over time, allows a greater appreciation of the factors that contribute to migration decisions beyond climatic variability and enables us to analyze the underlying conditions that contribute to the North-South oscillations of FulBe settlement and seasonal grazing movements over time. We present two case studies of the southerly movement of FulBe and their herds over the past 30 years. The first is the Say Region of southwestern Niger, a site falling within the northern Sudanian zone that has experienced a growth in cattle populations; a rapid extension of cultivation, and emigration of local cattle herders to northern Benin. The second is the Korhogo region in the Sudano-Guinean zone of northern Cote d'Ivoire where FulBe herders have settled in large numbers since the 1970s.

Say Region of Southwestern Niger

The southerly migration of FulBe from the Say District of southwestern Niger into northern Benin has increased rapidly since the 1970s—seemingly consistent with a drought-induced shift to greener pastures (Benoit, 1999; Toutain *et al*., 2001, pp. 12–13). As will be described below, the Say case illustrates not a shift but a relatively rapid migratory drift. Migration decisions were made only after many decades of experimental grazing movements to the south. A similar process of the southerly extension of grazing movements south; biological and social accommodation to southern conditions; and a sequence of seasonal to permanent residency has been followed by Say herders. Moreover, the Say District has not only been the source of emigrations to the south but the sink of immigrations from the north. In this way, the Say case illustrates that the southerly shift in livestock presence in West Africa has not resulted in long-range movements of FulBe families south but of shorter southerly migrations of farmers and herders into Sudanian areas that stimulate further southerly movements of members from Sudanian areas due to increased land-use pressure.

The nineteenth century historical geography of FulBe occupation of what is now southwestern Niger, southeastern Burkina Faso and northern Benin (Fig. 2) can be simply characterized as that of two centers of significant FulBe settlement: the Say region in southwestern Niger to the north (Loyance, 1947; Institut de Recherche en Sciences

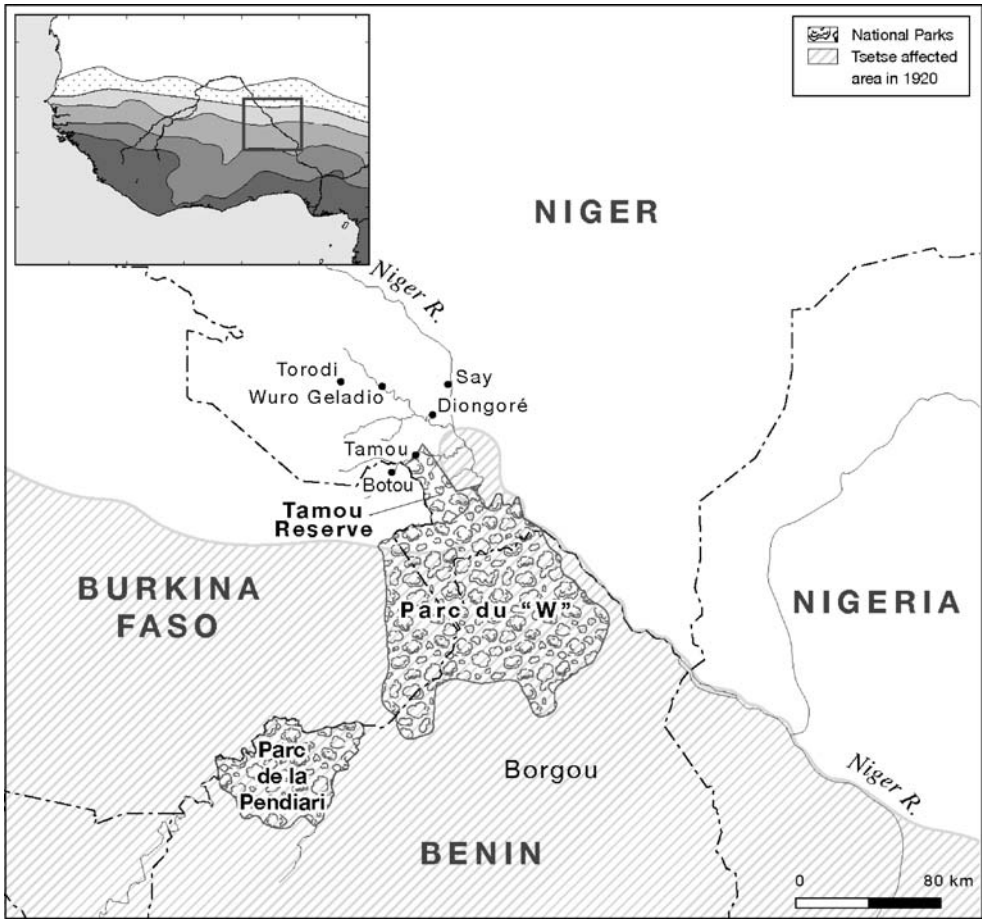

Fig. 2 The Say and Borgou regions of southwestern Niger and northern Benin. Contemporary national park boundaries and the northern limit of tsetse fly distribution as depicted by Roubaud (1920) are outlined.

Humaines, 1977) and the Borgou in northern Benin to the south (Lombard, 1957; Boesen *et al*., 1998). The Borgou region represents an important early case of significant southerly movement of FulBe during the eighteenth and nineteenth centuries, reportedly from either the Gourma region of southeastern Burkina or the Sokoto region of Nigeria to the northeast (Bierschenk, 1998). Livestock mobility has been limited to very short movements during the rainy season to avoid crop damage with somewhat longer movements during the dry season to take advantage of pastures within riparian zones (Atchy, 1976, p. 43). This region was politically, economically and socially isolated from the Say area to the north with the intervening area very sparsely populated by scattered Gourmanché farming communities (Rémy, 1964). Say, located along the Niger River, is a historic town known for the brief time when Mohaman Jobo settled there with his followers during the first half of the nineteenth century (Lem, 1943). Prior to Jobo, the area had been a political hinterland falling just within or outside the spheres of control of a succession of political/military power centers. At the turn of the last century, there were five major principalities within the area (Fig. 2) including: Lamordé-Bittinkodji for the *Bittinkooji*; Torodi for the *Toroɓe*; Wuro-Gueladjo (Kunari) for the *Fereɓe*; Tamou for the *Fetoɓe Foulmangaani* as well as the more cosmopolitan religious town of Say (Laya, 1991). Within these principalities, FulBe society was composed of military, religious, artisanal, slave, and pastoral castes. Pastoral FulBe generally operated in the area under the patronage of particular military and religious elite classes.

The Say District spans the 500 and 800 mm long-term isohyets in southwestern Niger (Fig. 2). The FulBe living southwest of the Niger River in the Say have long been distinguished from those living to the northeast of the river by their sedentary nature. Early colonial accounts describing transhumance systems in the region that would become Niger, never describe longer-distance movements by the Say FulBe (Doutressoulle, 1947, p. 45). Based on observations made during the 1950s, Margaret Dupire (1972) describes the Say FulBe as "sedentarized." In reality, pastoral mobility, while limited, most likely varied over time. Elders of FulBe herding clans in the Say area describe six historic periods of pastoral mobility since the mid-nineteenth century: (1) a precolonial period of eroded regional political authority and high insecurity resulting in frequent short-range movements within circumscribed areas (20–40 km radius); (2) recurrent bouts of rinderpest and drought (Aldige, 1918; Malfroy, 1926) leading to decapi-

talization of FulBe herders and sedentarization to farm during the first three decades of colonial rule; (3) reestablishment of herds and a reported return of dry season movements to graze floodplain pastures of the Niger River by the 1930s; (4) loss of floodplain pastures to cultivation and an increased reliance on short-distance movements (20–40 km) to sparsely populated areas to the south during the dry season beginning by the 1940s but intensifying during 1950s and 1960s; (5) an extension of the dry-season movements to the south into Burkina Faso and Benin during the 1960s (Bellot, 1980; Wilson, 1995); and (6) the effective migration of Say FulBe to northern Benin associated with an increased year-round presence of their herds there accelerating during the 1980s.[6] Here we will focus on the fifth and sixth phases.

Longer-range transhumance movements out of the Say region have been historically limited by its geography. Classic south-to-north transhumance was limited not only by the Niger River but by insecurity when moving through areas controlled by Djerma agriculturalists and Kel Tamashek pastoralists north of the river. To the south, the area surrounding what is now the transborder park, "Parc W," was a very sparsely populated area with significant threats to cattle from wild predators and tsetse flies (Hubert, 1907; Roubaud, 1920; Urvoy, 1929; Benoit, 1999). While the oral histories of the few settled FulBe in northern Benin during the 1950s (north of the Borgou) refer to migration from Say during the eighteenth and nineteenth centuries (Rémy, 1964, p. 8), contemporary Say FulBe point to the earliest movements into northern Benin by Say FulBe as beginning in the 1950s during the late dry season to take advantage of the earlier rains to the south. One of the leaders of the Say FulBe, Rouga Manga Hoore, states that he began such seasonal grazing movements in 1946 by following the Udaa*6e*, sheep herders long known for their long-distance transhumance movements.[7] He initially experimented by sending only half of his herd and found that those cattle that did not die of trypanosomiasis were more healthy and productive than those left behind in home pastures.

The transition from experimentation among FulBe rich in cattle to more widespread dependence on longer-distance movements to the south occurred during the 1970s and was driven by growing pasture shortage in the Say area. In the 1960s, FulBe lost access to key dry-season pastures along the Niger River to farming schemes controlled by government officials (Bellot, 1980). The deterioration in the quantity and quality of rainfed pastures in the Say area was driven in part by the influx of agriculturalists and livestock-rearing people from the north. Widespread drought in the early 1970s and again in 1984–1985, resulted in an influx of Djerma from the Zarmaganda region in search of cultivatable land (Institut de Recherche en Sciences Humaines, 1977, p. 54). The growing demand for cultivatable land exposed the schism that has long existed between FulBe elites and herding FulBe with the former increasingly granting immigrants farming rights to key pastoral resources. Even if local village leaders resist, immigrants have been able to circumvent local authority and gain rights through direct appeals to officials at level of the Canton or Sub-Prefect. Circumvention was facilitated by President Kountché's "land to the tiller" program (initiated in 1974) that granted land-use rights to those farming the land and worked to multiply the number of authorities granting agricultural usufruct (Ngaido, 1996). Due to its proximity to Niamey, government officials who were expected to demonstrate their ties to farming, converted large areas of pasture to create large mechanized farms. Pastoralists from the north have also increasingly utilized pastures particularly in the Torodi area (Bellot, 1980) lying directly west of the Say area (Fig. 2).

The case of growing pasture shortage in the Say area, illustrates our argument that the increased presence of FulBe in the Sudanian-Guinean zone does not represent an abrupt drought-induced geographical shift but reflects a whole series of longer-term adjustments by FulBe pastoralists. Certainly, cropland expansion in the Say area during the 1970s and 1980s has been dramatic (Ngaido, 1994), but this expansion is not explained simply by influxes of people fleeing the drought-stricken north. Due to the confluence of government policy, local governance structures, proximity to Niamey, and "unclaimed" cultivatable land, the Say area represented one of the few Sudanian zone areas in Niger open to significant immigration and cropland expansion. The Say case illustrates that the geographical shift results less from mass movements of people and livestock from the depopulating Sahelian zone to the Sudanian-Guinean zone than from a cascading series of shorter movements requiring fewer social and biophysical adjustments by different groups. Pastoralists in the Tera region northwest of the Say area generally did not respond to drought by moving directly to northern Benin—instead they extended their seasonal movements spatially southward into the Say and Torodi areas and progressively remained longer in the Torodi area (Bellot, 1980; Terraciano, 1994). While far from welcoming the new pastoralist immigrants, resident

[6] This is a rough periodization of what were often gradual and differentiated (across households) transitions in pastoral mobility. For example, the transition between phase 4 and 5 was often associated with short movements south during the second half of the dry season after floodplain pastures were depleted. Dupire describes the grazing situation in the area during the 1950s as one in which some clans continued to utilize floodplain pastures during the dry season while others relied more heavily on short southerly movements to the south (Dupire, 1972).

[7] Interestingly, Blench (1994:203) identifies the sheep-herding *Udaa'en* as being early migrants into southwest Nigeria.

FulBe had limited ability both culturally and politically to exclude them (Turner, 1999b). Moreover, the threat posed by outside pastoralists was significantly less than that of cultivation pressure. As a result, they responded to growing pasture scarcity by extending their stays in the pastures to the south, increasingly remaining through the rainy season and only returning home after crop harvest. In this way, their residence time in northern Benin was gradually extended from a couple of months (i.e., April–June) to most of the year (i.e., February–September).[8]

The prolongation of transhumance in the southern pastures has resulted in a growing division between herds managed by FulBe elders in the Say area and those managed by young men to the south. The typical pattern of transhumance systems in which a milking herd is left in the home area while the rest of the herd goes south with the young men becomes more difficult to carry out because of the limited opportunity to exchange animals between the two herds on a timely basis. In the case of Say herds this problem was magnified by increased enforcement of the boundaries of the transborder park that lies across the borders between Niger, Burkina Faso, and Benin (Turner, 1999b). Depending on the fluctuating nature of livestock exclusions by park personnel on different sides of the borders, Say FulBe often chose to remain throughout the year in Benin because of the risk of draconian enforcements by park guards (e.g., shooting of cattle). With growing social adjustments of herders in northern Benin and biological adjustments of their Benin herd to the trypanosomiasis threat, many herds have become resident in northern Benin. Increasingly, it is money rather than animals that is exchanged between the younger and older generations across the park barrier. Say elders wishing to maintain transhumance between Say and the south are increasingly frustrated. As the genetic make-up of the herds based in Benin change, they find themselves constantly seeking prophylactic drugs to protect their zebu in the south and to slow the growing genetic separation of Say- and Benin-based herds.

In the Say area there is now a whole generation of herders that has "grown up" in northern Benin. Some have married FulBe women in the south. Increasingly, there is less movement of animals between the two areas and more movements of people—fathers or older brothers visiting their herds in the south. While the younger herders maintain their Say identity their day-to-day social networks have developed in a different place—making it less likely that they (and possibly their sons) will move back if the situation improves in Say. In this way, the cascading movement of FulBe and cattle southward diverges greatly from the stimulus-response conception. There exist significant lags as different generations of herders make the necessary investments in local knowledge and social networks, as well as in the genetic make-up of their herds.

[8] The combination of porous pastoral tenure conventions and social/biological requirements for livestock security in new areas together explain in large part the prevalence of cascading migratory drift forms of regional adjustment among the FulBe.

Korhogo Region of Northern Côte d'Ivoire

FulBe livestock raising is concentrated in the Korhogo and Ferkéssédougou regions of northern Côte d'Ivoire (Fig. 3). In 1992, 70% of FulBe cattle were located in just these two administrative departments (N'Dri, 1993). A unimodal rainfall regime characterizes this zone: a single rainy season (May–November) is followed by a long dry season (December–April). The long-term rainfall isohyets lie between the 1,200 and 1,500 mm. Tsetse fly densities are highest on the western, southern, and eastern boundaries of this zone where population densities are low. With the exception of the densely settled zone around the city of Korhogo, livestock are concentrated in the central and northern areas where farmers have greatly modified the savanna environment to grow cotton, maize, rice, and yams.

The FulBe migration to Côte d'Ivoire during the 1970s and 1980s was widely viewed as an "invasion of foreigners" (Institut d' Ethno-Sociologie, 1975, p. 58; Coulibaly, 1980, p. 12; Bernardet, 1984; Arditi, 1990, p. 140). This perception of a massive influx of FulBe and especially their cattle reinforces the notion of a sudden movement of livestock from the Sudano-Sahelian region to the Sudano-Guinean zone. This view is strengthened by the responses of FulBe household heads to questions about their origins. They often state they are from the Seeno region of Mali and Burkina Faso where they periodically go to visit kin and to participate in certain ceremonies. The Côte d'Ivoire FulBe are also reminded of their northern origins when visited in Côte d'Ivoire by Muslim religious figures (*marabouts*) from their home country to pay taxes (*zakkat*) (Ancey, 1996, p. 326). There is, of course, an important difference between a group's historical home area and where they were born or spent the past 30 years. Only after enquiring about their life histories does it become clear that the majority of the Seeno FulBe were already living in the southern Sudanian savanna prior to entering Côte d'Ivoire (Ancey, 1996, pp. 311–326).

A typical migration history is that of Samboya Sidibé. His father was born in the Barani canton in the Nouna Circle of Burkina Faso. His father left Barani before Samboya was born. Samboya's national identity card stated that he was born in Koutiala, Mali to the south and west of Barani. He could not recall how long he stayed in Koutiala but his family moved further south in

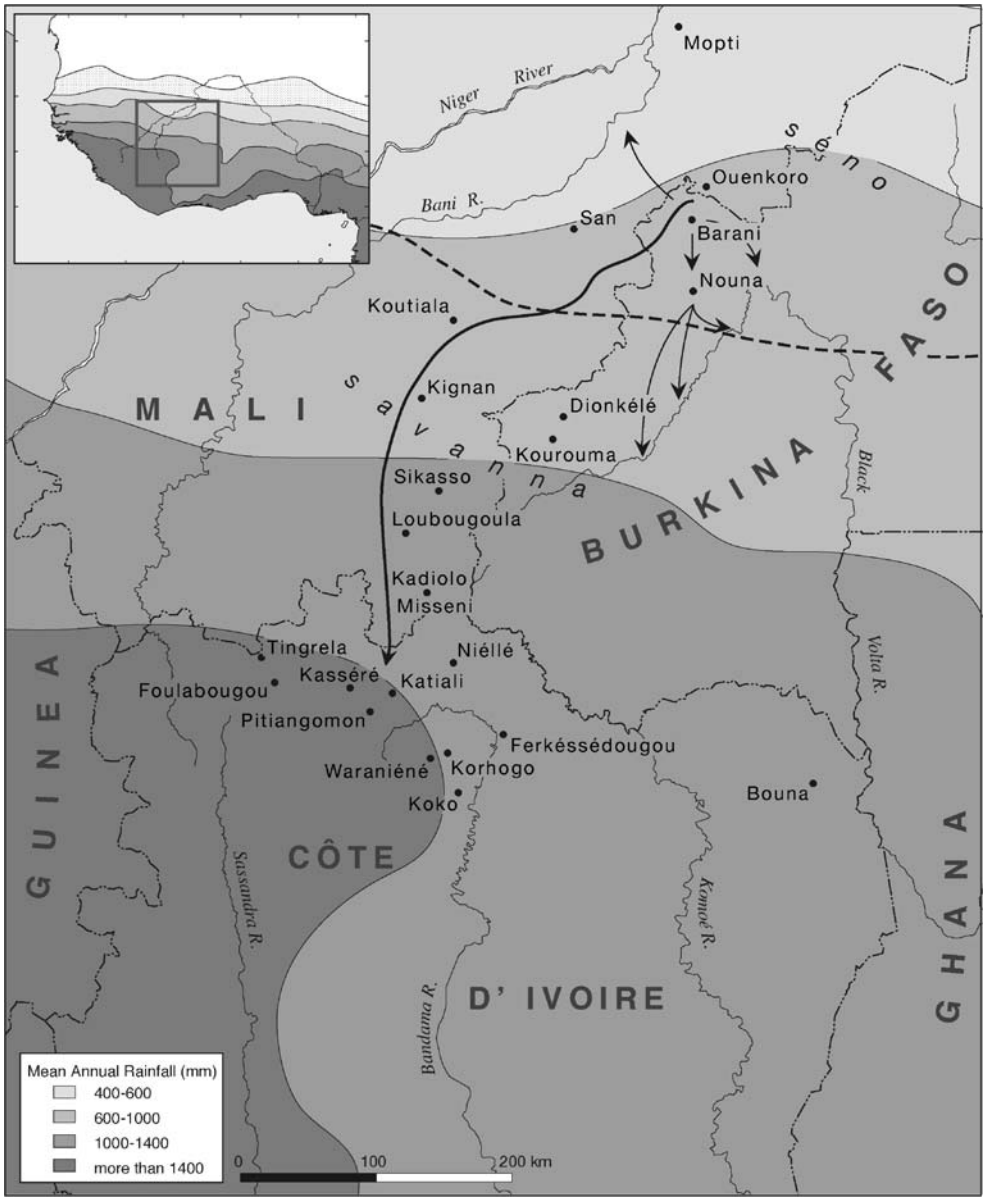

Fig. 3 FulBe transhumance routes in western Burkina Faso and major migration route to the Korhogo/Katiali region of northern Côte d'Ivoire.

1959 to Kignan, Mali. In 1962 they moved on to Lobougoula, Mali, where they settled for 2 or 3 years. From there the family headed to Misseni a small town about 20 km from the Côte d'Ivoire border. Their herds grazed in the Misseni area for 5 years before crossing over the Ivorian border in 1970.

This was not the first time that Samboya entered Côte d'Ivoire. He had visited the country with his herd while on transhumance from Mali during the previous 3 years. Drawn to the good grazing and relative lack of grazing animals in the Kasséré area, Samboya moved his family there in 1970 where they spent the next 11 years. He fled Kasséré in 1980 due to tense relations between herders and farmers over the acute problem of crop damage. It was also an election year in which some candidates running for national office promised to chase the FulBe from the country if elected. Samboya stopped outside of Pitiengomon but he and other FulBe familes were again attacked by armed Senufo farmers. This time he fled towards Katiali where he was assured by government authorities that the FulBe had the right to stay in the country. Samboya managed a herd of 362 cattle that was co-owned by his brother and herded by three salaried FulBe herders from Mali. It took a number of months of adjusting to the new but not unfamiliar rangelands before they decided to settle in the area (Bassett, 1986, pp. 242–244). The existence of more than a dozen FulBe families in the community facilitated the settlement process. In addition, more than half of Katiali's population is comprised of the Jula ethnic group. The Jula share the same Muslim religion as the FulBe and speak the major *lingua franca* of West Africa (Jula) understood by many FulBe. The Jula also dominate local

commerce and are eager to conduct trade (e.g., grain, livestock) with the FulBe families settled in the area.

Other herders of the Katiali region recounted similar migration stories but not all were unidirectional. For example, Moumouni Sangaré was born in Gounasso, Mali, and migrated south in 1941 to Dangrisso where his extended family stayed for 13 years. In 1954 they shifted further south to Kadiolo where they settled for 15 years. The family left for Côte d'Ivoire in 1969 but returned to Kadiolo after just 3 years because of conflicts with Senufo farmers in Côte d'Ivoire over crop damage caused by Moumouni's herd. He then spent the next 7 years in the Kadiolo area. Despite farmer–herder tensions in Côte d'Ivoire, he returned in 1979 and settled in the Katiali area with his two younger brothers, their wives, and their children. There he managed a herd of 159 cattle that moved about the region as rangeland conditions changed throughout the year (Bassett, 1986, pp. 239–243). In 1985 the farmers of Katiali forced him to leave the area because of uncompensated crop damage caused by his herd. Moumouni was killed the following year by Lobi agro-pastoralists in the Bouna region over a crop damage incident.

Scholarly studies of FulBe emigration from the Barani region of Burkina Faso lend further support to the migratory drift thesis. Benoit quotes from colonial archival documents dating from the 1930s that describe the gradual extension and displacement of dry season transhumance movements of FulBe herds from the Nouna Circle of Upper Volta (Burkina Faso) in which Barani is located to the Koutiala Circle of Mali (Benoit, 1979, pp. 117–123). By the 1940s, colonial administrators wrote of a "rural exodus" of FulBe herds from the Nouna Circle that had moved west and south to the Circles of San, Koutiala, and Sikasso, and even north to Mopti. In 1959 colonial authorities reported that there were 94 FulBe families from the Nouna Circle residing in the Sikasso Circle of southern Mali (Benoit, 1979, p. 120).

Political and ecological changes in livestock production systems were the principal forces driving this migratory drift. French colonial rule ended slavery, allowed more freedom of movement, and introduced veterinary medicine. In the Barani and Nouna area, these changes meant that the FulBe's slaves (*rimaaibe*) no longer worked in their masters' fields nor maintained their wells. Cattle poor households sent young men to work as salaried herders as far south as Côte d'Ivoire (Quéant and de Rouville, 1969; Benoit, 1979). Those FulBe with the means to do so began to build their herds and to rely more on transhumant livestock raising. Improved veterinary care also contributed to increasing livestock numbers. As cattle numbers increased in the 1930s, transhumant treks extended to the Black Volta River to the southeast and to the streams watering the Koutiala region in Mali to the southwest. Colonial administrators observing the exodus of FulBe from Barani believed that forced labor and cattle taxes were important factors driving this migration process (Benoit, 1979, p. 120). Agricultural encroachment on rangelands also played a role. Beginning in the 1950s, agricultural colonization schemes in the Souroui, Kourouma, and Dionkélé areas of Burkina deprived FulBe pastoralists of both Mali and Burkina Faso of important dry season grazing lands (Ancey, 1996, pp. 314–315). These encroachments, which continued into the 1970s and 1980s, required the FulBe to move their herds to alternative pastures. The migration process often involved reconnaissance trips by a younger member of the household to a southern location where a relative was already established. The network of clan members in the San, Koutialia, and Sikasso areas facilitated these movements by providing information on rangeland conditions, relationships with farming communities, the character of local markets, and employment opportunities for salaried herding in neighboring villages (Ancey, 1996, pp. 314–321).

The emigration from Barani continued into the 1960s. Between 1960 and 1969, a quarter of the FulBe familes residing in the Canton of Barani had definitively left the region. Benoit notes that 14 families departed each year whether rainfall was above or below average, which "allows one to argue against a 'cataclysmic' hypothesis such as the effects of drought" to explain this migration pattern (Benoit, 1979, p. 118).

In 1964 the first FulBe community was established in Côte d'Ivoire just south of Tengréla. It was named "Foulabougou" (Jula: the FulBe camp). The village was founded by two FulBe families from Baranai who had emigrated in the early 1950s. They spent a few years in the San region before moving south to the Mali–Ivorian border. They crossed the border into Côte d'Ivoire during dry season transhumance when their animals grazed in the vicinity of Tingréla (SEDES, 1965, vol 3, p. 220). By 1973, there were close to 500 FulBe residing in Foulabougou, most of them from the Sidibé clan from the Barani region (Institut d' Ethno-Sociologie, 1975, p. 60). By 1980 the Sidibé clan of the Nouna-Barani area accounted for more than 50% of the FulBe household heads in Côte d'Ivoire. The Sangaré surname was shared by 25% of households heads, while 11% were named Diallo. The remaining 12% held diverse clan names (e.g., Diakité, Barry, Bolly). It is more difficult to determine the country of origin of these herders since many FulBe born in Burkina possessed Malian national identity cards when they arrived in Côte d'Ivoire (Lagrue, 1977, p. 18). This discrepancy between origin and nationality reflects the process of migratory drift. In this case, it involved not just crossing international borders but residing for extended periods in a different country. What is certain is that nearly all of the herders

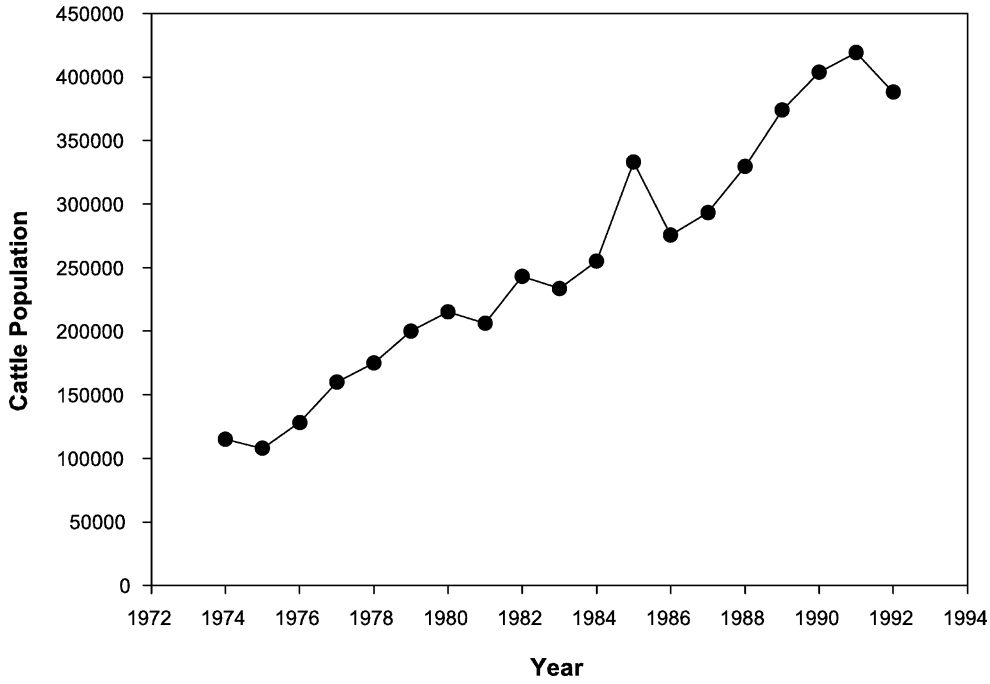

Fig. 4 Trend in FulBe cattle populations in Côte d'Ivoire, 1974–1992.

crossing into northern Côte d'Ivoire were from either Mali or Burkina Faso. The 1981 livestock census reported that 99% of the nearly 2,000 herders surveyed were from these two countries (Bonnet, 1982, p. 9).

Information collected in 1981 on the year of arrival in Côte d'Ivoire lends further support to the migratory drift hypothesis. Of the 47 herders interviewed by Bonnet in 1981, 38% indicated they had arrived prior to 1965; a total of 75% arrived before 1971. On the basis of these findings, Bonnet concludes that "one can thus not talk about a 'recent and massive invasion' [of the FulBe] as it is often wrongly stated" (Bonnet, 1982, p. 10).

Figure 4 shows the trend in FulBe cattle populations in Côte d'Ivoire between 1974 and 1992. Although one must treat with extreme caution any data concerning FulBe cattle due to the mobility of herds and the desire of their owners to conceal their size and location,[9] the numbers show a steady growth in FulBe cattle over this period. At the very least, the data indicate that FulBe herds continued to enter Côte d'Ivoire following the peak drought years. Most of these post-drought arrivals originated in the southern Sudanian savannas of Mali and Burkina Faso (Arditi, 1990, p. 140). However, some herds were constituted locally by FulBe salaried herders who, after many years of managing farmer-owned cattle, succeeded in building their own herds. One particularly successful case is reported by Petit (1980). Beyga Diallo arrived in Côte d'Ivoire in 1947 where he worked as a salaried herder in the community of Waraniéné near Korhogo. Thirty years later he was managing a personal herd of 700 head of zebu-Baoulé cross breeds (*worosoji*) near the village of Koko where he was cooperating in a Savanna Institute study on animal health. The genetic make up of Beyga Diallo's herd is indicative of the process of FulBe adjustment to the Sudano-Guinean zone. Indeed, the importance of cross-breeding to the FulBe's migration to the southern savannas lends further support to the migratory drift hypothesis.

Sudano-Guinean Cattle Breeds

Research on cattle breeds reveals that by the time FulBe herds arrived in the Sudano-Guinean zone in the 1970s, their genetic composition had been modified to resist cattle diseases of the humid savanna (Bernardet, 1988, pp. 23–24; Blench, 1994, pp. 207–209; Diallo, 1995, pp. 9–10; Boutrais, 2003). The main cattle breed of northern Burkina Faso is known as the *senooji*, a large, humpbacked zebu breed (*Bos indicus*) that is valued for its size, milk

[9] The annual reports of SODEPRA are frank about the strengths and weaknesses of their data on FulBe cattle numbers. Extension agents typically recorded the number of animals they treated during annual vaccination campaigns. Each time they injected an animal, they recorded it on a simple mechanical counter that fit in the palm of the hand. However, there were many FulBe herds that were located outside of SODEPRA's extension zones that were not vaccinated and thus not counted. SODEPRA's annual reports also note that FulBe cattle owners were reluctant to divulge information about their herds, and that transhumant cattle may have been counted twice: once in the dry season pasture and once again in their rainy season area.

production, and ability to walk long distances. The zebu is, however, highly susceptible to trypanosomiasis and tick-borne diseases common to the southern Sudanian and Guinean savannas. The *senooji* is named after its place of origin, the *seeno*, located in northern Burkina Faso in which the FulBe chiefdoms of Barani and Ouenkoro are situated.

As noted above, many FulBe migrated with their zebu cattle to southwestern Burkina, well within the tsetse fly belt. There they encountered the Bwaba's humpless taurin cattle (*Bos taurus*) known as the Baoulé (locally called *mereeji*) a breed that is widely appreciated for its tolerance to trypanosomiasis. When the FulBe saw that their cattle performed poorly in this pasture-rich but disease ridden area, they began to crossbreed their *senooji* breeds with the Bwaba's *mereeji*. The resulting cross, known as the *worsooji*, is more resistant to trypanosomiasis than the *senooji* (Boutrais, 1994). Although smaller than the *senooji*, the *worsooji* is still a large animal that is very capable of long distance treks.

When FulBe herders arrived in Côte d'Ivoire in the 1970s, many came with herds already composed of *worsooji* cattle. In the Niellé region, 36% of immigrant FulBe herds were crossbreeds. Another 15% were comprised of the humpless *mereeji* (Baoulé) breed (Bernardet, 1988, pp. 23–24). A 1981 survey of some 5,000 FulBe cattle in northern Côte d'Ivoire found that 42% were *worsooji* crossbreeds of zebu-Baoulé cattle (Bonnet, 1982, p. 26, Table 2).[10] The most common crossbreeding method involved introducing a Baoulé cow into a herd to breed with a zebu bull. To transform an entire herd of zebu cattle to *woosooji* would take a long time using this method.

The relatively high percentage of crossbreeds in FulBe herds indicates that many FulBe did not migrate directly from the Sudano-Sahel to the Sudano-Guinean savanna. They have taken their time en route to acclimate their cattle to the disease hazards of the southern savannas through crossbreeding or by buying crossbred cattle. The migration history of some dozen FulBe households in the Katiali region of Côte d'Ivoire supports this migratory drift hypothesis. Informants' itineraries suggested a stage-like migration pattern in which they spent up to 10 years in one location before moving on to the next. This decadal time frame of herd migration helps to explain the high percentage of crossbreeds in FulBe herds by the time they reached Côte d'Ivoire.

Those FulBe who arrived in the northern Côte d'Ivoire with zebu cattle soon began to cross their *senooji* breeds with the local Baoulé breed.[11] As in Burkina, the resultant cross is called *worsooji* or *merworsooji* (Field Notes, Korhogo, July 2002). The Côte d'Ivoire FulBe are keen to maintain the size and milk production levels characteristic of the zebu breed. To achieve these twin goals, the *worsooji* breed resulting from the first crossbreeding (zebu × Baoulé) is crossed with a zebu (*worsooji* × zebu) to produce a second generation crossbreed. This second generation crossbreed satisfies the FulBe cultural and economic preferences for large cattle that command good prices at cattle markets and produce adequate quantities of milk (Bernardet, 1988, p. 24; Diallo, 1995, pp. 9–10). These second generation breeds are also more resistant to trypanosimiasis than the pure *senooji* breed. With the exception of breeding bulls, it is increasingly difficult to find pure zebu cattle herds in northern Côte d'Ivoire. However, the widespread use of veterinary medicine to treat infected animals allows some FulBe, especially wealthy herd owners, to maintain a part of their herds as pure zebu.

In summary, the FulBe migration to Côte d'Ivoire resembles a series of shifts or steps rather than a sudden shift. It has been described by herders themselves as a process of sequential migration from the Sudano-Sahelian region that involved multiple and multiyear test movements before entering Côte d'Ivoire. This gradual displacement of herds is similar to Stenning's "migratory drift" category of FulBe population movements (Stenning, 1960). The migratory drift of the Sidibé and Sangaré clans from the Seeno region of Mali and Burkina to northern Côte d'Ivoire is evident in their life histories. These stories convey a southerly extension of families and herds that occurred over decades if not generations. The time-consuming pattern of cattle breeding lends further support to this decadal time frame. The droughts of 1973 and 1984 did not lead to a massive influx of FulBe herds into Côte d'Ivoire from the Sudano-Sahelian region. Rather, they accelerated a migration process that had been in progress in the context of changing social, political and ecological conditions dating from the first half of the twentieth century.

[10] According to Bernardet (1988, p. 24), 80% of all FulBe herds in Côte d'Ivoire contained *worsooji* breeds.

[11] The Baoulé breed is also called *mereeji* by Côte d'Ivoire FulBe originating from Burkina. Indeed there is some confusion with the use of the term *mereeji* as noted by Rege et al. (1994, p. 8) who write "it is currently used for both purebred Lobi and crosses of zebu with Lobi (Burkina Faso), with Baoulé (Côte d'Ivoire and Burkina Faso) and with N'Dama (Côte d'Ivoire, Burkina Faso, Guinea) and is thus quite confusing. In Mali, the term Méré (or Bambara) is used for stabilized zebu×N'Dama crosses." The authors propose that the term Méré (*mereeji*) be exclusively used to designate zebu-taurin crosses.

Conclusions

This paper has argued that the timing of livestock movements reflects the social networks and institutions that are negotiated when livestock and people move and the ecological and biological dimensions of herding cattle in disease-ridden environments. Existing data on southerly migration movements by FulBe are sparse. The seemingly simultaneous loss of FulBe and livestock from the Sahelian zone with observed increases of FulBe herding in the Sudano-Guinean zone should not be seen as resulting from rapid long-distance movements of FulBe south. Instead, we argue that political and economic changes, new livelihood strategies during the colonial period, and periodic droughts have led to the movements of pastoral and farming peoples into the Sudanian zone. These movements, which have taken place over decades and sometimes generations, have produced pasture shortages, an extension of grazing movements south, and, for those previously based in the Sudanian zone, with experience grazing in the Sudano-Guinean zone.

If one considers the North-South oscillations of FulBe settlement and grazing over a longer historical time frame, climate clearly plays an important role. The seasonality of rainfall, disease threat, and forage quality likewise play a strong role in grazing movement strategy. Interannual variations in rainfall shape the shrinking and expansion of grazing movements along the North-South axis (migratory drift). Longer periods of dryness and moisture stimulate migration movements. As we have discussed, northerly movements during the 1950s and 1960s reflect a moister period while southerly movements during the 1980s and 1990s reflect a dryer period. In sum, climate variations at different temporal scales play an important role in shaping the oscillations of FulBe grazing and migration movements along the North-South axis.

Still, an understanding of the timing of the regional oscillations of FulBe settlement and grazing in West Africa cannot be explained by climate alone. The process of FulBe migration to the south involves a number of adjustments that explain not only the rarity of abrupt long-distance migrations of herds to the south but also, over a longer historical time frame, the *periodicities* in the oscillations of FulBe settlement and grazing in West Africa. While these are not as obvious as those of climate in terms of affecting the incidence of FulBe shifts, these periodicities do strongly affect the timing and persistence of these movements. Our understanding of the FulBe expansion into the Sudano-Guinean savannas of West Africa is enriched by this simultaneous consideration of the generational, biological, and historical time frames. Our focus on temporal heterogeneities in this study will hopefully assist others in understanding the nature and direction of pastoral mobility in the future.

Acknowledgment This research benefited from a research grant (#BCS00-99252) made by the Geography and Regional Science Program of the National Science Foundation.

References

Adebayo, A. G. (1997). Contemporary Dimensions of Migration among Historically Migrant Nigerians: Fulani Pastoralists in Southwestern Nigeria. *Journal of Asian and African Studies* 32: 93–107.

Aldige, E. (1918). La Peste Bovine en Afrique Occidentale Francaise: Etude de l'Epizootie de 1915–1918. *Bulletin de la Comité d'Études Historiques et Scientifiques de l'Afrique Occidentale Française* 1: 337–399.

Amanor, K. S. (1995). Dynamics of Herd Structures and Herding Strategies in West Africa: A Study of Market Integration and Ecological Adaptation. *Africa* 65(3): 351–394.

Ancey,V. (1996). Trajectoires pastorals et politiques économiques de l'élevage: Eleveurs transhumants dans le nord de la Côte d'Ivoire. Thèse de doctorat d'Economie, Ecole des Hauts Etudes en Sciences Sociales, Paris.

Arditi, C. (1990). Les Peul, les Senufo, et les veterinaries: pathologie d'une operation de développement dans le nord de la Côte d'Ivoire. *Cahiers des Sciences Humaines* 26(1–2): 137–53.

Atchy, A. A. (1976). *Contribution à l'étude de la transhumance en République Populaire du Benin*. Diplome État, École Inter-États des Sciences et Médécine Veterinaires. Dakar, Senegal.

Ba, A. H., and Daget, J. (1984). *L'Empire Peul du Macina (1818–1853)*, Les Nouvelles Editions Africaines, Abidjan.

Barry, M. (1975). Economie de l'élevage transhumant dans le nord Côte d'Ivoire. *Cahiers du CIRES* 7–8: 1–18.

Bassett, T. J. (1986). Fulani Herd Movements. *The Geographical Review* 76: 233–248.

Bassett, T. J. (1988). The Political Ecology of Peasant–Herder Conflicts in Northern Côte d'Ivoire. *Annals of the Association of American Geographers* 78(3): 453–72.

Bassett, T. J. (1993). Land use conflicts in pastoral development in northern Côte d'Ivoire. In Bassett, T., and Crummey, D. (eds.), *Land in African Agrarian Systems*, University of Wisconsin Press, Madison, pp.131–154.

Bassett, T. J. (1994). Hired Herders and Herd Management in Fulani Pastoralism (Northern Côte d'Ivoire). *Cahiers d'Études Africaines* 34: 147–173.

Bellot, J.-M. (1980). *Kel Tamasheq du Gourma Nigerien et peul du Torodi: Sociétés agropastorales en mutation. Thèse de troizième cycle, Géographie*, Université de Bordeaux III, Bordeaux, France.

Benoit, M. (1979). Le chemin des Peuls de Boobola: Contribution à l'écologie du pastoralisme en Afrique des savanes, Travaux et Documents de l'ORSTOM, no. 101 ORSTOM, Paris.

Benoit, M. (1999). Peuplement, violence endemique et remanence de l'espace sauvage en Afrique de l'Ouest: Le no man's land du 'W' du Niger. *Espace Populations Sociétés* 1: 29–52.

Bernardet, P. (1984). *Association Agriculture-Elevage en Afrique : Les Peuls Semi-Transhumants de Côte d'Ivoire*, L'Harmattan, Paris.

Bernardet, P. (1988). *Vache de la houe, vache de la dot: Elevage bovin et rapports de production en Moyenne et Haute Côte d'Ivoire*, Editions CNRS, Paris.

Bernardet, P. (1999). Peuls en mouvement, Peuls en conflits en moyenne et haute Côte d'Ivoire, de 1950- à 1990. In Botte, R., Boutrais, J., and Schmitz, J. (eds.), *Figures Peuls*, Kathala, Paris, pp. 407–444.

Bierschenk, T. (1998). Les peuls dans le borgou occidental précolonial. In Boesen, E., Hardung, C., and Kuba, R. (eds.), *Regards Sur le Bourgou. Pouvoir et Altérité dans une Région Ouest-Africaine*, L'Harmattan, Paris, pp. 175–184.

Blench, R. (1985). *Pastoral Labour and Stock Alienation in the Sub-humid and Arid Zones of West Africa. Pastoral Development Network Newsletter 19e*, Overseas Development Institute, London.

Blench, R. (1994). The Expansion and Adaptation of FulBe Pastoralism to Subhumid and Humid Conditions in Nigera. *Cahiers d'Etudes Africaines* 34 (133–135): 197–212.

Boesen, E., Hardung, C. *et al*. (eds.) (1998). *Regards sur le bourgou. Pouvoir et altérité dans une région ouest-africaine*, L'Harmattan, Paris.

Bonfiglioli, A. M. (1988). *Dudal: Histoire de famille et histoire de troupeau chez un groupe de Wodaabe du Niger*, Cambridge University Press, Cambridge.

Bonnet, J. B. (1982). *Situation de l'élevage peulh-1981* (Korhogo: Sodepra).

Bourn, D. (1978). Cattle, Rainfall and Tsetse in Africa. *Journal of Arid Environments* 1: 49–61.

Bourn, D., and Wint, W. (1994). *Livestock, Land-use and Agricultural Intensification in Sub-Saharan Africa. Pastoral Development Network Paper* 37a, Overseas Development Institute, London.

Boutrais, J. (1986). L'expansion des éleveurs peul dans les savanes humides du Cameroun. In Adamu, M., and Kirk-Greene, A. H. M. (eds.), *Pastoralists of the West African Savanna*, Manchester University Press, Manchester, pp. 145–160.

Boutrais, J. (1994). Pour une nouvelle cartographie des Peuls. *Cahiers d'Etudes Africaines* 34(133–135): 137–146.

Boutrais, J. (2007). The Fulani and Cattle Breeding: Crossbreeding and Heritage Strategies. *Africa* 77(1): 18–36.

Cohen, A. (1965). The Social Organization of Credit in a West African Cattle Market. *Africa* 35: 8–20.

Chevalier, A. (1900). Les Zones et les Provences Botaniques de l'A. O.F. *Comptes rendus de l'Academie des Sciences*: 1205–1208.

Coulibaly, S. (1980). *La difficile mais nécessaire integration de l'élevage zebu dans le monde rural sénoufo*. Université Nationale de Côte d'Ivoire, Institut de Geographie Tropicale, Publication Provisoire no. 42.

de Bruijn, M., and van Dijk, H. (1994). Drought and Coping Strategies in FulBe Society in the Hayre Central Mali: A Historical Perspective. *Cahiers d'Études Africaines* 34: 85–108.

de Bruijn, M., and van Dijk, H. (1995). *Arid Ways: Cultural Understandings of Insecurity in FulBe Society, Central Mali*, Thela, Amsterdam.

Delgado, C., and Staatz, J. (1980). *Livestock and Meat Marketing in West Africa, Volume III, Ivory Coast and Mali*, CRED, Ann Arbor, Michigan.

Diallo, Y. (1995). Paysans, pasteurs et intervention étatique: Analyse préliminaire des problèmes et d'évolution du pastoralisme dans le département de Boundiali (Côte d'Ivoire). University of Bielefeld, Africa Program, Working Paper no. 225.

Diallo, Y. (1999). Dimensions Sociales et Politiques de l'Epansion Pastorale en Zone Semi-humide Ivoirienne. In Azarya, V., Breedveld, A., de Bruijn, M., and van Dyk, H. (eds.), *Pastoralism under Pressure? Fulbe societies confronting change in West Africa*, Brill, Leiden, pp. 211–236.

Diallo, Y. (2000). Les Peuls et les Sénoufo de la Savane Ivoirienne: Quelques Modalités de leurs Relations. In Diallo, Y., and Schlee, G. (eds.), *L'ethnicité Peul dans des Contextes Nouveaux*, Éditions Karthala, Paris, pp 65–92.

Doutressoulle, G. (1924). *L'Elevage au Niger*, Mortain, Paris.

Doutressoulle, G. (1947). *L'Élevage en Afrique Occidentale Français*, Éditions Larose, Paris.

Dupire, M. (1970). *Organisation Sociale des Peul*, Librairie Plon, Paris.

Dupire, M. (1972). *Les Facteurs Humains de l'économie Pastorale.* Centre Nigerien de Recherches en Sciences Humaines, Niamey, Niger.

Frelastre, G. (1986). Le Troupeau Nigérien en Peril. *Revue Francaise d'Etudes Politiques Africaines* 247/248: 97–105.

Frantz, C. (1981). Settlement and Migration Among Pastoral Fulbe in Nigeria and Cameroun. In Salzman, P. C. (ed.), *Contemporary Nomadic and Pastoral Peoples: Africa and Latin America*, College of William and Mary, Williamsburg, VA, pp. 57–94.

Gallais, J. (1975). *Paysans et Pasteurs du Gourma. La Condition Sahélienne*, CNRS, Paris.

Gallais, J. (1979). La Situation de l'élevage Bovin et le Problème des éleveurs En Afrique Occidentale et Centrale. *Les Cahiers d'Outre Mer* 126: 113–138.

Grégoire, E. (1992). *The Alhazai of Maradi: Traditional Hausa Merchants in a Changing Sahelian City*, Lynne Rienner, London.

Grégoire, E. (1997). Les grands courants d'échanges sahéliens: histoire et situations présentes. In. Raynaut, C. (ed.), *Sahels: Diversité et Dynamiques des Relations Sociétés-Nature*, Éditions Karthala, Paris, pp. 121–142.

Habou, A., and Danguioua, A. (1991). *Transfert du capital—betail au Niger (des pasteurs aux autres catégories socio-professionelles)*. Rapport Préliminaire du mission. Secretariat Permanent du Comite National du Code Rural, Niamey, Niger.

Hama, B. (1968). *Contribution à la Connaissance de l'Histoire des Peul*, Présence Africaine, Paris.

Heasley, L., and Delehanty, J. (1996). The Politics of Manure: Resource Tenure and the Agropastoral Economy in Southwestern Niger. *Society and Natural Resources* 9: 31–46.

Hellemans, P., and Compere R. (1990). Aspects Techniques et Socio-economiques de la Transhumance des Troupeaux de Zebus en Zone Soudanienne de la Bougouriba (Burkina–Faso). *Tropicultura (Belgium)* 8(2): 59–63.

Hendrickx, G., de La Rocque, S., and Mattioli, R. C. (2004). *Long-term Tsetse and Trypanosomiasis Management Options in West Africa*, Food and Agriculture Organization, Rome.

Hubert, H. (1907). Distribution Géographique des Mouches Tsé-tsé au Dahomey. *La Géographie*: 171–176.

Institut d'Ethno-Sociologie (IES) (1975). *L'Elevage Peul dans le Nord de la Côte d'Ivoire* (Min. de la Production Animale, Abidjan).

Institut de Recherche en Sciences Humaines (1977). *Étude de Say: Rapport final*. Niamey, Niger, Ministère de l'Education Nationale and Ministère du Plan.

Kervan, C. (1992). Customary Commerce: A Historical Reassessment of Pastoral Livestock Marketing in Africa. *ODI Agricultural Occasional Paper* 15. Overseas Development Institute, London.

Kimba, I. (1981). *Guerres et sociétés: Les population du "Niger" occidental au XIXème siècle et leurs réactions face à la colonisation (1896–1906)*, Institut de Recherches en Sciences Humaines, Niamey, Niger.

Lagrue, D. (1977). *La sedentarisation de l'élevage Peul dans le nord de la Côte d'Ivoire: Difficultés sociologiques, zootechniques et pathologiques*, Thèse pour le doctorat veterinaire, Ecole Nationale Veterninare, Maison d'Alfort, France.

Laya, D. (1991). Migrations et Integration Politique dans le Gourma Oriental au XIX Siecle: Example des Folmongaani. *Journal de la Société des Africanists* 61: 65–90.

Le Houérou, H. N. (1989). *The Grazing Land Ecosystems of the African Sahel*, Springer, Berlin Heidelberg New York.

Lem, F. H. (1943). Un Centre d'Islamisation au Moyen–Niger: Say. *La Terre d'Islam* 1943(2): 51–78.

Lericollais, A., and Faye, A. (1994). Des troupeaux sans pâturages en pays Sereer au Sénégal. In Blanc-Pamard, C., and Boutrais, J. (eds.), *A la Croisée des Parcours: Pasteurs, éleveurs, Cultivateurs*, ORSTOM, Paris, pp. 165–196.

Lombard, J. (1957). Quelques Notes sur les Peuhls du Dahomey. *Notes Africaines* 73: 4–7.

Lovejoy, P., and Baier, S. (1975). The Desert-side Economy of the Central Sudan. *International Journal of African Historical Studies* 8: 551–581.

Loyance, A. (1947). *Notes sur les Peuls et Gourmantché de la Région de Say*, Archives de la Subdivision de Say, Say, Niger.

Malfroy, M. F. (1926). La Peste Bovine en Afrique Occidentale Francaise. *Bulletin du comité d'études historiques et scientifiques de l'AOF* 1926: 439–496.

N'Dri, N. (1993). *Rapport d'Activites du Projet Encadrement Nord, Année 1992*, Korhogo: SODEPRA, mimeo.

Ngaido, T. (1994). *Le foncier dans le processus de la desertification: cause ou remede*. Paper presented at L'impact des système fonciers et des modes de propriété et d'accès aux ressources sur la dégradation des terres et la désertification, CRDI, Dakar, Senegal.

Ngaido, T. (1996). *Redefining the Boundaries of Control:Post-Colonial Tenure Policies and Dynamics ofSocial and Tenure Change in Western Niger*. Ph.D. dissertation, Institute for Environmental Studies. Madison, Wisconsin.

Nicholson, S. E., Kim, J., and Hoopingarner, J. (1988). *Atlas of African Rainfall and its Interannual Variability*, Department of Meteorology, Florida State University, Tallahasse, FL.

Nicolas, G. (1963). Notes ethnographiques sur l'élevage dans la vallée de Maradi. In *Notes ethnographiques sur le terroir, l`agriculture et l'élevage dans la vallée de Maradi*, IFAN, Niamey.

Okediji, F. (1972). *An Economic History of Hausa–Fulani Emirates of Northern Nigeria: 1900–1939*. Ph.D. dissertation, University of Indiana, Bloomington.

Penning de Vries, F. W. T., and Djitèye, M. A., eds. (1982). *La productivité des pâturages sahéliens*. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands.

Petit, F. (1980). *Amelioration de l'Elevage dans le Nord de la Côte d'Ivoire, Rapport Final d'Execution (1979–1980)*, Institut de Savanes, Bouaké.

Quarles van Ufford, P. (1999). *Trade and Traders: The Making of the Cattle Market in Benin*, Thela Thesis, Amsterdam.

Quéant, T., and de Rouville, C. (1969). *Agriculteurs et éleveurs de la region du Gondo–Sourou*, Centre Voltaique de la Recherche Scientifique, Ouagadougou, Burkina Faso.

Raynaut, C., and Lavigne Delville, P. (1997). Une espace partagé: complémentarité et concurrence des usages. In Raynaut, C. (ed.), *Sahels: Diversité et dynamiques des relations sociétés-nature*, Éditions Karthala, Paris, pp. 143–174.

Raynaut, C., Lavigne Delville, P., and Koechlin, J. (1997). Les relations sociétés/nature au Sahel: Quelques grans types de situation. In Raynaut, C. (ed.), *Sahels: Diversité et dynamiques des relations sociétés-nature*, Éditions Karthala, Paris, pp. 227–260.

Rege, J. E. O., Aboagye, G. S., and Tawah, C. L. (1994). Shorthorn Cattle of West and Central Africa. I. Origin, Distribution, Classification, and Population Statistics. *World Animal Review* 78(1): 2–13.

Rémy, G. (1964). *Yobri–Étude Géographique du Terroir d'un Village Gourmantché de Haute–Volta*, Mouton, Paris.

Roubaud, E. (1920). Les Mouches Tsétsés en Afrique Occidentale Française. *Bulletin du Comité D'Études Historiques et Scientifiques de l'Afrique Occidentale Française*: 257–300.

Schlee, G. (2000). Les peul du Nil. In Diallo, Y., and Schlee, G. (eds.), *L'Ethnicité Peul dans des Contextes Nouveaux*, Karthala, Paris, pp. 207–224.

Sedes (1965). *Région de Korhogo Etude de Développement Economique, Tome 3, Rapport Agricole*, SEDES, New York.

SODEPRA (1974). Encadrement Nord, Rapport Annuel 1974, Korhogo, *mimeo*.

SODEPRA (1981). Opération Zebu, Rapport Annuel 1981, Korhogo, *mimeo*.

Stenning, D. J. (1959). *Savannah Nomads*, Oxford University Press, London.

Stenning, D. J. (1960). Transhumance, migratory drift, migration: Patterns of pastoral Fulani nomadism. In Ottenburg, S., and Ottenburg, P., (eds), *Cultures and Societies of Africa*, Random House, New York, pp. 139–159.

Terraciano, A. M. (1994). *Contested Terrain: The Changing Politics of Land Use in Tera, Western Niger*. M.S. Thesis, Department of Geography, Madison.

Tonah, S. (2000). State Policies, Local Prejudices and Cattle Rustling Along The Ghana–Burkina Faso Border. *Africa* 70 (4): 551–567.

Tonah, S. (2003). Integration or Exclusion of Fulbe Pastoralists in West Africa: A Comparative Analysis of Interethnic Relations, State and Local Polices in Ghana and Cote d'Ivoire. *The Journal of Modern African Studies* 41: 91–114.

Toutain, B., Compaoré, A., Ouadba, J.-M, Kagoné, H., and Diallo, S. (2001). Mission d'appui scientifique "transhumance" (11 mai au 31 mai 2001). Rapport provisoire de mission. CIRAD-EMVT, Montpellier, France.

Tricart, J. (1956). Les échanges entre la zone forestière de Côte d'Ivoire et les savanes soudaniennes. *Les Cahiers d'Outre Mer* 35: 211–238.

Turner, M. D. (1993). Overstocking the Range: A Critical Analysis of the Environmental Science of Sahelian Pastoralism. *Economic Geography* 69: 402–421.

Turner, M. D. (1999a). Labor Process and the Environment: The Effects of Labor Availability and Compensation on the Quality of Herding in the Sahel. *Human Ecology* 27: 267–296.

Turner, M. D. (1999b). No Space for Participation: Pastoralist Narratives and the Etiology of Park-Herder Conflict in Southwestern Niger. *Land Degradation and Development* 10(4): 343–361.

Turner, M. D. (1999c). The role of social networks, indefinite boundaries and political bargaining in maintaining the ecological and economic resiliency of the transhumance systems of Sudano–Sahelian West Africa. In Niamir-Fuller, M. (ed.), *Managing Mobility in African Rangelands: The Legitimization of Transhumance*, Intermediate Technology, London, pp. 97–123.

Urvoy, Y. (1929). "La Mekrou et le double-v." *Afrique Francaise* 39 (2): 135–140.

van Driel, A. (1997). Relations entre agriculteurs et éleveurs: Cohabitation et problèmes majeurs. In de Haan, L. J. (ed.). *Agriculteurs et éleveurs au Nord-Bénin*. Karthala, Paris, pp. 127–148.

van Santen, J. (2000). "Garder du bétail, c'est aussi un travail" Les rélations entre pasteurs peuls et agriculteurs du centre du Bénin et du Nord-Cameroun. In Diallo, Y., and Schlee, G. (eds.), *L'ethnicité Peul dans des contextes nouveaux*, Éditions Karthala, Paris, pp. 129–159.

White, F. (1983). *The Vegetation of Africa*, United Nations Educational, Scientific and Cultural Organization, Paris.

Wilson, W. (1995). The Fulani Model of Sustainable Agriculture: Situating Fulbe Nomadism in a Systemic View of Pastoralism and Farming. *Nomadic Peoples* 36/37: 35–52.