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Livelihood Transitions and the Changing Nature of Farmer–Herder Conflict in Sahelian West Africa

MATTHEW D. TURNER*, AUGUSTINE A. AYANTUNDE**, KRISTEN P. PATTERSON*** & E. DANIEL PATTERSON III***

*Department of Geography, University of Wisconsin, Madison, USA, **International Livestock Research Institute, ICRISAT Sahelian Centre, Niamey, Niger, ***University of Wisconsin, Madison, USA

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ABSTRACT *The accommodation of livestock husbandry with crop agriculture is crucial for the future of the West African Sahel. Present trends are leading to greater restrictions on livestock husbandry and a growing convergence of livelihood practices among groups whose identities are tied to herding and farming. Using the cases of four rural communities in Niger, this study adopts an 'access to resources' framework to analyse the causal connections among: rural peoples' livelihood strategies, everyday social relations of production, perceptions of social groups' identities, and the potential for farmer–herder conflict. While the convergence of livelihoods arguably increases the frequency of conflict triggers, it has also, through the expansion of shared common interests and cross-group, production-related relationships, improved the ability of communities to effectively manage these incipient conflicts.*

I. Introduction

The Sahelian region of West Africa (200–650 mm of rainfall/year) lies south of the Sahara Desert and stretches from west to east across the countries of Senegal, Mali, Burkina Faso, Niger and Chad. The region is at the extreme periphery of global markets, investment, and economic development. There is little international demand for food crops grown in the region (millet, sorghum) and cash crops (cotton, groundnut) are prone to boom–bust price cycles. While one is hard-pressed to identify any 'competitive advantage' the Sahel enjoys in the global economy, it does arguably hold a competitive advantage in the West African regional economy through livestock and to a lesser extent, cheap labour (Asuming-Brempong and Staatz, 2004).[1]

Correspondence Address: Matthew Turner, Department of Geography, 160 Science Hall, 550 Park Street, University of Wisconsin, Madison, WI 53706, USA. E-mail: mturner2@wisc.edu

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Given the shortage of purchased livestock feed, a productive livestock industry depends in large part on the effective rainy-season use of open rangelands to the north (200–400 mm rainfall/year). Historically, the utilisation of these pastures by the regional herd relied upon the services of herding specialists – men with the knowledge, stamina, and social networks required to securely move livestock to distant pastures. The herding profession, like other occupations in West Africa, has been tied to particular ethnic/caste groups. Conflicts between farmers and herders have existed ever since livestock and cropping overlapped in space during the rainy season. Over the past 30 years, there has been a blurring of distinctions between the livelihood strategies of 'herding' and 'farming' ethnicities and castes (Toulmin, 1983). 'Pastoral' households who have lost most of their livestock now rely more heavily on farming and migrant labour. The household budgets of 'farming' families, especially those remaining in the true Sahelian zone, now rely less on farming income and more on livestock rearing and migrant labour remittances than in the past. Within the mixed ethnic communities of the region, most families are involved in farming, livestock rearing, and a variety of off-farm productive activities to cope with the severe economic and climatic constraints they face.

How does the increased prevalence of 'farmer–herders' affect the nature of conflict between herding and farming practices? Some have argued that due to the spread of agriculture and reductions in livestock mobility, changes that are associated with the increased prevalence of the 'farmer/herder', the potential for conflict has increased (Bennett, 1991; Moorehead, 1991; Blench, 1996; van Driel, 1999; Barrière and Barrière, 2002). Others have argued that there is little evidence for the growth of serious conflict (Hussein et al., 1999). An increased potential for conflict may not lead to serious conflict if there is greater potential for mediation. Improved mediation stems not only from institutional capacity and nature of community leadership but by the degree to which common interests are shared in the everyday relationships existing among 'herding' and 'farming' social groups in the community. How might the increased involvement of farming by 'herders' and livestock rearing by 'farmers' influence the development of shared interest in everyday relations that could facilitate conflict mediation?

A political ecology approach was taken to study how changing livelihood practices among 'herding' and 'farming' groups contributes to differences in the nature of farmer–herder conflict. A mix of group and individual interviews were conducted in four communities in Niger to address five questions:

1. How does the changing distribution of access to productive resources affect peoples' livelihood strategies (mix of productive activities) within and across ethnic groups?
2. What specialisations in work tasks and investment strategies continue to exist between 'farming' and 'livestock rearing' ethnic identities?
3. How do changing livelihood strategies, resource endowments, and local governance affect the prevalence of events (crop damage and field encroachments) that trigger conflicts between herders and farmers?
4. How do peoples' livelihood strategies affect day-to-day cooperative relations with those outside of their households and to what extent are these between households with 'herding' or 'farming' identities?

5. How do the livelihood trajectories in different study areas affect the potential for relations of trust and mutual interest to form among herding and farming groups?

This paper is organised in the following fashion. First, major approaches to farmer–herder conflict will be briefly reviewed and an alternative approach, informed by political ecology's 'access to resources' framework, will be introduced. The changing regional political ecology (broader forces affecting resource access) will be described before introducing the four study communities and the methods used in this study. The results of the research will be presented to address: the relationship between resource access and livelihood strategy; factors affecting the observed variation in livelihood specialisation; differences in the importance of everyday social relations of production across 'farming' and 'herding' groups; and the local views of the causes and prevalence of the farmer–herder conflict. In a discussion section, these findings will be used to analyse how present trends in the Sahelian region will affect the nature of farmer–herder conflict.

II. Applying an 'Access to Resource' Framework to Resource-Related Conflict

Widespread concern about the social impacts of global climate change, has reinvigorated environmental security portrayals of social conflict within resource-dependent communities (Homer-Dixon, 1999; Obi, 2000; Ki-moon, 2007). Reduction in the availability of resources is seen to lead to greater resource competition and conflict. Such portrayals have been critiqued as overly simplified – highly reduced materialist accounts of social conflicts which are in fact socially produced, mediated, and felt (Breusers et al., 1998; Peluso and Watts, 2001; Turner, 2004). Instead of here-and-now struggles over a dwindling stock of resources, most 'conflicts over resources' are shaped by social identities, political interests, historical precedent, and the defense of broader principles. Still, many of these conflicts do have an underlying material basis. There is a need to understand the interplay between the social and biophysical bases for resource-related conflict without reducing either through overly idealistic or materialist portrayals.

Political ecology encompasses a diverse set of approaches (for example Escobar, 1999; Zimmerer and Bassett, 2003; Robbins, 2004). One of the core contributions of early political ecology was the introduction of the 'access to resources' framework to understand the decision-making process of smallholders with respect to natural resources (Blaikie, 1985; Blaikie and Brookfield, 1987). This framework, which has been further elaborated in different ways elsewhere (for example Ribot and Peluso, 2003), is useful for understanding the material roots of resource-related conflict (Figure 1). 'Access' refers to the ability to make effective use of a natural resource to support livelihood practices. Access is affected by changes in the physical availability of the resource due to its use by others and/or by environmental change. Access is also shaped by social factors such as formal or informal use rights to the resource; ability to extract the resource given capital or labour constraints; and the ability to benefit from resource extraction as shaped by market structures. Changes in 'resource access' incorporate physical and social changes and in so doing, can provide insights into their interaction within particular settings.

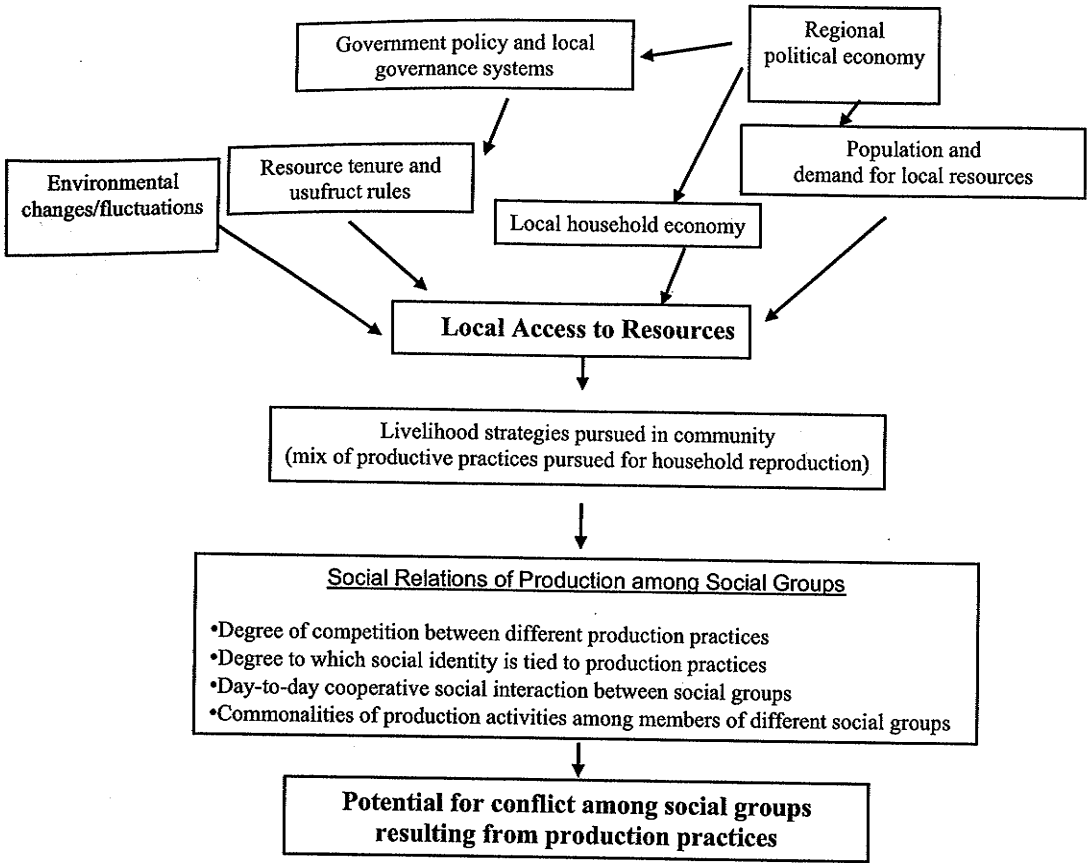

Figure 1. Political ecology approach utilised for analysing resource-related conflict. Physical and social changes shape the distribution of access to productive resources which affect both the livelihood strategies of community members and everyday social relations among social groups.

Peoples' access to resources influences their livelihood strategies and, in so doing, the material roots of competition between farming and herding. Resource-related conflict does not simply arise from increased competitive pressure driven by physical scarcity of a resource. Yes, triggering events are often involved – livestock straying into a farmer's field due to negligence of a herder or a new field blocking a livestock corridor. But these triggering events are commonplace and do not lead to conflict unless they are seen to violate ideological commitments. Resource-related conflict is more often spurred by perceived violations of resource-access norms including: (i) historical precedent in usufruct rights; (ii) perceived commitments to some equitability of access to commonly-held resources; and (iii) the right to pursue the livelihood that is tied to one's social identity.

III. Farmer–Herder Conflict in the West African Sahel

Portrayals of farmer–herder conflicts by participants and outside observers alike have clustered around two poles: (i) conflicts are induced by the increased physical scarcity of the resource (pasture or grain harvest) resulting from the actions of adversaries (Homer-Dixon, 1999; Ki-moon, 2007); and (ii) conflicts reflect deeply-

imbedded cultural animosities between herding and farming groups (Bernus, 1990; Barrière and Barrière, 2002). In some cases the former is seen as the trigger for the latter (Bennett, 1991; Blench, 1996). The juxtaposition of these invocations of scarcity and culture in the generation of conflicts provides a useful tension through which to explore their interplay. How is resource scarcity mediated through institutions and ideology to affect farmer–herder conflict?

Approaching farmer–herder conflict through an 'access-to-resources' framework requires adopting a broader political economic perspective – tracing chains of causation linking government policies, commodity markets, and changing social power differentials to community members' access to resources. In a classic article, Bassett (1988) traces an expansion of farmer–herder conflict in northern Ivory Coast to that country's policies to expand cotton production and encourage the immigration of livestock producers from the Sahelian zone. In the Sahel zone proper, the political economy behind farmer–herder conflict involves:

1. The legacy of colonial policies that generally accorded greater authority to the village-based authority (dominated by farming interests) and disregarded pastoralists' claims to commonly-held pastures and water points (Le Bris et al., 1982; Schmitz, 1993; Niamir-Fuller, 1999). Various postcolonial tenure reform policies according greater rights to 'users' of land (Ngaido, 1996) have further eroded the grazing rights of pastoralists since grazing does not visibly demonstrate use or management of land.
2. In contrast to precolonial states, colonial and post-colonial governments have not protected major transhumance corridors linking populated areas in the south with rangelands to the north (Niamir-Fuller, 1999). Programmes seeking to devolve resource management authority to the local level, through either government administrative structures (Ribot, 1999; O'Bannnon, 2006) or NGO-led village projects of land management (gestion de terroirs villageois), further threaten the connectivity of extant regional networks of livestock movement corridors (Painter et al., 1994).
3. Population growth and soil exhaustion (van Keulen and Breman, 1990) along with a series of the boom–bust cycles of groundnut and cotton production (Moseley, 2005) has led to an expansion of cultivated area, reducing the availability of rangeland and transhumance corridors in cropped zones to the south (450–650 mm of rainfall/year).
4. Since the early 1970s, recurrent cycles of drought have worked in favour of those whose income is buffered against the predictable price swings against and for livestock during droughts and inter-drought periods respectively.[2] As a result, livestock ownership has shifted southwards (Bourn and Wint, 1994) and toward social groups without a historic connection to livestock rearing (Bassett, 1994; Turner and Hiernaux, 2008). Over the past 25 years, ethnic/caste groups whose identities are tied to livestock husbandry have increasingly relied on farming to support their families (Bonfiglioli, 1990).
5. While labour emigration is not new to the Sahel, emigration to gain menial work in plantations, mines, and cities to the south has intensified as households have not been able to support themselves on farming and livestock rearing alone (Painter, 1994; Pedersen, 1995).

As a result of this regional political ecology, there is a convergence in livelihood strategy among all social groups (agropastoralism supplemented by labour emigration); a greater presence of livestock in the cropped zone during the rainy season, and a growing reliance on herding contracts for grazing animals. Therefore, communities in the region are experiencing countervailing trends with respect to farmer–herder conflict. On one hand, increased prevalence of livestock during the growing season increases the chances of conflict with farming. On the other, there is greater chance for 'herding' and 'farming' groups to share common livelihoods and interact more closely on a day-to-day basis.

This paper reports on research conducted in four different communities in Niger composed of a mix of social groups (herding and farming). All have experienced the countervailing trends described above. While households of different ethnic and caste groups have diversified their livelihood strategies by practicing a mix of farming, livestock husbandry, and labour emigration, their social identities often remain tied to particular production activities (Toulmin, 1983). A poor FulBe herder is likely to continue herding the livestock of others while farming with hope that he will be able to re-establish a herd in the future. A rich Djerma or Hausa farmer, who derives greater income from his livestock herd than from his infertile croplands, still seeks to make investments into his fields with his economic surplus. Still, given the fact that these two individuals, as agropastoralists, are involved in the same production activities and that one (the rich farmer) may be hiring the other (the poor herder) to manage his livestock herd, there may be greater potential for community-level mediation of conflict due to an increase in shared perspective and greater day-to-day interaction.

IV. Study Sites

Research was conducted in four communities from August –December 2004 (Figure 2). These four were chosen based on two major criteria: (i) communities with whom researchers had a prior working relationship (to ease the establishment of trust); and (ii) communities with contrasting biophysical and social settings that could influence the relationships between farming and livestock-rearing groups (Table 1). Four sets of variables were seen as particularly important in this regard: (i) existing cropland pressures (rainy and dry season) as well as the potential for further expansion/intensification (soil fertility, rainfall, market access...and so on.); (ii) the relative political power of 'livestock rearing' and 'farming' social groups; (iii) the degree of organisation within herding groups; and (iv) the degree of ethnic diversity within study communities.

The vast majority of residents in all four villages are engaged in farming and/or animal husbandry as a means of income. All have experienced the necessity of increased labour migration (primarily by young men) in search of income elsewhere. All four villages were composed of a mix of social groups whose identities are primarily tied to farming (Djerma, Hausa), livestock-rearing (FulBe), or mixed (Bella). In all cases except for Sabon Gida, livestock-rearing groups live in separate hamlets from those of farming groups. Intermarriage between these groups does not occur except in the case of Tountoubé where there are cases of intermarriage. Land tenure is similar to other areas in Sudano-Sahelian West Africa with village land

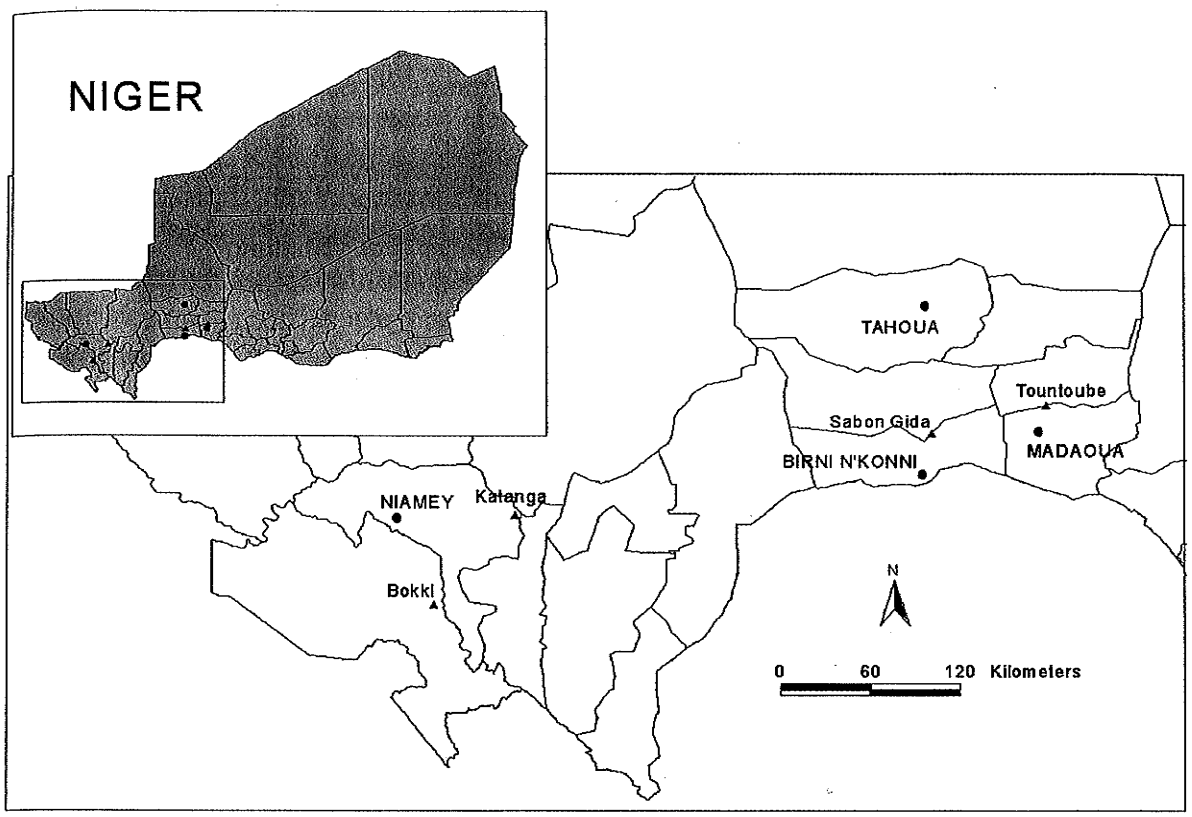

Figure 2. Location of the four study communities (triangle symbols) and major market towns (circle symbols) in western Niger.

formally controlled by the lineage that first settled in the area but with others gaining informal but secure rights over time. Land sales are uncommon but increasing – particularly in Sabon Gida and Tountoubé.

Bokki, Katanga, Sabon Gida, and Tountoubé reflect a range of biophysical, social, and political conditions that affect conflict and its management (Table 1). The villages are surrounded by lands having different productive potentials, with Bokki and Sabon Gida receiving more rainfall; having better soils; and having higher water tables to support dry-season gardening. Reflecting these biophysical conditions, both of these villages have experienced greater cropping pressures than Katanga or Tountoubé. Bokki has the highest access to markets and both Bokki and Sabon Gida have enjoyed greater investments of community development infrastructure. The local political situations are also quite variable with both Bokki and Sabon Gida displaying greater political power of herding interests due to the fact that local FulBe include the land-controlling lineages and have a greater degree of organisation compared to FulBe of the other two sites. Tountoubé and Bokki have the highest ethnic diversity – which may or may not affect the prevalence of social conflict depending on the distribution of political power.

V. Methods

The research was conducted with the help of four research assistants, one stationed within each of the study villages. Research was conducted in five phases using a mix of survey instruments and qualitative research activities:

Table 1. General characteristics of the four study villages relevant to farmer–herder relations

Characteristic	Bokki	Katanga	Sabon Gida	Tountoube
Population (approx)	2500	450	880	750
Access to markets[a]	High	Low	Medium	Low
Community development[b]	High	Low	High	Medium
Ethnic diversity	High	Low	Medium	High
Power of livestock-rearing interests	High	Low	High	Low
Organization of herders	High	Low	High	Medium
Ethnicity of founding lineage (owners of land)	FulBe	Djerma	FulBe	Hausa
Cropping pressure	High	Medium	High	Medium
Dry season gardening	Yes	No	Yes	No
Soil fertility	Medium	Low	Medium	Low
Mean rainfall (mm/year)	High	Medium	Medium	Low
Access to ground water	Medium	Low	High	Low

[a]This measure of access to markets incorporates both qualitative measures of transport access (distance and road quality) to major market towns (e.g. Niamey, Konni, Gidan Iddar, Madoua) and the strength and activity level of the commercial class within the study site.
[b]This is a qualitative measure of the degree of community development infrastructure that is in place within each study site. In Bokki there is a primary school (1975), a medical dispensary (2003), a Friday mosque (2001) and an active savings and loan bank. In Katanga there is a primary school (2002). In Sabon Gida, there are two primary schools (2000, 2002), a Friday mosque (2001) and a government-built health dispensary, which was constructed in 2003, but had not yet opened at the time of the research. In Tountoubé there is a primary school (1993) and the community (2000) along with Sabon Gida (1997) has benefited from CARE International's *Mata Masu Dubara* programme that establishes women's savings and loan accounts.

1. Collection of general village-level information through group interviews of representatives of major social groups within the village.[3] Topics covered in these group interviews included: distribution of resource access (pastures, cropland, labour, and livestock) across social groups, major livelihood strategies, and general information about farmer–herder relations. Groups interviewed consisted of four to eight members of each social group. Separate interviews of men and women were conducted for questions concerning access to cropland and labour.
2. Demographic and socio-economic data were collected through an exhaustive census of all households in the four study villages.[4]
3. Seventy-two households, representing the major social groups found within the four study villages, were surveyed as to their household composition, productive activities conducted by each household member, labour investments into the weeding of cropped fields during the previous year, and how household-owned livestock were managed over the previous year.
4. One hundred and thirty-nine adults of the 72 sample households were interviewed about their specific productive activities and how each is dependent on the actions of other people (within and outside of the household) as well as the misunderstandings that can develop with these other people.
5. Interviews of small groups representative of major social groups within each village (30 groups of two to three individuals each) were conducted to gather:

(i) their reactions to the veracity of and importance to their village territory of different changes related to farmer–herder conflict; (ii) their assessment of changes in the prevalence of farmer–herder conflict over the past 17 years (since the end of Kountché's presidency); and (iii) their descriptions of important conflicts that have occurred over the previous four years.

Quantitative and qualitative data on resource access, livelihood strategies, social relations and conflicts are presented in aggregate form (counts, percentages and means) by social groups. When data are missing or of poor quality, table cells are left blank. The only statistical analyses performed were ordered logistic and least-squares multiple regression of household variables on livestock wealth categories and agricultural productive capital, respectively. Residuals of all regression models were analysed to ensure constancy of variance, independence, normality of error terms, and lack of collinearity. Only models that did not violate these conditions were used.

VI. Results

Results of the group and individual interviews are presented in sections that focus on research themes addressed in the political ecology approach adopted in this study (Figure 1): (i) how do livelihood strategies vary between livestock and crop production in relation to households' access to productive resources; (ii) what are the perceived importance and qualities of inter-group relationships for production practices; and (iii) what are informants' views of the factors that have influenced farmer–herder conflict in their communities and of how the prevalence of farmer–herder conflict has changed over time.

Access to Productive Resources and Livelihood Strategies

The day-to-day relations among members of 'herding' and 'farming' groups are affected by the mix of productive activities pursued by rural households which in turn is influenced by their access to productive resources. Access to natural pastures, cropland, labour, crop productive capital, livestock, knowledge, and social networks are all important resources affecting rural livelihoods. 'Access' cannot be seen solely as an externally-produced constraint but is in part internally-produced by prior investments made by households themselves. A focus here will be on the distribution of resources that strongly reflect/influence the mix of farming and livestock husbandry pursued by members of the four study communities. These include access to: natural pastures, cropland, agricultural equipment capital and livestock.

Access to productive land. With respect to land resources, the four different communities' experiences mirror that of the region. Recurrent drought and the expansion of cultivated area have generally led to a decline in access to cropland and pasture over the past 30 years. Still, the four study villages have different land endowments, social histories, and forms of local governance (Table 1). These differences may shape variations within and across villages with respect to the distribution and security of land access.

Natural pastures are managed as common property resources in all four villages. In group interviews, informants from the main social groups in each village were asked to rank local pastures with respect to their quality to support livestock during the cropping and dry season during two time periods: 1988–1990 and 2003–2004. Except for the village of Tountoubé, local pastures are seen to be of lower quality in the later period. The most commonly stated reason is the extension of crop fields (nine of 15 groups interviewed describe it as the most important reason for decline).[5] This is especially true for the village of Bokki where both herding groups (FulBe) and others cited the extension of fields as the most important reason for pasture quality decline. In the other two villages, there is a stronger difference between FulBe, who generally see cropland extension as the major cause, and farming groups, who are more likely to cite declines in the productivity of natural pastures.

In group interviews, informants were asked to assess the availability of cropland to rent/borrow or purchase; estimate the fraction of the land farmed by their group in fallow and average fallowing times; and the degree to which access to land is a major constraint to increasing agricultural production. Cropland shortage is felt strongest in Sabon Gida and Tountoubé followed by Bokki and Katanga. In the first three villages, land is reported to be only available in the territories of neighbouring villages. In all four villages, land is available for purchase (although land sales are uncommon in Katanga and Bokki) and the availability of land for borrowing/renting is less in Tountoubé and Bokki. While cropland scarcity in Sabon Gida and Bokki is associated with high population densities, shortages in Tountoubé are largely due to the severe soil and geomorphological constraints to farming within its territory.

Land scarcity is felt differentially by social groups within the four villages. For Bokki and Katanga, the two villages lying to the west, access to cropland is generally less secure – relying on the loans from a relatively small group of land owners. In Katanga for example, the FulBe report that their claims to cropland are highly insecure with Djerma land owners often taking back land once it has been manured by FulBe-managed livestock. Land in this village remains in the hands of a relatively small group of Djerma land owners while in Bokki, access is controlled by FulBe elites. In Sabon Gida and Tountoubé, informants report much higher rates of traditional field ownership (Table 2) supplemented by measurable fractions of purchased fields which are virtually nonexistent in Bokki or Katanga. This finding based on the group interviews suggests greater security of cropland access, which is consistent with data collected from the household census (Table 2).[6]

Investments into crop agriculture and livestock. Effective farming requires not only access to land but the necessary productive capital to plough and weed the land and to bring in a harvest. Crop production capital includes: ploughs and carts and working animals such as donkeys, horses, camels, and oxen. Livestock rearing is another productive activity into which households can make investments. Table 2 shows that self-reported crop production and livestock assets are highly skewed within the four villages. Once controlling for household size and village, social groups associated with livestock husbandry (FulBe) generally hold lower amounts of crop production capital and higher livestock capital than others (Table 3). In the case of the eastern villages, this difference is less pronounced.[7]

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Table 2. Demographic and economic characteristics of surveyed households in four study villages

Village	# of Cen Hshlds	Cens Pop	Ethnic Group	# of Hshlds	Avg # People	Avg # Adult Equiv[1]	%Adults Labor Migrants	Avg. Ag. Equip. Value (FCFA)[2]	Livestock Wealth Category (cattle equiv) %					Number of Crop Fields per Household					
														Not Owned		Owned		Total	
									0	<1	1–3	4–9	>9	No(%)	Avg	No(%)	Avg	No(%)	Avg
Bokki	237	2,008	Bella	16	7.9	6.6	5	40313	19	63	13	6	0	19	1.3	31	1.5	0	2.9
			Djerma	112	9.9	8.0	15	199375	29	30	19	11	12	67	1.6	9	3.6	0	5.1
			Hausa	21	7.6	5.9	6	76429	24	38	24	14	0	33	1.6	48	2.7	7	4.4
			FulBe	86	7.0	5.5	4	36860	0	6	16	20	58	60	1.8	30	2.1	13	3.8
Katanga	66	601	Djerma	32	10.7	8.2	42	103750	9	53	28	6	3	50	3.4	47	6.8	0	10.3
			FulBe	34	7.6	5.9	18	47500	0	6	24	6	65	0	1.8	100	–	0	1.8
Sabon Gida	168	1,167	Hausa	97	6.3	4.8	7		47	10	38	4	0	84	1.3	4	1.7	5	2.9
			FulBe	69	7.7	5.7	2		4	15	44	19	18	93	1.0	6	1.8	17	2.7
Toun toubé	157	1,159	Bella	23	5.2	4.0	48	43478	30	57	13	0	0	83	1.3	26	2.2	23	3.5
			Hausa	121	8.0	6.2	28	83636	19	55	16	4	7	74	1.3	5	4.7	2	6.1
			FulBe	12	5.2	4.0	22	130417	17	50	8	0	25	83	1.5	0	4.0	0	5.5

Notes: For each village, the number of censused households, total censused population, and the major ethnic groups in each village are listed. For each ethnic group, the following data are provided: the number of households; average number of people per household; average number of adult equivalents per household; percentage of adults that typically migrate to work elsewhere during some portion of the year; estimated value of 'equipment' (working animals, ploughs, and carts) for agricultural production; the percentage of households owning 0, <1, 1–3, 4–9, and >9 cattle equivalents (one cattle equivalent is equal to nine adult sheep or goats); the percentage of households *not* farming fields (No%): and for those households farming at least one 'not owned' and 'owned' fields, the average number farmed (Avg).

[1]Children (0–14 years) are equal to 0.5 adult equivalent. [2] The economic value of agricultural working capital was calculated by using these average prices: donkey cart (130,000 FCFA), plow (35,000 FCFA), ox (50,000 FCFA), camel (70,000 FCFA), donkey (15,000 FCFA), and horse (40,000 FCFA).

Table 3. Coefficients (b), standard errors, standardised coefficients (β) and significance levels (p) of ordered logistic regression model used to estimate livestock owner classes expressed in cattle equivalents, or CE (0 = 0 CE; 1 = 1–3 CE; 2 = 3 to 9 CE; and 3 = greater than 9 CE); and least-squares regression model to estimate crop production capital (10,000 FCFA) for households in four study villages

Independent Variables	Livestock Ownership Class[1] (cattle equivalents)				Crop Production Capital[2] (10,000 FCFA)			
	b	SE	β	p	b	SE	β	p
Constant					6.23	1.94		0.001
Household size (adult-equivalent)	0.18	0.03	7.1	<0.001	1.34	0.20	0.30	<0.001
Herding social group (HSG)	3.99	0.29	13.6	<0.001	−10.09	2.05	−0.30	<0.001
Katanga	−0.37	0.40	−0.9	0.36	−6.86	2.87	−0.15	0.017
Sabon Gida	0.34	0.27	1.3	0.21				
Tountoubé	−0.47	0.27	−1.7	0.09	−6.23	1.82	−0.18	0.001
Katanga*HSG	0.38	0.58	0.7	0.51	7.50	4.14	0.12	0.071
Sabon Gida*HSG	−2.01	0.41	−4.9	<0.001				
Tountoubé*HSG	−3.46	0.56	−6.2	<0.001	12.06	3.46	0.20	0.001

Notes: Independent variables include: the number of fields owned by the household and dummy variables for whether (1) or not (0) the household is from: a herding social group (for example FulBe); the village of Katanga; the village of Sabon Gida; or the village of Tountoubé. Due to missing data, Sabon Gida households were excluded from the crop production capital model.

[1]The chi-square statistic of the ordered logistic regression model is equal to 317 ($df = 8$, $p < 0.0001$). The Cox and Snell pseudo R-square equal to 0.21.

[2]The F statistic of the general linear model is equal to 15.9 ($df = 6$, $p < 0.0001$) with the adjusted $R^2 = 0.16$.

With livestock ownership distributed across all social groups but herding being largely practiced by the FulBe, a key economic relationship tying herding with farming groups is that of contract herding. As shown in Table 4, livestock owned by farming households in all villages except for Katanga are herded by someone outside the family across the year (usually FulBe). The lack of contract herding by farming households in Katanga lowers the potential for cooperative economic activity among the two groups. In the two eastern villages, herding households in the community show much higher reliance on contract herding than herding households in western villages. These findings reflect the higher prevalence of livestock specialists in the two western villages

In sum, Bokki and Katanga display stronger investment specialisation than the villages to the east: Sabon Gida and Tountoubé. It should be noted that the observed cross-village difference with respect to livestock investment is driven less by a greater interest in livestock rearing by farming groups and more by reduced livestock ownership among herding groups in Sabon Gida and Tountoubé (Table 3).[8] In these two villages there is evidence of a reorientation of investment toward crop production by herding groups. In Tountoubé, FulBe households, on average, farm more fields and invest more heavily into crop production capital than farming households (Hausa and Bella). Crop production capital investment data are not available for Sabon Gida households but FulBe do crop a similar number of fields as farming groups and testimony elicited in group interviews support the conclusion that crop production capital investments by FulBe households is similar to that by Hausa households.

Day-to-day Relations of Production between Farming and Herding Groups

While all ethnic groups farm, ethnic identity plays a very important role in proclivity to herd livestock with the FulBe being the ethnic group most associated with grazing

Table 4. Livestock management among 72 surveyed farming and herding households in the four study villages

				Herding (# of management herds)					
				Rainy Season			Dry Season		
Village	Social Group Type	N	No Livestock	No herd	House-hold	Cnt	No herd	House-hold	Cnt
Bokki	Farming	18	4	2	1	17	5	3	11
	Herding	4	0	0	10	1	0	11	0
Katanga	Farming	5	1	6	4	0	11	0	0
	Herding	10	0	0	21	0	5	15	0
Sabon Gida	Farming	11	2	0	2	10	0	0	12
	Herding	7	0	0	7	13	1	9	9
Tountoubé	Farming	12	0	2	3	13	2	0	16
	Herding	5	1	1	0	7	1	0	7

Notes: The number of groups of animals independently managed by households (management herds) and not herded (free pasture or kept in concession for fattening), herded by a household member (Household), or herded by someone outside of the household through an entrustment or wage contract (Cnt) during the rainy and dry seasons of 2004–2005. The number of surveyed households with no livestock is presented (no livestock).

management.[9] Along with the relationships between landlord and farmer and that between merchant and client, the relationship between livestock owner and herder is one of the most common social relations of production involving multiple ethnic groups in the Sahel. Given the high dependence of livestock owners within farming groups on FulBe herders (at least in all villages besides Katanga), the degree of day-to-day social interaction around production could be seen as high between herding and farming groups. Still, there are many farming households who own no livestock (particularly in Bokki and Sabon Gida). In addition, it is important to recognise that farmers or herders may not view their social interactions around contract herding as constituting a relationship that is important to their livelihoods. One hundred and thirty-nine members of the 72 households chosen for detailed surveys were asked to list relationships with people (inside and outside of their household) that play an important role in their production activities. Of the 500 outside relationships mentioned, 43 per cent were with members of their same social group (as defined in Table 2) and 57 per cent involved members of a different social group. Sixty-three per cent of these cross-group relationships involved farmer–herder relationships (36% of relationships outside of household). Interestingly, the western villages (57 informants) only listed a total of 177 important relationships (compared to 593 in the eastern villages) of which 72 per cent implicated members of the same household or social group (compared to 45% of relationships in eastern villages). While one cannot rule out the possibility of differences in how information was recorded across the four villages, informants were prompted with the same question. This suggests that there may be stronger disregard of, or hesitancy to mention the importance of relationships outside of the immediate household and social group in the two western villages.

These same informants were asked to describe any misunderstandings or problems that can develop with these social relations of production. Despite listing fewer such relationships, the two western villages provided the most misunderstandings that can develop in such relations (54 of 96 or 56%). The types of problems most commonly mentioned in all four villages include, in order of frequency mentioned, problems/disagreements concerning: competition between pasture and fields, including livestock-caused crop damage (39%); field boundaries (11%); entrusted livestock that are lost or stolen (10%); loans and prices between sellers and purchasers of goods and services, other than farming and herding labour contracts (9%); rent and length of tenancy between landlords and tenant farmers (7%); access to water from wells (7%); remuneration and responsibilities of herding labour contracts (6%) and field labour contracts (4%); abuse of power by government agents (2%); and manure contracts (2%). Problems between pastures and fields were most often mentioned in Bokki. Both Bokki and Sabon Gida had disproportionate references to problems of field boundaries with Sabon Gida also displaying a high rate of references to landlord–tenant problems (13%).

Farmer–Herder Conflict

To assess the changing nature of the farmer–herder conflict in all four villages, two types of information were gathered. The first are reactions to a set of propositions

related to the causes and consequences of farmer–herder conflict by 30 small groups of informants (stratified by gender x village x social group). Table 5 summarises the results of these groups' reactions to the propositions. With respect to the assessments of the veracity of different propositions, the data reveal fewer differences among villages and between herding and farming groups than might be expected. All groups acknowledge that land claims associated with farming are stronger than those tied to pasture; the expansion of cultivated area has led to an increase of competition between farming and livestock rearing; there are too many livestock in the village territory during at least one season of the year; and there has been an increase in livestock-induced crop damage.

There are few perceptual differences of propositional veracity and impact between herding and farming groups in the two western villages (Bokki and Katanga).[10] Sabon Gida shows more contrasts between herding and farming group assessments. However, those propositions that were assessed differently were generally those that were also seen to have little effect on the prevalence of disputes within the community. In fact, Sabon Gida informants generally perceive a larger fraction of true propositions as not leading to an increased prevalence of conflict compared to informants in the two western villages. Moreover, a number of propositions related specifically to competition between farming and livestock rearing (for example, propositions 5, 7, 8, 9, 17, 18, 19) are seen to have little effect on conflict, with herding groups in particular deviating from their expected assessment (too many fields). This likely reflects the greater convergence of herder and farmer livelihood strategies observed there. The fact that Tountoubé informants do not show the same convergence of perception may simply reflect the fact that only one herding group was interviewed.

These same groups were asked to assess whether farmer–herder conflicts have become more frequent over the previous 17 years. In Bokki, there was a difference between informants from herding and farming groups with the majority of the former generally perceiving a slight decline of farmer–herder conflict due to recent initiatives to protect transhumance corridors. Farming groups on the other hand ubiquitously portray conflict as increasingly caused by a combination of growing scarcity-driven competition and a local leadership that is not truly committed to resolving conflicts. Bokki farmers, especially those who have insecure tenure rights to their cropland (see Table 2), reveal in informal conversations that they cannot seek compensation for livestock-induced crop damage since they are not owners of their fields and their landlords are FulBe who support livestock interests. In Katanga, there are no strong differences between herding and farming groups – all see farmer–herder conflicts increasing during the period due to increased competition between farming and livestock rearing. In Sabon Gida, perceptions are evenly split between those who feel that conflict has declined and those who feel that it has increased, unrelated to membership in herding or farming groups. Those who feel that the incidence of farmer–herder conflict is declining, attribute these changes to commitment within the community to avoid and resolve conflict. Those that feel that conflict has increased generally attribute this less to management factors or to rising resource demands and more to recurrent drought leading to reduced biological productivity. In Tountoubé, the vast majority of the small groups describe farmer–herder conflict as declining over the time period due in large part to recurrent

Table 5. Reactions to different propositions related to the causes of farmer–herder conflict by thirty small groups of informants (2–3 people) representing major social groups in four study communities: Bokki, Katanga (Kat), Sabon Guida (SG), and Tountoubé (Toun)

	Bokki (n = 3/5)		Kat (n = 2/4)		SG (n = 3/6)		Toun (n = 1/6)[1]	
Proposition	V	Impact	V	Impact	V	Impact	V	Impact
Land tenure								
1. Cultivation rights are stronger than pasture rights	T	++	T	=/+	T	++/−	T	++/=
2. Pasture rights are stronger than cultivation rights	F		F		F		F	
3. There is a lack of land tenure security	T	++	F		T	++	T/F	++/
Loss of pasture resources								
4. There is a conversion of fields to pasture	F		F		F/T	/++	F	
5. There is a conversion of pasture to fields	T	++	T	+	T	=	T	++/=
6. There is a loss of livestock corridors to fields	T/F	++/	T/I	++/=	T	++	F	
7. There are too many farmers who live in village lands	T	++	T	+/=	T	I/-	T	++
8. There are too many fields in village lands	T	++/I	T	=	T	=/-	T	++/=
9. There are too many gardens in village lands	T	++	F		F/T	/=	F	
10. Movements of livestock are restricted in village lands	T	++	T/I	++/+	T	++	F	
11. There is a lack of water during the rainy season	T	++	T	-/=	T	=	T	++/+
12. There is a lack of wells to provide water to livestock	F		T	++	T	=	T	++
13. The species composition of pastures has changed	T	++	T	=	T	=	T	++/I

(continued)

Table 5. (*Continued*)

Proposition	Bokki (n = 3/5)		Kat (n = 2/4)		SG (n = 3/6)		Toun (n = 1/6)[1]	
	V	Impact	V	Impact	V	Impact	V	Impact
Local livestock populations								
14. There has been an increase of crop damage in territory	T	++	T	++	T	=/++	T	++
15. There are too many outside herders in the village lands	T/I	++/++	F		T	++	T	++
16. The village lacks relations with outside herders	T	++	F		T	++/+	T	++/−
17. There are too many herders who live in the village lands	T	++	I/T	++/+	T	I/-	T	++
18. There is lack of livestock after harvest that does not permit the creation of beneficial relns with herders	F/T	/++	F		T	=	T	++/+
19. There is a lack of milk being sold in the village	T	++	F		T/F	=/	T	++
20. Too many livestock in village lands prior to harvest	T	++	F		F/T	/+	T	++
21. Too many livestock in village lands after harvest	T	++	T	−/+	T	++	T	++
Quality of herding								
22. Livestock return too early during harvest	T	++	F		T	++	T	++
23. There is a lack of quality herders in territory	T	++	T	++	T/F	I/	F/T	/++

Notes: Informants were asked to comment on the veracity (V) of the proposition (T = true, F = false, I = indeterminate due to wide differences within herding and farming groups) and if seen as true, to assess impact on the prevalence of disputes within the community. Aggregate results of interview groups' perception of impact of these propositions on the prevalence of farmer-herder conflict are coded in the following fashion: seen to increase (++) or diminish (−) by more than 75 per cent of groups; seen to increase (+) or diminish (−) by at least 50% with the rest viewing the proposition as having no effect; seen to have no effect by more than 50% (=); or seen to have effects of mixed directionalities (I = indeterminate effect). If assessments of veracity or impact differed significantly between herding and farming groups, the herding groups' assessment proceeds the farming groups' assessment, separated by a backslash (/).

[1]Following each village (x/y) designates the number of small groups interviewed from herding (x) and farming (y) social groups respectively.

drought leading to the reduced presence of outside herders in the village area during the cropping season.

It is difficult to quantitatively compare different villages with respect to the incidence of farmer–herder conflict due to the wide variation in the recollection and openness of informants as well as how they define 'conflict.' Informants were asked to describe public farmer–herder conflicts that have occurred in their village during the previous four years (10–17 conflicts described per village). All of the reported farmer–herder conflicts in Bokki were associated with livestock–induced crop damage with local FulBe herders implicated in 75 per cent of the cases. In Katanga, public farmer–herder conflicts, as reported by informants, were of three types of equal prevalence: disagreements around water at the village well during the dry season; livestock-induced crop damage (one half implicating Katanga FulBe and the other half, outside herders); and conflict associated with the blockage of livestock corridors by farmers' fields. All of the reported farmer–herder conflicts in Sabon Gida were associated with livestock-induced crop damage with FulBe herders of Sabon Gida implicated in about a third of the cases and outside herders implicated in the remaining two-thirds. Approximately half of these cases involved herders who were hired to herd village livestock. All of the conflicts described by Tountoubé informants were associated with livestock-induced crop damage with 75 per cent of these cases involving local farmers and outside herders. One major difference between the western and eastern villages is the reduced incidence of conflicts between herding and farming residents of the eastern villages. This is associated with the reorientation of livelihood strategies toward farming among herding households in Sabon Gida and Tountoubé with their greater reliance on hired herders from the outside (Table 4).

VII. Discussion

A major concern of this research is how changing material conditions have influenced the prevalence of conflict triggers and the levels of trust and common interest that exist between farming and herding groups within small-scale communities. We have adopted a political ecology approach – tracing out the causal connections between changing material conditions to the distribution of access to resources; to livelihood strategies and the prevalence of triggering events, and to interethnic social relations and the existence of webs of common interest and trust.

As described above, the situations in the four study villages capture much of the range of livelihood transitions observed in the Sudano-Sahelian region of West Africa over the past 35 years of recurrent drought (pasture and cropland shortage, labour emigration, and shifts in livestock ownership).

Competition between farming and livestock rearing, most commonly experienced in the form of livestock-induced crop damage, is the most important 'trigger' leading to farmer–herder conflict (verbal, political, violent) in the four study communities. The increased proximity of grazing livestock to cropped fields results primarily from an expansion of cropped area in the four study areas. There is no evidence for large increases in the number of livestock owned in any of the four study communities. There is evidence however for significant variations in the presence of livestock managed by outside herders and for the greater presence of community-owned

livestock during the cropping season. In all villages besides Katanga, the early return of livestock to the village territory (prior to harvest) is described by informants as an important cause of farmer–herder conflict (Table 5). While the western two villages have larger aggregate livestock populations, a greater fraction of these livestock are owned by livestock-rearing specialists and as such, are more likely to move away from the village during the cropping season and when in the village territory, be grazed more diligently due to their greater liability for any crop damage than contract herders.[11] On the other hand, a large fraction of the eastern communities' livestock is managed by herding contracts with restrictions on hired herders to move too far from village.

Clearly, the different villages are on different livelihood trajectories with important implications for competition between livestock-rearing and crop agriculture. Livestock specialization persists in Katanga and Bokki. Competitive pressures are relatively manageable in Katanga but Bokki is experiencing significant competition due to rapid expansion of cropped area and deteriorating access to outside pastures. Still livestock remain mobile and are away from the village lands for a longer period during the rainy season than is the case for the eastern two villages. For the two eastern villages, shortages of arable land are more acute and of older vintage. Livestock ownership is lower and more balanced across social groups with livestock mobility restricted and only maintained through the hiring of herders by herding and farming groups alike. As a result of these multiple factors, it is difficult to rank the villages with respect to the prevalence of triggering events (crop damage and field encroachments) although the western two villages, and Katanga in particular, do seem to have lower potentials for triggering events when compared to the eastern villages (due to lower cultivation density and lower rainy-season presence of livestock).

Crop damage or field encroachment onto a livestock corridor as a 'trigger' doesn't necessarily lead to socially-degenerative conflict . Effective institutions and webs of trust and of common interest can in combination mediate an accommodation of the harm caused by the event. Our research was directed at how material conditions influence livelihood practices which in turn affect the ability to resolve these incidents before they become public conflicts. While much of the existing literature on conflict management adopts a strong institutional perspective, we focused in this study on how day-to-day interactions between groups with herding and farming identities contribute to the development of relations of trust and shared common interest. Relations of trust and a sense of common interest are both prerequisites for effective institutions (Platteau, 1996).

The lines of evidence presented above support the conclusion that the two eastern villages (Sabon Gida and Tountoubé) manage farmer–herder conflict more effectively than the western villages. Underlying material reasons for their relative success fall into four domains:

1. Convergence of productive interests across herding and farming social groups in the two eastern villages. The livelihood strategies of the herding groups are more similar to farming groups in the two eastern villages leading to greater commonalities of interest and interdependency as all households are in need of arable land, farming implements, labour (herding and farming), and to a lesser

extent, livestock. This convergence of productive interest is associated with more secure claims to arable land of FulBe in the eastern villages to those of FulBe in Katanga. This finding is consistent with those of Brockhaus et al. (2003) who found that secure land access by herding groups have a significant effect on reducing socially-degenerative conflict.

2. A higher degree of perceived interdependence. Informants in the eastern two villages were found to be more likely to cite dependencies on other households – many of which are in different social groups. This suggests a higher prevalence of multi-stranded relations among 'herding' and 'farming' groups (for example 'social capital') that work to buffer and mediate interactions when differences arise.
3. The despecialisation of FulBe households in the two eastern villages has led to their growing reliance on contracted herding services to manage smaller herds in strong contrast to FulBe households in the western villages. While in the western two villages, livestock wealth and grazing management are conflated and tied to village FulBe, these two features are separated in the eastern villages. Crop damage there is more likely to have been caused by a contracted herder (from the outside) and by livestock owned by multiple owners (FulBe, Bella or Hausa). Therefore, crop damage is more likely to be seen as management failure rather than an instance of the negligence of the rich causing the suffering of the poor (Breusers et al., 1998).
4. The distribution and exercise of political power. The study provides four separate configurations of political and economic power of herding groups in relation to farming groups. In Bokki and Sabon Gida, the FulBe lineages control land distribution and therefore populate local positions of authority while in Katanga and Tountoubé, farming interests hold political power (Djerma and Hausa lineages respectively). Livestock wealth, an important measure of economic wealth, is high in Bokki and Katanga among the FulBe while relatively low in Sabon Gida and Tountoubé. While leadership is very much about the inter-relationship between the personal qualities of leaders and the nature of political institutions, we can, with appropriate qualifications, suggest that these configurations explain in part how power is exercised. In Bokki, FulBe leaders are rich in both livestock and land. Their livelihood interests remain with livestock herding and they remain politically powerful – leading to a situation in which crop damage goes uncompensated and conflicts unresolved.[12] In contrast, FulBe in Sabon Gida are relatively poor in livestock and therefore have more interest in accommodating livestock rearing and farming. In the other two villages, FulBe lack political power. In Katanga, conflicts arise since local political leaders have fewer interests to resolve problems facing livestock rearing with significant local livestock populations owned by FulBe while in Tountoubé, livestock populations are much lower with little divergence between leadership interests and local livelihood practices.

VIII. Conclusions

In this paper, we have explored the interconnections between changes in livelihood practices and farmer–herder conflict in Sudano-Sahelian region of West Africa. The

results of this work reveal a major development conundrum facing policymakers of the region. As most illustrated by the eastern two study sites, livelihood transitions are leading to a convergence of livelihood practices of ethnic/caste groups whose historic identity has been tied to livestock husbandry and dryland farming. This convergence is associated with an increased prevalence of 'conflict triggers' due to the increased expansion of cropped fields, labour withdrawals from herding, and reduced mobility of livestock rearing. While the potential for land-use competition is higher, socially-degenerative conflict is less likely due to higher levels of shared livelihood interests and cooperation across social groups. In these ways, the same livelihood trajectories that work to increase the competition between livestock rearing and farming, may lead to less conflict *within* agropastoral communities.

How should we think about these trends in relationship to the development future of the region? Do the more 'harmonious' situations observed in the two eastern villages support a view held by some of a mixed farming future for the region that is more economically prosperous and socially cohesive (McIntire et al., 1992; Powell and Williams, 1993)? Is this period of heightened farmer–herder conflict simply associated with a transitional phase of socioeconomic development? Responding to these questions requires us to consider how 'harmony' is achieved in such communities and at what cost. Given that livestock populations are relatively low and grazing management performed by hired herders from the outside, 'harmony' seems to be simply achieved by displacement of livestock husbandry from the community. In this way, conflict 'goes away' from the community simply by having fewer livestock, the adoption of a stronger farming identity among 'herding families' and shifting the anger toward outside herders. Such a displacement dynamic would have serious negative consequences for a region where the accommodation of livestock husbandry with crop agriculture is of critical economic importance.

Scaled-up from communities to districts, such displacements of livestock husbandry have potentially serious consequences. Livestock production remains a major part of the region's economic future. Range ecological work has demonstrated the need for widespread livestock mobility to maintain livestock and pasture productivity in these semi-arid areas (Scoones, 1994; Niamir-Fuller, 1999). Livestock mobility requires some degree of herding specialisation and land-use accommodation with crop agriculture to persist (Scoones, 1994; Turner and Hiernaux, 2008). Rather than taking a hands-off approach, comforted by the illusion of a settled, mixed farming future, there is a strong need to utilise the shared interests that have increased in agropastoral communities under transition so as not to abandon livestock grazing altogether but to improve the security and transparency of institutions that are instrumental in the accommodation of crop agriculture and livestock husbandry (herding contracts, transhumance corridors, labour sharing, livestock ownership marks ... and so on).

Notes

1. Livestock produced in the Sahel supply regional markets that are strongly shaped by rising urban demand within the humid tropical zone along the coast where livestock production is limited by trypanosomiasis (tsetse fly). Young men from the Sahelian drylands also move south on a seasonal or

semi-permanent basis to work in mines and plantations, as well as taking on menial urban-based jobs within the region. While the export of livestock and labour is not new in the region, the centrality of these movements for the economy's future has grown with the 1995 devaluation of the currency of Sahelian countries (FCFA), reduction of Sahelian government subsidies/support for crop agriculture, and reduction of trade barriers among the countries in the region.

2. There has been a shift in livestock ownership toward inhabitants to the south (less drought risk); to the wealthy who have the flexibility to shift investments in response to predictable price swings; and to those whose income is better buffered from drought (government officials, merchants, Islamic clergy).
3. There were three to five major social groups surveyed through group interviews within each village. In Bokki, the major social groups were the FulBe, Djerma (freeman ancestry), Djerma (slave ancestry), and Hausa. In Katanga, the major social groups were the FulBe 1 (settlement to east), FulBe 2 (settlement to west), and Djerma. In Sabon Guida, the major social groups were the FulBe (of village), FulBe GD (residents of the Gidan Daji hamlet), Hausa 1 (Islamic cleric lineage), Hausa 2 (blacksmith lineage), and Hausa 3 (barber lineage). In Tountounbe, the major social groups were the Hausa, Bella, and FulBe.
4. For each household, the following information was collected: the household's ethnicity/caste; the total number of adults and children within the household; the number of working animals (donkeys, camels, horses, oxen), ploughs and carts owned by the household; the approximate number (0, 1–3, 4–9, >9) of goats, sheep and cattle owned by household; the number of fields farmed by the household stratified by ownership (inheritance, purchase, loan, rental); and the number of family members involved in particular nonagricultural pursuits (Islamic clergy, commerce, artisanal activities, wage labour, labour migration, medical treatment).
5. Reasons given by informants for declines in natural pasture quality during the period were grouped into the following categories: declines in rainfall, declines in pasture productivity, increases in livestock population, shifts in species composition of pasture, changes in tree/shrub density, harvesting of fodder by farmers, and the extension of crop fields.
6. An important caveat to the use of these characterisations is that there may be significant differences in the meaning attached to these different categories. For example, the dividing line between 'locally-accepted cropping rights' and 'loans of fields' is actually somewhat blurred in reality with real possibilities that different social groups categorise similar situations differently.
7. Logistic regression analyses of these data reveal that both livestock wealth and crop production capital are found to be positively associated with the household's size (adult equivalents). Once controlled for household size, Tountoubé shows significantly lower livestock investments and Bokki higher investments into crop production capital than others. Families with herding social identities (HSG) show significantly higher and lower investments into livestock and crop production capital respectively. The negative interaction terms for HSG*Village for the two eastern villages, suggests that the differential in livestock investment between herding and farming groups is less than in the two western villages.
8. Fifty-seven and 74 per cent of the Hausa households in these two villages own less than one cattle equivalent (less than nine small ruminants) – rates of ownership that are similar to farming group households in the two western villages (Table 2). The difference is caused by herding groups in the eastern villages being poorer in livestock.
9. Bella outsiders are reportedly hired to graze livestock in Tountoubé.
10. In Katanga, the different perceptions concerning livestock corridors and restrictions on livestock movements within the village territory are best explained by a controversy during the research period over a livestock corridor. Despite the fact that farming groups' assessment of these corridor-specific propositions is indeterminate (I), they did view the expansion of cultivation as a major factor contributing to disputes within the community. Differences observed for Tountoubé should be interpreted with caution given that only one interview of herding group members was conducted there.
11. In all four villages, owners are liable for crop damage caused by their livestock when managed by hired herders.
12. A major factor in West Africa more generally for the lack of conflict resolution is the interest of the authorities (customary and governmental) to perpetuate conflicts since they benefit economically (competing bribes) from recurrent flare-ups (Moritz, 2006).

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