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Post drought migration and technological innovations among Fulani herders in Senegal: the triumph of the tube!

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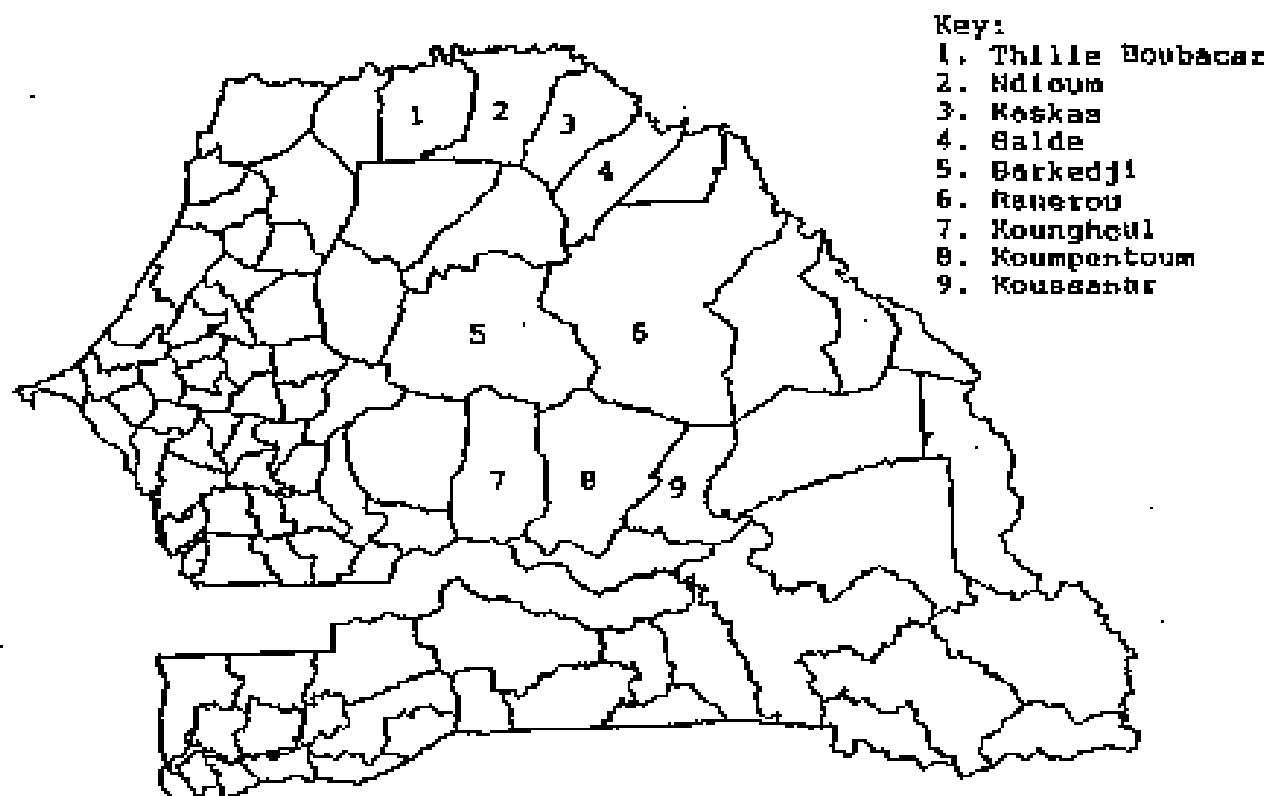
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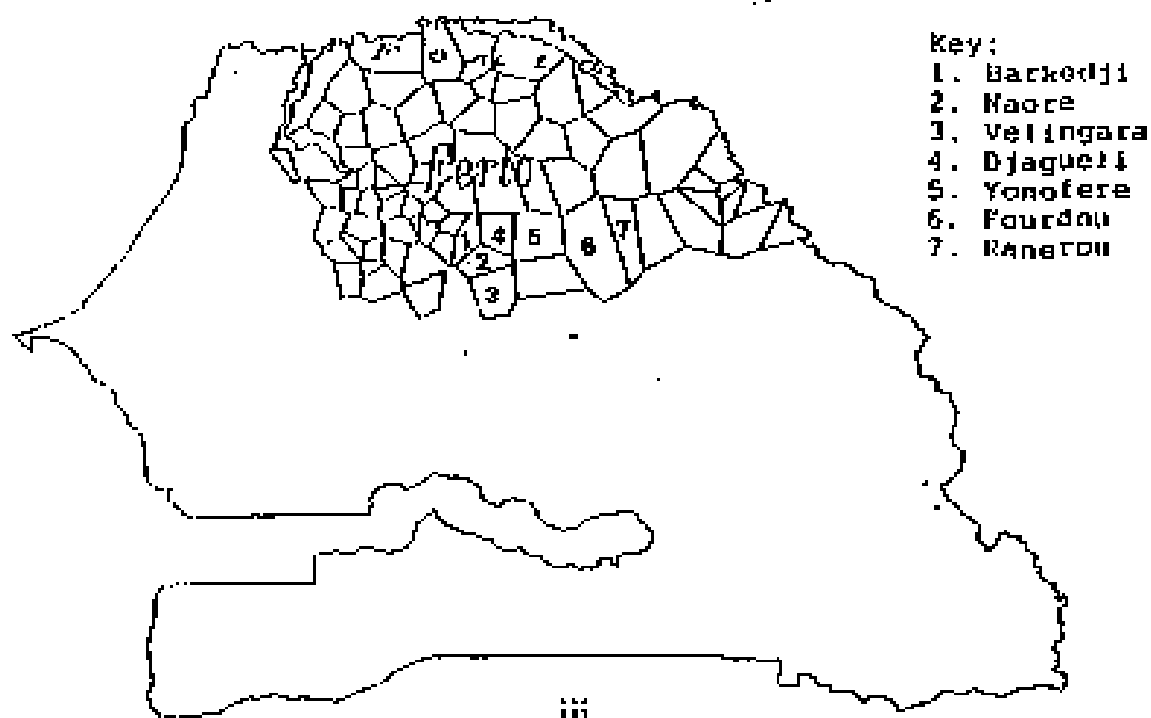
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The numbered wells are those included in the study.



POST DROUGHT MIGRATION AND TECHNOLOGICAL INNOVATIONS AMONG FULANI HERDERS IN SENEGAL: THE TRIUMPH OF THE TUBE!

INTRODUCTION

Pastoral production systems are often considered as being in crisis, suffering from economic, political and social marginalization, and made manifest by the transfer of land ownership from specialized herders to the hands of a few urban based elites, the continuous loss of rangelands due to agricultural encroachment, and insecurity of tenure in pastoral areas.¹ But the imagination and innovation of herders in adapting to new circumstances are less well described.

In northern Senegal, the establishment of irrigated rice fields along the Senegal River has led to a minor revolution in the herding system. Although some herders have been forced out of their traditional dry season pastures with the extension of irrigation along the river, others have adapted successfully to the new conditions, and have even turned the situation to their advantage. The most important single factor in this process is the invention of a new system for carrying water over long distances: the use of huge tractor-type inner tubes from machinery employed when laying-out rice fields. When laid on horse or donkey carts these tubes can transport large quantities of water, and have made a major contribution to the prosperity of many Senegalese herders. The mobility of pastoralists has been increased, which in turn has considerably raised the productivity of sheep and goat rearing.

Agricultural encroachment and improvement of production opportunities

Pastoral areas of northern Senegal have changed considerably over the last 40 years, profoundly altering relations between the wetlands of the Senegal River Basin, the *Waafo*, and the dry hinterlands, the *Jeeri*. There has been continuous pressure on the pastoral zone from agricultural encroachment but, at the same time, the digging of wells and improved mobility have provided new opportunities by enlarging the area which can be pastured in the dry season.

Agricultural encroachment is taking place from both the south and the north. In the Ferlo it dates back to the turn of the century when a cash economy emerged

¹ See for example Hogg 1986, UNSO/UNDP 1994, Brennan et al. 1985, Thébaud 1993, Lane 1994.

based on production and sale of groundnuts. The expansion of groundnut production into the inhospitable areas of Senegal's interior was largely undertaken by disciples of the Islamic Brotherhood of the Mouride, one of the three major Sufi sects in Senegal. Through the establishment of pioneer farming communities they were able to resist the hostile pastoral population of the area and clear vast areas for groundnut production. New Mouride landholdings in areas hitherto dominated by pastoralism are still being cleared today.² Large tracts of land are also being cleared by Wolof migrants pushed out of the so-called 'Groundnut Basin' further south by land scarcity and loss of soil fertility.

Herders have few means of defending their pastures from agricultural encroachment as the legal framework is strongly biased in favour of agricultural production. Even in the pastoral reserves or 'classified' forests, the Mouride have managed, through their economic and political power, to convert thousands of hectares of classified land into groundnut fields with the blessing of both the rural council and the state.³

Irrigation has been a major policy option along the Senegal River since the mid 1960s. Until 1972 production was low due to heavy bureaucratic controls, soaring costs and unresolved technical problems. Considerable investments were made in large and small scale irrigation schemes along the river as a result of the drought periods of 1972/73 and 1983/84. Large numbers of destitute Wolof and Toucouleur farmers were settled along with Fulani herders who had lost most of their animals during the drought. From 1975 to 1988 the area under irrigation increased from 9,000 ha to 35,000 ha (Seck 1991), and from 1988 to 1992 another 20,000 ha were added. Although this squeeze on riverine land has considerably reduced the area available for grazing, its effects have been less severe than anticipated as it has coincided with an expansion of pastoral opportunities further south.

During the 1950s, new drilling techniques made it possible to exploit the giant freshwater aquifer which lies under a large part of northern Senegal, establishing a network of deep-wells (or boreholes). This opened up for year round grazing what had formerly been considered as the Fouta desert. Permanent water sources meant herds were no longer forced to return to the river during the dry season but could exploit the rich pastures of the Fouta, even after the surface

² In the Communauté Rurale of Velingara, the Mouride *marabout* were given no less than 80 km² alone in 1990 adding to 50 km² attributed in previous years (Juul 1993).

³ Several forest reserves have been declassified in order to satisfy the need of the Mouride Brotherhood for land. The latest case was in 1991 where 45,000 ha of what used to be the forest reserve of Mhégne was cleared for groundnut production (see Freudentherger 1991).

water ponds had dried up. Over the next 10 years many Fulani herders gave up their annual transhumance and settled around the boreholes. The intensified use of the vast pastures of the *Jeeri* uplands, combined with improved veterinary services, allowed for considerable increases in both average herd size and in the total number of livestock in the region (Mathieu, Niasse and Vincke 1986; Richter 1991).

The conquest of the *Jeeri* resulted in different practices developing amongst the Fulani groups. The *FulBe WalwalBe*, who retained property rights in the riverine *Walo*, preserved an agro-pastoral lifestyle, cultivating dry season flood-plain recession crops (primarily sorghum) and millet on rainfed plots in the *Jeeri*. Their herds spent the rainy season some 20 km from the River, but entered the *Walo* in April after the harvest to graze on stubble (Schmitz 1986). By contrast, the *FulBe JerjerBe* had less attachment to the *Walo* along the river and limited their agricultural efforts to small plots of rainfed millet on the *Jeeri* uplands.

Changing practices resulting from the drought

The year 1968 marked the end of conditions which had been particularly favourable for pastoralism. During the following 20 years annual rainfall in the *Walo* and near *Jeeri* was very poor, and included the two great Sahelian droughts of 1972/73 and 1983/84. Very low rainfall and the absence of proper flooding over several years severely affected both pastures and flood recession agriculture.

When the rains failed in 1972, most herders waited until the end of the rainy season before moving southward. By that time the animals were already extremely weak and therefore less able to endure the long trip. They were also far more vulnerable to animal diseases encountered in the south (Santoir 1994). Although 60% of the herds and 40% of the families ended up leaving the valley to seek refuge in the 'Groundnut Basin', herd losses were considerable. Santoir (op. cit.) estimates that around 60% of the cattle of the valley was lost during the drought, and more than a quarter of Fulani households were left with no cattle.

Those Fulani who had suffered such heavy losses had little alternative but to opt for an irrigated plot. *Walo* cultivation had diminished due to the limited flooding, so herders farmed the irrigated land to produce sufficient food to prevent further sales of animals and to ensure their annual grain. In this period, village schemes mushroomed along the valley, funded by a variety of means -

the state, donors, NGOs or villagers themselves. This massive search for alternative subsistence contributed to making 1975 to 1988 the peak expansion period for irrigation.

But this expansion of irrigation has made livestock rearing in the *Waalo* increasingly difficult. First, irrigation has taken over the depressions which used to contain some of the best pasture land. Second, access to the river has become increasingly difficult as few cattle paths have been laid out. It is very hard to avoid animals trespassing onto irrigated fields and the imposition of exorbitant fines makes it hazardous to keep large herds near irrigation schemes. Finally, the dykes hamper the filling of ponds which used to provide fresh water in those areas where the aquifers are salty (Santoir 1983). As a result the majority of herds are now kept year round in the *Jeeri* at distances of 30 to 40 km from the irrigated rice fields.

In terms of labour requirement, irrigated agriculture is difficult to combine with pastoral production, in contrast to flood recession agriculture where labour needs are low and fall outside the peak pastoral periods. Farmers who do not comply with the agreed schedules for sowing, weeding, and timely application of insecticides and fertilizers risk being expelled from the irrigation scheme. Many herders lack sufficient manpower to split the family into two units during the cultivation season. As a result the agricultural performance is poor as herders are forced to move constantly between their herd in the *Jeeri* and their farm plots in the *Waalo*.

When the drought hit again in 1983/84, those *FulBe WalwaiBe* who still had a large number of animals started moving southward earlier and on a larger scale than in 1972/73. But because of the increasingly difficult conditions for pastoral production in the valley, the large majority of them decided to abandon the flood plains and remain more permanently on the abundant pasture lands in the Ferlo region. Here, the new systems of water transport, combined with intensive sheep and goat rearing, have brought new prosperity.

The *Egge-egge* in the Linguere-Matam area

The principal refuge for migrants in time of drought has been the southern edge of the Ferlo from Linguere to Matam. Here the herders have more or less permanent wet-season camps. During the dry season they usually migrate over shorter or longer distances depending on the availability of pasture. Referring to their mobile lifestyle or their zone of origin, they are called either *Egge-egge*, which in FulBe means 'those who are always on the move' or *FuutankoBe*.

referring to the Fuuta area which includes both the *Waalo* and the northern fringe of the *Jeeri*.

The largest concentrations are to be found around the deep-wells between Linguere and Matam in the arrondissements of Barkedji and Ranerou (Map 1), but they are also found over a much larger area. No official statistics are available on these populations as only a minority of the herders pay tax in their area.

A field survey carried out in October 1994⁴ estimated a *FuutankoBe* population far larger than expected, and the number of immigrants at certain deep-wells even exceeded the indigenous population (see Table 1), though on average they constituted one third of the total population around each deep-well.

Table 1 Distribution of indigenous and *FuutankoBe* households around seven deep-wells in the Linguere/Matam region (Map 2), October 1994.

Arrondissement	Indigenous	<i>FuutankoBe</i>	Total households
Barkedji	241 (83%)	51 (17%)	292
Naoré	36 (29%)	87 (71%)	123
Velingara	154 (81%)	37 (19%)	191
Diaguéli	146 (61%)	93 (39%)	239
Yonoféré	60 (41%)	86 (59%)	146
Fourdou	56 (64%)	31 (36%)	87
Ranerou	127 (85%)	22 (15%)	149
Total	820 (67%)	407 (33%)	1227

The majority of herders (75%) claim to have arrived either during the first drought period 1973/74 or after the second drought (1983/84). However, the influx has continued on a more moderate scale from the late 1980s. Some of

⁴ It is important to stress the indicative character of this population and herd property survey. The data was collected through interviews with representatives from the well committees at seven selected boreholes and (in the cases where such lists existed) consultation with the list of users. At each borehole the data was verified with both *FuutankoBe* and sedentary herders, and whenever possible with the village chiefs/sub-clan leaders representing the existing groups. The informants were asked to give only rough indications of the sizes of the herds using their deep-well on a regular basis. These were grouped within five categories. Consequently we have refrained from calculations of average herd size etc.

The sampling unit selected was the *galla*, or household at which level the animals are owned and decisions concerning the herd are made. As we have not collected data on family sizes it is not possible to control to what extent the very large herds correlate with very large families and thus with several owners of equal status (i.e. not wives or children). One would suspect this to be the case with some of the very large herds (several thousand head) of smallstock.

these are poorer herders who have only recently been able to accumulate sufficient animals to join their relatives in the new grazing areas.

In certain cases large groups of herders from the same area and clan appear to have moved more or less simultaneously thus creating new 'villages' in the area of settlement. The most spectacular case was found in Diaguéli where 68 households from the village of Bano had settled at different stages from 1973 onwards. New households were still joining in 1993.

If one considers the scale of this immigration and its impact on production systems, both in the area of out-migration and in the area of reception it is surprising how little notice it has received and until recently, this phenomenon was almost unknown by the Senegalese administration.

Uneven herd distribution

The extent of this in-migration and its impact on the existing production systems is even more spectacular if one looks at the distribution of animals among sedentary⁵ and *Foutankobe* households.

Households without animals (135, or 15%⁶) are entirely sedentary. For those possessing animals, the survey reveals a very uneven distribution of herds; most of the small cattle herds (1-9 head) are owned by sedentary agro-pastoralists, while the great majority (69%) of very large herds (> 100 head) are owned by *Foutankobe* migrants.

⁵ The term 'sedentary' is used to describe those Fulani agro-pastoralists (*Ferlankobe*, *Sannaraabe*, *Jamabe*, *FafaBe*, *HaabooBe* and *FalaBe*) who were present in the area before the arrival of the *Foutankobe* migrants. Wolof and Maurea households are also included in this group. It is important to stress, however, that the term sedentary does not exclude annual migrations between wet and dry season camps, nor exceptional nomadisations prompted by drought, breakdown of the deep-well or other types of calamity. Although some exceptions are found within the group, these households are predominantly agro-pastoral with limited possibilities of mobility on a larger scale. For the sake of variation the terms 'indigenous' or 'first-comers' have been used for this sedentary group.

⁶ Data from Velingara and Nanre are not included in these figures.

Table 2 Ownership of cattle herds amongst sedentary households and newcomers

Cattle herd size	0	1-9	10-49	50-99	>100
Sedentary (total: 550 households)	46%	18%	28%	4%	4%
<i>FuutankoBe</i> (total: 240 households)	15%	5%	37%	23%	20%

The uneven distribution of livestock is even more pronounced when looking at sheep and goats which are almost entirely owned by *FuutankoBe* households (89%). By contrast, most of the small herds between 1 and 49 head are owned by sedentary herders.

Table 3 Distribution of smallstock amongst sedentary households and newcomers

Sheep and goats: herd size	0	1-49	50-99	100-299	>300
Sedentary (total: 558 households)	28%	46%	12%	11%	2%
<i>FuutankoBe</i> (total: 240 households)	0%	8%	10%	40%	43%

The *FuutankoBe* herd owners are generally referred to as *Jaarga* i.e. very rich herd owners. It is therefore interesting that the survey reveals the existence of a group of *FuutankoBe* households with herds of a much more modest size. As can be seen in Table 2, 15% (or 37) of the *FuutankoBe* households possess no cattle and only smallstock. Of these, 14 own less than 50 sheep.

The spatial distribution of camps also demonstrates the difference in production strategies between old and new residents. Generally speaking, camps located close to the deep-well tend to be oriented more towards agricultural production, and do not possess large numbers of animals. In contrast, the large herd owners (especially those specializing in smallstock) camp at distances varying between 10 and 20 km from the deep-wells, enabling their animals to reach both the deep-well, where they are watered every second day, as well as distant and untouched pastures. These varying strategies mark differences in herd management practices between old residents and newcomers and hint at present and potential areas of conflict.

New production strategies

The production strategies of herders in this area challenge conventional wisdom on several counts. First, their strategy for drought recovery has been to specialize rather than to diversify. Second, it is based primarily on sheep rearing, which contradicts the general consensus of cattle raising as the superior form of pastoralism. Third, the tendency among the herders is to increase mobility rather than to become more sedentary. Finally the rapidly growing number of smallstock seem to contribute not to overgrazing but instead to a better use of pasture lands, at least in the short term.

Drought recovery through specialization instead of diversification.

According to most accounts of drought recovery in pastoral societies, the principal remedy for herd reconstitution is to limit off-take from the herd through alternative income sources⁷ such as cropping, wage labour, collection and sale of wood or fruits gathered in the bush etc. With income generated from these sources, grains and other necessities can be purchased without selling off animals. In successful cases, surplus income might also be used to purchase smallstock to ensure faster reproduction of the herd. In this model, however, smallstock is regarded primarily as an intermediate category, to be exchanged later for heifers (Richter 1991).

Although effective in cases where few livestock remain or where families have sufficient manpower available, this dependence on non-pastoral incomes has its disadvantages. Increased emphasis on agriculture limits mobility, particularly in periods critical for herding such as the end of the dry season when water and pastures are scarcest and labour requirements greatest. At a certain stage of herd

⁷ See for example Dahl (1979) on the Waso Borana; Bonfiglioli and Diallo (1988) on the Senegalese Fulani subgroup, the *Ferlunkelle*.

reproduction, the herder is therefore faced with a choice. He can choose to limit weight losses during the dry season by migrating to more remote areas, and at the beginning of the rainy season move southwards 'to meet the rains'. He will then return well into the rainy season when the animals are strong enough to manage the trip back home. Alternatively, he can stay at home and prepare the fields for a new agricultural season. The choice depends on the availability of labour and the size of the herd and its ability to provide for the consumption needs of the family.

In spite of their agro-pastoral production system, the large majority of the *Fuutankobe* in the southern Ferlo have opted for increased specialization and pursue no supplementary activities besides pastoralism. Instead of herd reconstruction by limiting off-take, herd reproduction rates are kept as high as possible by increased mobility ensuring optimum fodder availability throughout the year.

Contrary to the poetic statement of Lattimore (Khazanov 1983) of 'the poor nomad being the true nomad', mobility is not an option for the most impoverished herders. Only rich herders can depend solely on the herd. Poorer herders are forced to seek supplementary incomes, which means they must settle for a while. Once the herd has reached a certain size other activities may be abandoned and mobility resumed.

From cattle to sheep.

Pastoralism is often associated with cattle rearing. Indeed many surveys hardly take other species into account (Barral 1981; Fayole 1974; Lhoste and Milleville 1986). The general assumption is that smallstock are raised mainly to limit off-take from the cattle herd.

When moving southward in the aftermath of the 1972/73 drought, the rehabilitation strategies of the *Fuutankobe* herders depended largely on sheep. This allowed them to adjust herd composition to suit the new and more difficult ecological conditions since fodder requirements of sheep and goats can be met through browsing on tree products which are less affected by the lack of rain.

Rearing of sheep has proved to be an extremely viable strategy. Due to the higher drought resistance and shorter reproduction cycle of sheep, herders originating from the Futa area were able to recover their losses very quickly and today most of them have flocks far beyond their pre-drought size. Among *Fuutankobe* herders in the southern part of the Ferlo region it is not unusual to see herds of 400-700 or even 1,000 sheep and goats (Tables 3 and 4).

Table 4 Distribution of flocks of sheep and goats with more than 300 head

Size	300	400	500	600	700	800	900	1000	2000	> 3000
Number	41	22	6	10	4	5	0	7	4	2

Inspired by the success of the *FuutankoBe* herders the original inhabitants in the Linguere and Matam area are now copying this herding strategy. As a result livestock population, stock composition and geographical distribution have been substantially modified during the last two decades.

According to figures from the National Department of Livestock (Direction de l'Elevage, DIREL) the growing importance of sheep and goats in the southern part of the Ferlo has resulted in an increase of 162% in the smallstock population in the département of Linguere from the pre-drought level in 1971 (286,000) to 1993 (751,200) (Table 5).

Table 5 Development of sheep and goat population

	1971	1992	1993
Linguere	286,000	718,000	751,200
Podor	415,000	369,500	386,100
Dagana	164,000	104,900	109,600
Matam	454,000	432,500	451,800

Source: Direction de l'Elevage (DIREL), Dakar.

However, data from DIREL concerning sheep and goats cannot be regarded as accurate and should be used with caution. In contrast to cattle, these species are not systematically vaccinated and the data consists of estimates corrected according to an estimated annual growth rate of 5% (Tourrand 1993). Given the significantly higher growth rates in *FuutankoBe* herds it seems likely that the figures are underestimated, a view shared by Santoir (1994).

Table 6 shows that regeneration of cattle herds has been far slower and has not yet reached pre-drought levels. As a result, species composition has altered significantly. Cattle exceeded smallstock in numbers in the northern half of Senegal until 1968, while today 35 head of cattle to 100 head of smallstock are

found in Senegal, north of the Gambia⁸. Preference is given to sheep rather than goats and the relation between the two species is 2.3 to 1 (Tyc 1994).

Table 6 Development of cattle population

Département	1971	1992	1993
Linguere	302,000	196,430	203,280
Podor	334,000	166,100	172,000
Dagana	167,000	68,600	71,000
Matam	241,000	136,200	140,900

Source: Direction de l'Elevage (DIRBL), Dakar

Table 7 Development in Tropical Livestock Units (TLU)⁹

Département	1971	1990	1993	Difference 1971-93
Linguere	245,720	211,347	232,440	-12,791
Podor	283,600	156,540	166,723	-116,877
Dagana	136,580	59,240	62,852	-73,728
Matam	223,180	142,500	148,526	-74,654

In Table 7 Tropical Livestock Units (TLU) are used to show the fall in livestock numbers in the northern area between 1971 and 1993. In Linguere, the stocking rates are still slightly under the pre-drought level. Two elements should, however, be borne in mind when interpreting these data. First, the general underestimation of smallstock points to the possibility that herd regeneration (especially in the Département of Linguere) is higher than indicated by the figures. Second, TLU is a conversion developed to estimate fodder

⁸ Measures at local level confirm this tendency. In 1982 Sotter measured a ratio of 1 head of cattle to 1.1 head of smallstock in Gubye Kadar in the eastern Ferlo. Recent figures from a census made in Bouleyni (northwestern Ferlo) show a herd distribution significantly in favour of sheep with a cattle/smallstock ratio of 1 to 3.7 i.e. 2.8 sheep and 0.9 goat (Thébaud 1994). Data from the systematic reconnaissance flights in 1992 over the Linguere department display a ratio of 1 head of cattle to 2.8 small ruminants in 1992 (215,022 head of cattle to 602,297 head of smallstock (CSE 1992)).

⁹ The conversion factors used are 0.70 for cattle and 0.12 for smallstock.

requirements and stocking rates, and does not reflect the economic value of the different species. Although herds sizes may remain below their pre-drought level in TLU, the present economic value of the herds is probably greater than before.

Marketing strategies

The growing importance of sheep has been due to a substantial rise in their market value¹⁰. According to calculations made by Tye (1994) the financial productivity of sheep is estimated at around 5,000 CFA per animal per year compared with 9,400 CFA for cattle and 2,500 CFA for goats. As a result, 'One is better off with 10 cows and 100 smallstock than with a cattle herd of 50' (herder from Mbiddi 1989). 'With 100 head of smallstock you can have 30-40 lambs every year' (Wolof peasant, Dodji 1989). 'If you sell two sheep you can buy one heifer, with three a cow' (herder, Tessekrc 1989).

Smallstock are easier to sell, especially at village level, and in contrast to cattle they are usually paid for in cash. Furthermore the revenue from sale of one or two head of smallstock tends to fit better with the cash needs of the herder who is under considerable pressure from his family members to dispense cash if a large animal is sold. As stated by one herder: 'The sheep is closer to the mouth, you can slaughter if you have visitors and sell if you have needs.' Finally, commercial sale of rams for religious feasts is a developing market. Particularly favourable marketing conditions followed the 1989 conflict between Mauritania and Senegal when imports of animals from the former were cut. Prices of rams rise on the eve of *Tabaski*¹¹ and the price of a big ram will easily reach triple that of an adult female. Making a good *Operation Tabaski* might be extremely lucrative but also involves a good deal of gambling.¹²

¹⁰ In 1992 mean prices for adult males (the most expensive category) registered on Senegalese markets was 368 F CFA per live kg for bulls, while adult rams were sold at an average of 712 F CFA per live kg. Young females (cheapest categories) were sold for 322 F CFA per live kg (calves) and 570 F CFA (sheep) (DIREI, Annual Report 1992).

¹¹ Major Muslim feast where a ram is sacrificed.

¹² In 1988 the annual demand for rams at *Tabaski* in Senegal was estimated at 320,000 head. It is believed that local production is sufficient to cover demand in Senegal but, at present, rams are imported mainly from Mauritania and Mali, officially in order to keep prices low. As a result 25% of the rams presented on the market in 1991 were not sold (ISRA 1992).

Changing herding strategies

This trend towards breeding of sheep has a number of consequences for the herding strategies adopted and the amount of labour invested in livestock herding. In herds based primarily on cattle the principal production goal among Fulani herders is to ensure growth of the herd, and to increase milk yields (Niamir 1990). Although the rearing of sheep is compatible with a milk-oriented strategy (Thébaud 1994), meat production and commercial sale are the essence of sheep-based systems.

Labour demands for cattle rearing are fairly limited. Due to the safe environment and the reduced mobility a herd is normally not guarded except during the agricultural season to avoid stray animals damaging crops. Such cattle centred production has normally been combined with keeping a few head of smallstock for grazing freely in the vicinity of the camp, under supervision of young children (Ba 1986). Production results have generally been poor, and mortality among smallstock high.¹³

One of the main reasons why productivity is much higher in *FaaurankoBe* sheep flocks is the amount of labour invested. First, it is carried out either by several adolescent boys and/or adult herders already well initiated into herding practices. The animals are subject to intensive care and suitable pastures and fodder are carefully selected in order to ensure proper feeding. Through intense surveillance on the trip to wells and pastures, losses are kept low. Finally, large flocks are usually split into several units, often separating goats and sheep, with the youngest animals kept near the encampment, herded by the women or the youngest members of the family.

This makes the system very demanding in terms of labour and skills. In many cases herders make use of hired labour but complain of many difficulties in ensuring proper care of the herd when looked after by hired herders.¹⁴

The inner tube and the donkey cart

A major challenge during the dry season is to ensure optimal fodder conditions while limiting energy losses related to watering. As the dry season progresses,

¹³ According to ISRA (1992), mortality rates for newborn lambs (between 0 and 1 year) were 17% in the Louga Region in northern Senegal.

¹⁴ During our fieldwork many cases were reported of animals lost. In some cases the hired herdsman had fled his post leaving most of the flock unguarded while taking a smaller part of the flock to sell. Theft and sale of smallstock is also frequent among adolescent sons in want of some pocket money.

the distance between the watering point and fresh pastures increases. Contrary to the traditional system, where herders bring their dry season camps near to the deep-well, *FuutankoBe* herders prefer to camp far from the well so as to ensure easy access to pasture. Every second day adult animals are taken to the borehole. The following day they graze distant pastures located in the opposite direction. Several times during the dry season camps may be moved a few kilometres without moving closer to the borehole. In this way the younger animals who graze in the vicinity of the camp are ensured fresh pasture and the herd good fodder conditions.

Smallstock, however, are far more dependent on regular watering than cattle. Hence, the availability of water within the reach of the youngest and the weakest animals is crucial for the *FuutankoBe* herding system. The adaptation of tractor inner tubes for water carrying over long distances has therefore constituted a genuine technological revolution for the herding systems in the area.

Use of inner tubes for water transport is also known in Mauritania, where car inner tubes are cut and sown up at each end and laid over a donkey-back to carry water from the well to the household. A similar technique is employed by the pastoral Maasai (Jacobs 1980). But, the transformation of huge rubber inner tubes into vessels to transport up to 1,000 l of water¹⁵ to camps located 15 to 20 km from the borehole seems to be peculiar to northern Senegal.

This by-product of irrigation facilitates mobility and enables herders to settle farther from the deep-wells. The rapid growth of *FuutankoBe* herds is closely linked to this technological innovation and is consequently referred to as 'the secret of the Fulani'.

The 'triumph of the tube' has only been possible because horse and donkey carts are widespread among herders. Although introduced by the cooperative movement during the 1970s as part of the general attempt to mechanize the agricultural sector, very few pastoral households used carts at first¹⁶. Between 1975 and 1991 the number of carts increased tenfold (Santoir 1994) from one per 24 households to a cart and a horse for almost every second household. It

¹⁵ Thebaud (1994) registered three sizes of tubes with a capacity of 200, 400 and 600 l around the borehole of Widou Thiengoly. Larger tubes have been seen on several occasions but are less popular as they are more difficult to handle and require many donkeys to pull them.

¹⁶ Santoir (1982) stated that Fulani herders rarely owned horse or donkey carts. According to a survey made by Berot-Inard and Di Meo in the mid 1980s only one out of five Fulani households in Lalygar, where the main centre of the Société de Développement de l'Élevage dans la zone Sylvio-Pastorale (SODESP) is located, owned a cart. SODESP, the parastatal in charge of livestock development in northern Senegal was the main distributor of carts.

is worth mentioning that these fairly substantial investments were made without external assistance and in a drought period, the boom coinciding with the mass migration of the *FuutankoBe* herders when the carts became essential for the new herding strategies. Private traders in the area report a rapidly growing interest in carts and tubes from 1983 onwards, and today there is a flourishing market for used inner tubes as well as second hand tyres and spare parts for carts. Local craftsmen, mechanics and specialists in puncture repair are present in every village equipped with a borehole.

At present most pastoral households use at least one, but often two or three, carts¹⁷, mainly for transporting water and for travel. During transhumance they carry young and older members of the family, luggage, poultry, water and sometimes animal feed. Herders are now able, with the carts, to transport newborn lambs or sick animals that would otherwise have to be left behind.

While the tube and cart system helps to limit energy losses among animals it is extremely labour demanding, especially for adult women responsible for supplying water to livestock and the family. As camps may be up to 15 km from the borehole the women can spend 7 to 8 h a day fetching water, particularly towards the end of the dry season.

Increased mobility and new grazing techniques

The high survival and reproduction rates of *FuutankoBe* herds are closely related to the greater mobility and enlargement of the range of accessible pastures made possible by the new means of water transportation. Mobility has increased in several ways since the introduction of the tube and cart. *FuutankoBe* herders move their dry season camps several times during the dry season while preserving the same distance to the borehole, ensuring the availability of fresh pastures.

Another innovation developed by the *FuutankoBe* to increase mobility is to construct tents using large truck tarpaulins draped over one or two carts and supported by sticks and trees. These act as comfortable shelters during the rainy season and avoid the need to return to the wet season camp in advance to collect dry grass to repair old and damaged huts during the most intensive labour period of the year. These tents have become very popular since the Mauritania/Senegal

¹⁷ In 1994, pastoral households (*gallax*) in Bouteyni had an average of 1.62 carts. Eighteen of the 33 households included by Thébaud had at least one cart while the richest households each owned between three and six (Thébaud 1994). In some parts of eastern Faso (Lounibi Sarrha and Dendoudi) however, a large group of the poorest households do not own any means of transport.

crisis of 1989 when tarpaulins were distributed among the refugees. Due to the size of the investment (between 50,000 and 250,000 F CFA) they are, however, not within reach of all and many herders must endure many rainy nights without shelter during transhumance.

Apart from migration associated with drought, mobility generally aims to reduce weight losses during the dry season. It is especially the search for leguminous plants, preferably *Zornia glochidiata*, particularly appetizing for smallstock, which motivates herders to travel long distances, with some herders going several hundred kilometres south of their usual zone to reach areas with large stands of *Zornia*.

Contrary to what one would think, the increased number of animals browsing on the range does not seem to limit the amount of pasture available. In fact migrants and sedentary herders alike recognize the positive impact of migrant herds opening up new lands for pasture and improving the quality of the range. Because the *Egge-egge* usually settle far from the borehole in order to find pastures which have not been trampled, they often go into areas formerly dominated by dense bush. Browsing of sheep in such areas tends to clear the bush so that high quality pasture can grow up with the next rains.¹⁸

The results found by the German range management project at Widou Thiengoly in the northern Ferlo confirm the benefits gained from grazing. Surveys over a period of 9 years showed that regeneration of pastures was less satisfactory in areas where the project had enclosed grazing than in areas submitted to 'normal' pressure. In consecutive years of good rainfall (such as 1988, 1989 and 1990), controlled grazing at low stocking rates proved harmful to pastures. When the range is not grazed sufficiently, grass left from the previous year hampers proper germination of new vegetation (Tluczykont 1991). Quality and diversity of pastures in the enclosed plots thus diminished significantly during 3 successive years of good rainfall. Some of the most drought resistant and nourishing plants tended to give way to other species browsed only in the rainy season and with little or no nutritional value in the dry season (for example *Schoenefeldia gracilis*). Finally, a reduction in the reserve of seeds from drought resistant species led to an almost total loss of production in the first dry year following several years of good rainfall (Miehe cited from Tluczykont 1991).

¹⁸ In a study carried out by Carl Bro Int. in Knongheul in 1988, the most frequent answer given by the local (sedentary) population when asked to compare conditions of pasture before and after the drought was that pastures were much better now. This was attributed to the reduced number of trees leaving more space for pastures. This answer was, however, ascribed to a lack of consciousness of the scarce fodder resources (Carl Bro 1988).

At present there is no evidence to indicate that the increased number of animals grazing in the southern part of the Ferlo is leading to range deterioration. On the contrary, water transport enables herders to spread their animals over a larger area and to exploit under-used pastures. Range deterioration is therefore likely to be insignificant in comparison with the impact of grazing within more sedentarized production systems where animals are concentrated around the village.

Competition for resources and conflicts over access

While the introduction of carts and inner tubes has provided a substantial boost to pastoral production in the Ferlo, the increased mobility to which it leads has increased competition over water and grazing resources. Many villages experience an invasion of herders in the dry season, and in dry years many well committees reported a doubling or even tripling of animals using their wells. This creates problems of competition for pasture and maintenance of boreholes and motor pumps.

Conflicts are partly due to differences in range management practices. Farmers in the southern Ferlo have been investing in livestock to such an extent that from 1972 onwards, the number of cattle found in the southern half of Senegal has exceeded that of the traditional cattle breeding areas in the north (Santoir 1994). Where herders on transhumance from the north formerly represented an opportunity for these farmers to get their fields manured, most farmers now possess some animals themselves, so reciprocal arrangements such as manure contracts have lost importance, and the general environment has become more hostile to transhumant herders.

Herders confirm these changes:

'Before herders were well received. You were even given part of the groundnut harvest if you would let the animals manure their fields.'
(*Foutankoré* herder, Fourdou 1993).

'Transhumance is more difficult now. There is more jealousy and competition than in 1983/84. At that time people in the south were agriculturalists and hunters rather than herders, now they also have large herds of smallstock.'
(Transhumant herder, Mbiddi interviewed in Loumbi Aly Tedy 1993).

The shift towards smallstock has further added to the problem. In contrast to the past when cattle dominated transhumant herds, today's herds of smallstock need types of fodder other than those likely to be found in the fields. This usually causes herders to live in the bush rather than close to areas of farmland. The

FuutankoBe strategy of dispersing their camps in the bush has an adverse effect on local households and their herds. Local herds are usually grazed in a 'centrifugal' pattern from a fixed dry-season camp located close to the borehole (Sutter 1987). As the dry season progresses, animals travel to more and more distant pastures. But many pastures will already have been grazed and trampled by *FuutankoBe* herds, which has led to hostility and jealousy towards these newcomers.

At some boreholes local herders have tried to control access to pastures by forcing visitors to make their dry season camps at the same distance from the deep-well as their own, and preferably on their fields in order to take advantage of the manure. But the *FuutankoBe* generally refuse, pleading the free use rights to the range affirmed in the legal code of 1964. Even where well committees have managed to enforce 'controlled settlement' it has turned out to be a double edged sword. Once the accessible radius of grazing has been consumed the *FuutankoBe* herd move on, leaving the settled population with a large bare area to cross before reaching adequate pastures. In such cases, settled agro-pastoralists may be forced to move, involving considerable difficulties as many have neither sufficient manpower nor equipment, such as donkey carts and inner tubes. They also risk income losses as they are unable to pursue their usual range of activities.

Forced migrations are also prompted by the breakdown of the borehole motor pump. The constant pumping to supply sufficient water for the large number of animals results in frequent breakdowns, forcing all herders to move to neighbouring pumps for shorter or longer periods.

Having no legal means to control access to transhumant herders, many well committees resort to very high watering fees to discourage migrants from prolonging their stay. During the dry season of 1992/93, for example, many herders said they had been forced to pay the equivalent of a whole month's water fee for a single day's access to the well. At other boreholes watering was deliberately made more arduous by cutting the connection to the water troughs or by halting the pump.

However, with the arrival of the *FuutankoBe* herders most well committees have also increased their income dramatically. The deep-wells have turned out to be not only a key institution in resource management, but also an important means of income generation for the host community. Many wells are now almost exclusively financed by taxes imposed on *FuutankoBe* herders, and in cases of breakdown, it is not infrequent for a well-committee to wait for the rich but

vulnerable *Fuutankobe* herders to pay for the repairs. Thus, many well-committees have an ambivalent attitude to 'foreign' herders who, while they put heavy pressure on grazing resources, also provide the cash needed to maintain borehole pumps.

Adaptation to new opportunities

The arrival of the *Egge-egge* has not only brought conflict, but also new prosperity to at least some of the old inhabitants. The fees imposed on *Fuutankobe* herds keep watering fees for the resident herds to a minimum. They can also provide a source of income for individual members of the well-committees. Furthermore, agro-pastoralists are able to barter their surplus grains with *Fuutankobe* herders for either milk or animals on favourable conditions, and the arrival of large groups of rich transhumant herders is a considerable boost to the weekly markets in the reception areas.

The new strategies developed by the *Fuutankobe* herders have also been copied by local herders. Raising of smallstock is increasing and more labour is now invested in guarding the flocks. In order to make better use of the available pastures many of these herders have started to move their camps further out into the bush in the dry season.

But, the change of emphasis towards smallstock has turned out to be more difficult to combine with agricultural production than cattle raising. In April 1993 members of the well-committee of Loubi Aly Tedy explained:

'It is the smallstock that provokes problems. Before we had mainly cows and maybe five head of smallstock besides. But since the droughts of 1972/73 and 1983/84 we started having both small and large stock. Now we are forced to do as the *Fuutankobe*. We are forced to live in the bush and to transport water. Now we have more beasts but they are not in good shape and give less milk. In general the sedentary Fulanis have five times as many animals as before. Add to this the animals belonging to transhumants. No wonder the pump has difficulties.'

Their neighbours from Ribo added:

'It is mainly the ways in which the herds are managed which has changed. Now people live out in the bush and have increased surveillance of the animals. It is difficult to combine this form of herding with manuring of fields. Animals get thin if they are tied up when competition on pastures is high as now. It is no longer possible to convince migrating herders of making manuring contracts. They want to ensure the well-being of their animals.'

The shift in herd composition and intensification of herding practices pose a number of problems for agro-pastoral producers. Before, animals were tethered during the rainy season, or were kept together in a village herd which was moved to another area to avoid crop damage. Now many agro-pastoral households have too many animals for them to be part of the common village herd and must find labour for herding from within their own household. Instead of creating closer links between agricultural and pastoral activities through manuring and fattening of animals on farm by-products, some households appear to be de-linking these activities. Animals are fed almost entirely on fodder from the bush and are kept at a considerable distance from the fields.

The conventional division of labour between the sexes among southern Fulani clans also complicates adaptation to this new system. While for the nomadic clans from the north such as the *Fuutankobe*, fetching of water and building of new huts is the task of women, among the southern clans, these tasks, which increase considerably in the new herding system, are supposed to be carried out by men.

CONCLUSION

The growth in sheep numbers and their greater mobility have led to important changes in the agro-pastoral systems of Senegal. While the situation faced by pastoralists in northern Senegal has been made more difficult by encroachment on pastoral lands by agricultural expansion, certain technological innovations, particularly improved water transportation, now enables more animals to survive and prosper by making better use of grazing. Although important pastoral resources were lost as irrigation expanded in the *Walo*, herders have shown a remarkable ability to adapt to the new conditions. Greater mobility as well as increased use of industrial fodder, mineral supplements and veterinary medicine have provided partial compensation for the resources lost and have rendered herders less vulnerable to drought. As a result, many *Fuutankobe* herders have become richer than they were before the drought forced them to migrate southward, a trend also shared by a number of sedentarized herders. In contrast to other Sahelian countries, herd ownership has not been transferred to absentee owners but has been kept in the hands of highly skilled and specialized producers with a thorough knowledge of the animals and their environment.

As noted by Stroosnijder (AAU Reports 32):

'The production level that can be reached and the number of people that can be fed without destroying the natural resource base is everywhere more a function of production technology than of the renewable resources.' (1994)

Pastoral society has moved beyond the crisis years associated with the drought of 1984. Although some pastoral households have not been able to cope with the new problems and opportunities, it is important to recognize the basically healthy state of the pastoral production system and its capacity to renew and adapt, even in the absence of external interventions.

REFERENCES

- Ba, Cheick 1986. Les peul du Sénégal, étude géographique. Dakar, Abidjan, Lomé.
- Bonfiglioli, A.M. and Diallo, Y.D. 1988. Kisal, production et survie au Ferlo (Sénégal). Rapport préliminaire préparé pour OXFAM, Dakar.
- Breman et al. 1985. Analyse des conditions de l'élevage et propositions de politiques et de programmes, Burkina Faso. Etude préparée pour le Club du Sahel et le CILSS.
- Carl Bro International 1988. A livestock development study in the Sahel to assess the potential role of livestock in integrated farming systems, Country Report, Senegal.
- Centre de Suivi Ecologique (CSE) 1992. Estimation des effectifs du bétail par vol systématique de reconnaissance dans la moitié nord du Sénégal. Rapport de campagne. Document NT 92.
- Dahl, Gudrun 1979. Suffering Grass, Subsistence and Society of Waso Borana. Stockholm Studies in Social Anthropology.
- Direction de l'Elevage du Sénégal (DIREL): Rapports Annuels 1966-1977 and 1986-1993.
- Freudenberger, K.S. 1991. Mbegué: the disingenuous destruction of a Sahelian forest. IIED Issues Paper No. 29.
- Hogg, Richard 1986. The new pastoralism: poverty and dependency in Northern Kenya. *Africa*, 56(3): 319-333.
- ISRA 1992. Groupe de Travail sur l'autosuffisance en moutons de Tabaski au Senegal, Mars 1992, Dakar.
- Jacobs, Allan H. 1980. Pastoral Masai and tropical rural development. In: R.H. Bates and M.F. Lofchies, *Agricultural Development in Africa : Issues of Public Policy*. Praeger, New York.

Juul, K. 1993. Pastoral tenure problems and local resource management. The case of northern Senegal. *Nomadic People* 32, pages 81-91, Uppsala, Sweden.

Khazanov 1983. *Nomads and the Outside World*. Cambridge University Press, Cambridge.

Lane C. 1994. Introduction. In: *Pastoral Tenure Overviews*. Draft manuscript submitted to UNRISD.

Lhoste, Ph. and Milleville, P. 1986. La conduite des animaux: techniques et pratiques. In: E. Landais (Editor), *Actes de l'atelier: Méthodes pour la recherche sur les systèmes d'élevage en Afrique Intertropicale*. ISRA/IEMVT/ORSTOM, Mbour, Sénégal.

Mathieu, P., Niasse M. and Vincke, P. 1986. Aménagements Hydro-agricoles, concurrence pour l'espace et pratiques foncières locales dans la Vallée du Fleuve Sénégal, le cas de la zone du lac de Guiers. In: B. Crousse, Le Bris and Le Roy (Editors), *Espaces disputés en Afrique Noire*, Paris.

Niamir, Maryam 1990. Herders decision-making in natural resource management in arid and semi-arid Africa. *Community Forestry Note 4*, FAO, Rome.

Profil de l'Environnement de la Vallée du fleuve Sénégal 1990, Euroconsult and Institut National de Recherche pour la Conservation de la Nature. Document préparé à la demande de la Direction Générale de la Coopération au Développement (DGIS). Ministère des Affaires Etrangères, Pays-Bas.

Richter, M. 1991. Les Peul dans la zone du projet and other articles. In: G. Kasberger-Sanftl, M. Richter and S. Thuczykont, *Le pâturage contrôlé: Un système d'exploitation sylvo-pastorale comme modèle pour la sauvegarde des ressources naturelles*. Mission Forestière Allemande, GTZ, Saint Louis, Senegal.

Santoir, C. 1982. Contribution à l'étude de l'exploitation du cheptel. Région du Fouta-Sénégal. ORSTOM, multigr., Dakar.

Santoir, C. 1983. *Raison Pastorale et Développement*. Les sociétés peuls face au aménagements. *Travaux et Documents de l'ORSTOM no.166*, Dakar.

Santoir, C. 1994. Décadence et résistance du pastoralisme. Les Peuls de la Vallée de fleuve Sénégal. *Cahiers d'Études africaines*, 133-135; XXXIV-1-3: 231-263.

Schmitz, Jean 1986. Projet d'irrigation de Kaskas et situation des périmètres villageois de la zone. SAED, ADRAO, Université de Wageningen et ORSTOM.

Seck, Sidy M. 1991. La dynamique de l'irrigation dans la vallée du fleuve. Crousse et al. *La vallée du fleuve Sénégal: évaluations et perspectives d'une décennie d'aménagements*, Paris.

Stroosnijder, L. 1994. Population density, carrying capacity and agricultural technology in the Sahel. *Proceedings from the 6th Sahel Workshop*, 6-8 January, 1994. AAU Reports 32, Aarhus, Denmark.

Sutter, J.W. 1987. Cattle and inequality: herd differences and pastoral production among the Fulani of northeastern Senegal. *Africa*, 57 (2) 1987.

Thébaud, Brigitte 1993. Le foncier dans le Sahel Pastoral, situation et perspectives. EHESS Seminar, December 1993 (in press).

Thébaud, Brigitte 1993. Causes et conséquences de la désertification en Afrique: essai d'interprétation. Document préparé dans le cadre du Panel International d'Experts sur la Désertification, Genève.

Thébaud, Brigitte 1994. Projet, Exploitation agro-sylvo-pastoral des sols dans le Nord du Sénégal (GTZ): Bilan et identification d'un nouveau projet. Rapport de mission 28 mars au 5 mai 1994.

Thuczykont, Siegfried 1991. Le modèle de pâturage contrôlé. In: G. Kasberger-Sanfil, M. Richter and S. Thuczykont, 1991. *Le pâturage contrôlé: Un système d'exploitation sylvo-pastorale comme modèle pour la sauvegarde des ressources naturelles*. Mission Forestière Allemande, GTZ, Saint Louis, Sénégal.

Tourrand, J.F. 1993. Un pasteur devient agro-pasteur: une étude de cas dans le Delta du fleuve Sénégal. Séminaire RESPAO. Accra, 13 pp.

Tyc, Jean 1994. Etude diagnostique sur l'exploitation et la commercialisation du bétail dans la zone dite des six forages. Rapport de mission, avril 1994. Projet de l'exploitation agro-sylvo-pastorale des sols dans le nord du Sénégal, GTZ.

UNSO/UNDP 1994. Pastoral Development in Africa. Proceedings from the first technical consultation of donor and international development agencies, December 1993, Paris.