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Pastoralist Responses to Floodplain Rehabilitation in North Cameroon

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This paper examines the responses of mobile pastoralists to a floodplain rehabilitation program in north Cameroon. From 1993 to 1999, we measured changes in number of camps and herds, and the time they spent in the 600 km^2 *of the Logone floodplain that was reflooded in 1994. The first year, few pastoralists anticipated the reflooding or its impact, and the increase in grazing intensity was caused by a prolonged stay of pastoralists who already used the area for transit. The following three years showed a sharp increase in the number of camps and herds, which stabilized from 1997 onwards. Overall, grazing intensity increased threefold, following the gradually recovering perennial grasslands, with no signs of overexploitation of the area. These developments closely match the ideal preemptive distribution model. We also examined how reflooding affected pastoral incursions in the Waza National Park located in the floodplain.*

KEY WORDS: pastoralists; grazing intensity; floodplain rehabilitation; national park; ideal free preemptive distribution.

INTRODUCTION

Mobile pastoralists are remarkably well adapted to the drylands of Africa, much better than sedentary pastoralists or ranchers (Breman and de Wit, 1983; Niamir-Fuller and Turner, 1999). Floodplains play a key role

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in the yearly migration of many transhumant and nomadic pastoralists, due to the availability of nutritious grass regrowth and surface water far into the dry season, when surrounding grazing lands have dried up (Hiernaux and Diarra, 1983). However, human pressure on these floodplains is increasing and restricting pastoralists' access to them. One of the more devastating impacts on floodplains is the construction of dams for electricity and irrigation purposes (Drijver and Marchand, 1986). Increasing awareness of the importance of wetlands for rural economies in semiarid Africa has led to a series of initiatives to reduce the impacts of existing dams (Acreman and Hollis, 1996). Most initiatives aim at improving water management, so that 'excess' water can be released and restore former floodplain functions, including that of dry season pastures for transhumant pastoralists. In several places in Africa experiments with such releases have started. But despite the importance of African floodplains for mobile pastoralists, there had not yet been an assessment of their responses to floodplain rehabilitation. This paper examines the responses of mobile pastoralists to the reflooding of the Logone floodplain, focusing on changes in transhumance patterns and grazing intensity from 1993 until 1999. It offered a unique chance to study pastoralists' reactions to *improving* grazing conditions in a Sahelian environment.

In 1979, the Waza-Logone area in the Far North Province of Cameroon met the fate of other African floodplains when a dam and embankment along the Logone River were constructed forming a reservoir for a parastatal irrigation scheme (Fig. 1). In combination with lower than average rainfall during the last two decades (Beauvilain, 1995), the dams reduced flooding in an area of about 1500 km^2, which included Waza National Park, an important refuge for wildlife such as elephant, lion, antelopes, and waterfowl (Scholte *et al.*, 1996a). Annual grasses invaded previously productive perennial grasslands, limiting regrowth in the dry season and reducing the floodplain's carrying capacity for wildlife and livestock (Scholte *et al.*, 1996a). Studies that documented the detrimental effects of the dam on ecology and local economies (Drijver and Marchand, 1986) were the impetus for a reflooding program, which took shape in the Waza-Logone Project. An appraisal study showed the potential for reflooding (Wesseling *et al.*, 1996), which was supported by local people, authorities, and wildlife managers. Reflooding was started in May 1994 with the reopening of a watercourse that had been closed off by the embankment along the Logone River, starting the recovery of perennial grassland vegetation (Scholte *et al.*, 2000).

One of the main goals of the reflooding was to stop the incursions of pastoralists into Waza National Park in order to reduce the competition between wildlife and livestock for dry season grazing (Scholte, 2003). Livestock is not allowed in national parks and this has caused numerous

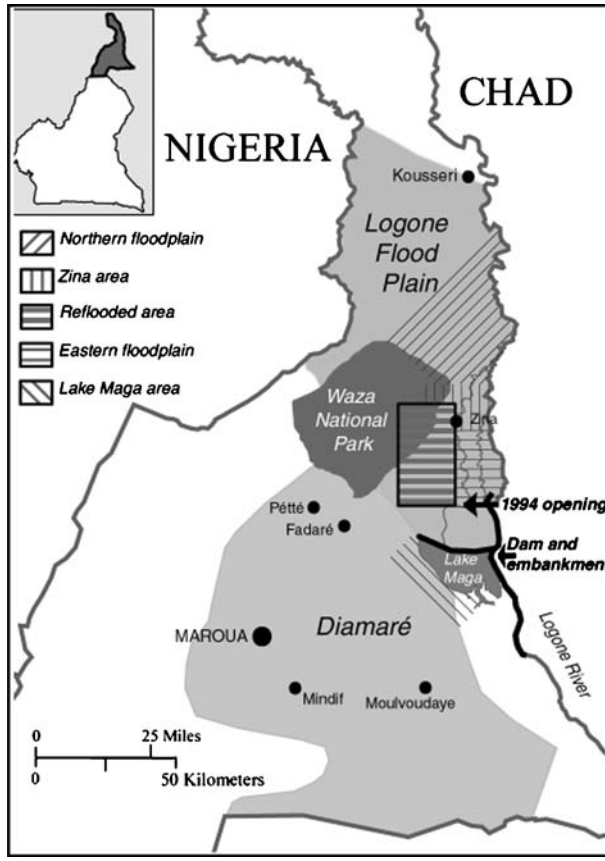


Fig. 1. The Far North Province with the Waza-Logone area.

confrontations between park authorities and pastoralists (Scholte *et al.*, 1996b, 1999). The project anticipated that the floodplain rehabilitation would motivate pastoralists to find grazing lands adjacent to the park, where the reflooding was expected to have its main impact.

The reflooding feasibility study predicted that the productivity of the floodplain grasslands would increase two- or threefold (Wesseling *et al.*, 1996). One of the questions was how mobile pastoralists would respond to this increase in rangeland productivity and whether a potential influx of 'new' pastoralists would jeopardize the projected rehabilitation of the Logone floodplain. Another question was whether pastoralists would indeed refrain from entering Waza National Park with increasing productivity of the floodplain.

Predicting Pastoralists' Responses

The scenarios envisioned by pastoralists, researchers, and authorities diverged on the reactions of mobile pastoralists to the floodplain rehabilitation and the subsequent impact on Waza National Park.

Overshoot Scenario

The first scenario assumed a 'free-for-all' open access situation in which pastoralists would flock to the improved grazing opportunities. This would result in grazing intensities largely exceeding the improved carrying capacity, i.e., an 'overshoot' of cattle. The fear was that this would lead to overgrazing and conflicts with other pastoralists, thereby counteracting the rehabilitation of the floodplain. In this scenario, pastoralists would most likely continue to take their cattle into Waza National Park because there would be no alternative grazing opportunities.

Territorial Scenario

The second scenario assumed that pastoralists who used the area before reflooding would somehow defend their grazing lands, i.e., display territorial behavior (Casimir, 1992). Territoriality among mobile pastoralists has been observed in neighboring Chad (DHV/LRVZ, 1994) and in the Niger floodplain in Mali (Legrosse, 1999; Turner, 1999). Although there seemed to be a system in the floodplain in which pastoralists had customary rights to specific campsites and surrounding pastures, it was unclear whether and how pastoralists would defend these rights if there were an influx of 'newcomers.' In this scenario, there would be most likely a slow increase in grazing intensity and a low exploitation of perennial grass cover in the rehabilitated floodplain. Potentially this would allow pastoralists with claims in the floodplain to return to their old campsites and thus refrain from taking their cattle inside Waza National Park.

Ideal Free Distribution Scenario

The third scenario predicted that any improvement in grazing land condition, i.e., perennial grass cover, would lead to a corresponding increase in the number of cattle. The assumption underlying this scenario was that pastoralists would adjust the number of herds in the reflooded area and/or the time they spent there to make optimal use of the available resources. The result would be a gradual increase in grazing intensity following a similar increase in perennial grass cover. In this scenario, grazing resources outside

the park would gradually become available to pastoralists who were taking their cattle into the park.

The data presented in this article allows for an evaluation of which scenario best matches pastoralist responses to reflooding. We will also consider how other factors, such as insecurity, cattle theft and predation, and conflicts with fishers and farmers affected transhumance patterns.

BACKGROUND

The Waza-Logone Floodplain

The Waza-Logone floodplain receives a mean annual rainfall of *ca.* 650 mm with between-year fluctuations of up to 50%, a typical Sahelo-Sudanian climate (Beauvilain, 1995). The rainy season is from June to September. In parts of the area, the Logone River and its branches flood during August to November. In April and May, temperatures rise as high as 45°C. In areas subject to annual flooding, perennial grasses such as *Echinochloa pyramidalis, Oryza longistaminata* and, on the slightly elevated parts, *Vetiveria nigritana* and *Hyparrhenia rufa* dominate. When the floods recede at the end of December, most parts are burned by pastoralists and hunters, leaving a bare landscape and only some humid spots remain with vivid green vegetation and concentrations of fishermen, livestock, and birdlife.

Until the Maga dam construction in 1979, the study area, the 'reflooded area' located in the southern floodplain, used to be flooded and was composed of productive perennial grasslands (Fig. 1). When flooding ceased, perennial grasses were replaced by annual grasses, especially the reed-like unpalatable *Sorghum arundinaceum*. The reflooding in 1994 brought back the annual floods in an area of about 180 km^2 and raised the water level in a further 400 km^2. Following the reflooding an annual 7% increase in perennial grass cover was measured (Scholte *et al.*, 2000). The improvements were dramatic: *Sorghum arundinaceum* has disappeared and one can again see for miles and miles fertile perennial grasslands. This period coincided with average rainfall and flooding conditions, and without droughts like those that plagued the area in the 1970s and 1980s (Beauvilain, 1995).

Pastoralists in the Waza-Logone Floodplain

The Logone floodplain historically has been a key resource area for pastoralists in the Lake Chad Basin. When rangelands in the surrounding

plains and mountains are drying up and sources of surface water are disappearing, pastoralists trek to the Logone floodplain to find forage and easily accessible surface water for their animals. Each year, thousands of pastoralists with about 200,000 cattle from Cameroon, Chad, Nigeria, and Niger enter the floodplain for a period of six to eight months (Beauvilain, 1981).[6]

The mobile pastoralists who use the floodplain pastures belong to two ethnic groups: (Shuwa) Arabs (Braukamper, 1996) and FulBe (e.g., Azarya *et al*., 1999), (Table I). The Arabs do not sell milk, which they use for household consumption or leave for the calves. This is one of the reasons why their herds grow at a higher rate than those of FulBe pastoralists. Other reasons are their involvement in livestock trade, the profits of which are invested in cattle, and the fact that they care for animals entrusted from relatives in Nigeria. The Arab pastoralists who use the reflooded area are nomadic and practice transhumance from the Diamaré plains, south of the floodplain, where most FulBe pastoralists also come from (Fig. 1).

The FulBe can also be divided in nomadic and agropastoral groups. This distinction refers to the fact that the former do not practice agriculture and are without permanent settlements. Agropastoral FulBe, on the other hand, have families that live in villages where they cultivate. Agropastoral herds may be permanently on transhumance and come back to the village only once or twice a year for a few weeks.

There are two distinct groups of agropastoral FulBe that practice transhumance to the reflooded area. One group comes from the area south of Waza National Park and is referred to as the FulBe Ngara'en, which is the name of the ruling clan of the towns of Pétté and Fadaré (Fig.1). Their transhumance takes them along the borders of Waza National Park, and not surprisingly, it is the FulBe Ngara'en who are responsible for incursions into the park. The other agropastoral FulBe group comes from further south and is often referred to as the FulBe Yillaga'en, which is the ruling clan in the towns of Mindif and Moulvoudaye (Fig. 1). Most agropastoralists from both groups are descendents of FulBe that conquered the area two centuries ago (Mohammadou, 1988).

The nomadic FulBe group can be divided into three distinct sub-ethnic groups: Adanko'en, Alijam'en, and Mare'en.[7] The majority of nomadic FulBe originally came from Nigeria, but have been in Cameroon for the last

[6] Use of floodplains in the Lake Chad Basin is facilitated by international agreements (CIRAD-CTA, 1996). In principle, pastoralists have to pay a small fee per head of cattle and show certificates of herd vaccinations when they cross the border, but in practice border controls are not very strict.

[7] A sub-ethnic group refers to a group consisting of different clan fractions that have in common a migratory history and certain cultural traits (Burnham, 1996). Other, numerically smaller nomadic FulBe groups in the Logone floodplain have been grouped with one of the three main nomadic FulBe groups with whom they associate.

Table I. Characteristics of Pastoral Groups at the End of the Study Period, 1999.

	Nomadic pastoralists				Agro-pastoralists	
	FulBe Adanko'en	FulBe Alijam'en	FulBe Mare'en	Arabs	FulBe Ngara'en	FulBe Yillaga'en
Number of households (or herding groups)	25	89	114	135	89	89
Number of households per camp	2.5	9.8	3.8	9.6	NA	NA
Number of camps	10	9	30	14	26	16
Number of herds per camp	7.2	9.4	8.4	13.9	10.9	12.0
Number of herds per household	2.9	1	2.2	1.5	NA	NA
Total number of herds	72	85	252	195	283	192
Estimated number of cattle	4,593	5,338	21,344	23,653	23,829	16,320
Presence in the floodplain (in years)	20	30	60	30	> 100	> 100

Note. Unlike the nomadic groups, the FulBe Ngara'en and FulBe Yillaga'en are mostly herders on transhumance without their families. The term household cannot be used for this group, it is better to think of these units as herding groups in which a number of herders of one village cooperate. Large herding groups often constitute one camp; smaller herding groups camp together with herding groups from neighboring villages. The herds in these herding groups, in turn, are often composed of animals from multiple households in the village.

20–60 years. They have Cameroonian identity cards and identify themselves as Cameroonians. Their kin network extends across all borders, which reflects their readiness to move, responding to ecological as well as sociopolitical conditions.

Although cattle account for more than 90% of the total Tropical Livestock Units in the floodplain, there are also FulBe Uuda'en shepherds who practice transhumance from Nigeria and Niger to the Logone floodplain. But since they do not exploit the reflooded area we have excluded them from this study. We also excluded the sedentary, village-based Musgum, who own less than 10% of the total number of cattle in the floodplain.

Transhumance Patterns

One can distinguish two phases of pastoral exploitation of the floodplain. During the first phase from November through January, after the recession of flooding, cattle feed on young grass shoots. At the beginning of this phase, when pastoralists enter the floodplain, they often split their herds. Older and lactating animals stay with the families, while young herders take the stronger, healthy animals on a separate transhumance, called *luci*, following the retreat of the water in search of the best pastures. During this period camps and herds move frequently. In January–February, the herds are reunited again and the pastoralists often settle in one or two campsites for the rest of the dry season. During this second phase, cattle feed on the regrowth of perennial grasses that result from fires. At the onset of the rainy season in May–June, pastoralists direct their animals to those places where the first rains have fallen and leave the floodplain till the following dry season.

One can also distinguish different ways in which the reflooded area fit into the transhumance patterns of different pastoral groups before it was reflooded in 1994. A first group of pastoralists, mainly FulBe Alijam'en and Arabs, used the reflooded area as a transition zone from the rainy season pastures in the south to their dry season pastures further north and east (Fig. 1). A second group, FulBe Mare'en and FulBe Adanko'en, used the reflooded area only in the cold dry season (November–January), before they went to their dry season pastures at the borders of Lake Maga, further south. A third group of pastoralists spent the entire dry season in the reflooded area. This last group consisted predominantly of the agropastoral FulBe Ngara'en and FulBe Yillaga'en, and the FulBe Mare'en. We will see below that most pastoral groups continued these transhumance patterns after reflooding, while spending increasing time in the reflooded area.

METHODS

Early 1994, before the reflooding, we visited all pastoral camps in the southern part of the floodplain (Fig. 1). The main objective was to start a dialogue with a wary group that had suffered from previous governmental and project interventions (Moritz *et al.*, 2002; Scholte *et al.*, 1996b). Most of the time was spent discussing ongoing developments in the floodplain and pastoralists' concerns, in particular insecurity. During the visits in following years, we obtained information on 'new' pastoralists in the study area, which were included in our annual monitoring of pastoralists' responses to the reflooding. We also obtained information on pastoralists that we missed in our earlier campaigns. Generally, these 'missing' pastoralists used the reflooded area only as a transition zone from rainy season pastures in the south to dry season pastures further north outside our study area. At the end of each campaign, we organized a session in a centrally located market town to discuss results and upcoming issues, such as further reflooding initiatives.

Assessing Grazing Intensity

The visits in 1994 and subsequent years also served to establish a database of all pastoral groups that spent time in the reflooded area (Table I). Groups were entered in the database by the name of the camp's leader and for each group we listed the campsites visited in the floodplain and the number of weeks spent there. Early in our work, we compiled a list with all campsites and marked them on a topographic map. We used this list to record transhumance patterns and determine the number of weeks that pastoralists spent in the reflooded area. The interview method was an effective and reliable way to assess changes in grazing intensities; pastoralists could recall without difficulty how many days they had camped in each site over the last year.[8]

In subsequent campaigns, we also collected data on the number of herds and herd size (i.e., the numbers of cattle per herd) in informal discussions with group leaders.[9] The trust we had built up through the projects' commitment to resolving pastoralists' primary concern of insecurity (Scholte *et al.*, 1996b) allowed the estimation of these otherwise very sensitive topics.

[8]Pastoralists used moon cycles and weekly market days as reference points to recall how long they had camped in particular sites. We cross-checked this information with other pastoralists.
[9]We have considered herds as management units, i.e., the animals that graze together during daytime under the guidance of a herder, and not as property units (Dahl and Hjort, 1976, p. 134).

Table II. Average Herd Size by Source of Information.

	Self-report	Vaccination records	Direct count	Average herd size used in this study (vaccination records and direct counts lumped)
Nomadic pastoralists				
FulBe Adanko's	65.8 a[a] (25)	63.8 a (5)		63.8i
FulBe Alijam'en	64.4 *b*[b] (36)	64.5 b (15)	50.0 b (2)	62.8*i*
FulBe Mare'en	75.3 e (72)	84.0 f (38)	92.3 f (3)	84.7k
Arabs	98.7 c (15)	120.8 d (13)	122.3 d (6)	121.3j
Agro-pastoralists				
FulBe Ngara's	80.8 *g* (62)	84.2 g (20)	—	84.2k
FulBe Yillaga's	79.1 *h* (51)	85.4 h (29)	82.7 h (6)	85.0k

Note. Number of reports or counts is given in parentheses.
[a]Same letter: p (means) >0.05 and p (variance) >0.05.
[b]Same letter in italics: p (means) >0.05 (t-test, SPSS, 1999) and p (variance) <0.05 (Levene's Test for equality of variance, SPSS, 1999).

We checked self-reported herd numbers and size with direct counts during overnight stays, crosschecking with pastoralists in other camps and data from vaccination campaigns (see Table II).[10] Because there were significant differences between self-reported herd size from FulBe Mare'en and Arabs and our own direct counts and vaccination campaigns, we have disregarded the former.

In this study of changes in grazing intensity, we consider herd size to be a constant value, although grassland productivity increased after the reflooding and presumably led to greater reproductive rates and thus larger herds. Moritz (2003), for example, found that nomadic herds in the Logone floodplain grew on average 4.5% per year, slightly higher than the 3.4% postulated for a 'normal' herd by Dahl and Hjort (1976). Increased reproductive rates and herd growth is reflected in an increase in the number of herds per pastoral group when pastoralists 'split' their herds.

We have operationalized *grazing intensity* as the number of herds multiplied by the number of weeks each camp spent in the reflooded zone and that multiplied by the number of cattle per herd of the concerning pastoral group. The resulting grazing intensity is expressed as cattle densities, i.e., the number of cattle per km^2 averaged over the six months of the dry

[10]Initial analysis using stem-and leaf plots in SPSS (1999) showed that herd size data followed a normal distribution. Herd size data from different sources have subsequently been analyzed with t-tests, variances of herd sizes with Levene's Test for equality of variances (SPSS, 1999) to enable possible lumping. Subsequently, herd size data from different pastoral groups were lumped if results of ANOVA and Tamhane Post Hoc tests (SPSS, 1999) allowed for it.

season. This also allows us to compare our data with livestock surveys in other floodplains.[11]

RESULTS

Changes in Transhumance Patterns

In individual and group discussions, pastoralists invariably expressed their appreciation of the reflooding initiatives. At a meeting in 1997 with about 20 representatives of different pastoral groups, a proposed opening of a second watercourse, in addition to the 1994 reflooding, was applauded with "the more water the better." How pastoralists responded in terms of changing transhumance patterns will be discussed below.

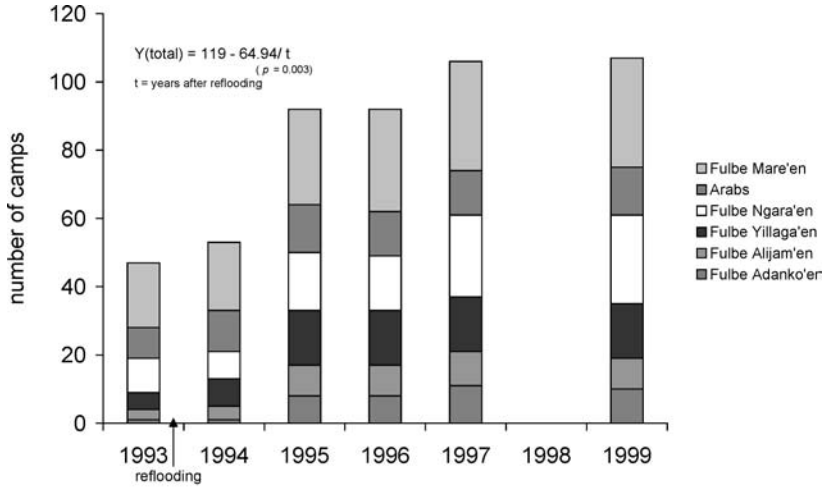
Changes in the Number of Pastoral Camps

In the first year of reflooding, the fact that few pastoralists had heard about the reflooding or had anticipated its impact was reflected in the limited increase in the number of pastoral camps (Fig. 2). When the positive impact of the reflooding became apparent, it was the subject of much discussion in market places and other pastoralists' fora. The number of pastoral camps increased dramatically in the second year, 1995, and continued to increase until 1997 after which it stabilized (Fig. 2). Unlike the other pastoral groups, the number of Arab camps did not increase, although some 'newcomer' Arab pastoralists are said to have joined the existing camps, contributing to the highest ratio of herds per camp (Table I).

Changes in the Number of Herds

Initially, the number of herds followed a relatively low increase rate as newcomers had relatively few herds compared to the increase in the number of camps (Fig. 3). The number of herds continued to increase until the last monitoring year. Part of the increase is due to normal herd growth and subsequent splitting of herds that were already present. The 4.5% annual growth rate of nomadic herds (Moritz, 2003) would translate in an increase

[11] The 27 to 69 cattle km^2 increase in the reflooded area in the Logone floodplain falls within the range of aerial surveys of other African floodplains, which assessed average cattle densities from 25 to 80 cattle per km^2 (e.g., DHV/LRVZ Farcha, 1994). Obviously, care should be taken to compare surveys of different scales and methodologies.



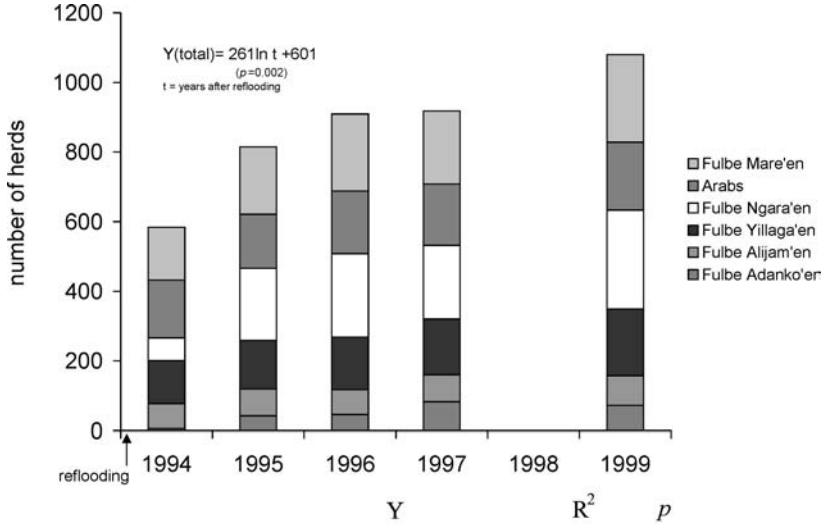
	Y	R^2	p
Total	**119.222-64.937/ t**	**0.963**	**0.003**
FulBe Adanko'en	**12.7437 – 11.430/ t**	**0.937**	**0.007**
FulBe Alijam'en	LnY = 2.5350 – 1.0642/ t	0.873	0.020
Arabs	LnY = 2.6415-0.1397/ t	0.520	0.169
FulBe Mare'en	**35.1329-14.962/ t**	**0.990**	**0.000**
FulBe Ngara'en	**LnY = 3.4362-1.3599/ t**	**0.932**	**0.008**
FulBe Yillaga'en	18.9114-10.025/ t	0.862	0.023

Bold:table-wide significant ($\alpha = 0.05$)
Regression equations have been determined between the number of camps and, grazing intensity with increasing time, using best-fitted curve estimation (SPSS, 1999). Significance levels have been adjusted on a table-wide level, using the Bonferroni test for multiple tests at a 0.05 significance level (Rice, 1989).

Fig. 2. Development of number of camps in the reflooded area, 1993–1999.

of 30% in the number of cattle from 1993 to 1999. If we assume a similar increase in the number of herds, then approximately one-third of the increase in the number of herds in the study area during that period is due to growth of existing herds, while two-thirds is due to the arrival of new herds.[12]

[12]This assumption seems reasonable given the large number of animals and herds in our study, respectively 95,077 and 1,079 in 1999.



	Y	R^2	*p*
Total	**Y=261.340 ln t + 601.438**	**0.970**	**0.002**
FulBe Adanko'en	**LnY = 5.0152- 3.1211/ t**	**0.957**	**0.004**
FulBe Alijam'en	2.4865X + 68.2432	0.689	0.082
Arabs	6.7297X + 152.865	0.740	0.061
FulBe Mare'en	**LnY = 5.5587- 0.5454/ t**	**0.927**	**0.009**
FulBe Ngara'en	**LnY = 5.9663 – 1.7059/ t**	**0.929**	**0.008**
FulBe Ngara'en	**13.1486X + 111.324**	**0.991**	**0.000**

Bold: table-wide significant (α=0.05), see also remark Fig.2

Fig. 3. Development of number of herds in the reflooded area, 1993–1999.

Changes in Grazing Duration

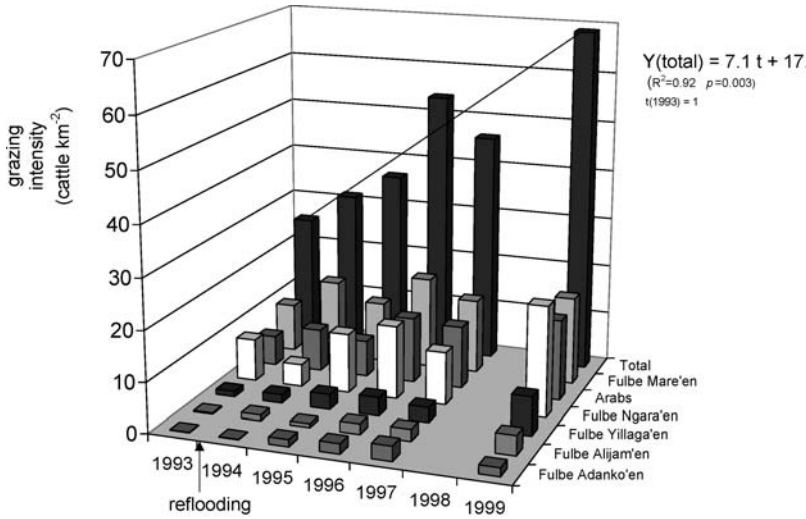
We also measured how long pastoralists stayed in the reflooded zone, which we refer to as grazing duration, i.e., the number of weeks pastoralists stayed in the study area. Before reflooding in 1994, FulBe Mare'en stayed in the reflooded zone almost twice as long as other groups. After reflooding the difference between the FulBe Mare'en and the other pastoral groups has become less distinct as unlike most other pastoral groups, FulBe Mare'en stayed only slightly longer than before. From 1993 until 1999, FulBe Alijam'en and Arab groups have stayed increasingly longer in the reflooded zone on their yearly migration to pastures further north and east into Chad.[13]

[13]Respectively $Y = 0.00344$ (year)–6.9, $R^2 = 0.91$, $p = 0.003$ and $Y = 0.0039$ (year)–7.8, $R^2 = 0.87$, $p = 0.006$.

Changes in Grazing Intensity

With the data on the changes in the number of herds and the time that they spent in the reflooded area, we can estimate the changes in overall grazing intensity for the impact zone. Between 1993 and 1999 grazing intensity in the impact zone increased from 27 to 69 cattle km^2 for the six-month dry season (Fig. 4). Three pastoral groups, FulBe Mare'en, Arab, and agropastoral FulBe Ngara'en accounted for the largest increase in total grazing intensity. The FulBe Ngara'en and the Arab pastoralists have been the main beneficiaries of the reflooding, accounting for respectively 33% and 24% of the increase in grazing intensity (Table III).

In terms of increase in grazing intensity per individual household, agropastoral Ngara'en and Yillaga'en FulBe have benefited most from the



	Y	R^2	*p*
Total	**7.1X + 17.9**	**0.91**	**0.003**
Fulbe Adanko'en	0.38X -0.017	0.54	0.096
Fulbe Alijam'en	**0.59X – 0.40**	**0.93**	**0.002**
Arab	**1.7X + 2.1566**	**0.88**	**0.006**
Fulbe Mare'en	LnY = 2.9 – 0.63/t	0.67	0.046
Fulbe Ngara'en	2.33X + 3.4	0.71	0.035
Fulbe Yillaga'en	**0.99X – 0.26**	**0.85**	**0.009**

Bold: table-wide significant ($\alpha = 0.05$),see also remark Fig. 2

Fig. 4. Development of grazing intensities in the reflooded area, 1993–1999.

Table III. Contributions of Pastoral Groups to Increase in Relative Grazing Intensity, 1993–1999

	Nomadic pastoralists				Agro-pastoralists	
	FulBe Adanko'en	FulBe Alijam'en	FulBe Mare'en	Arabs	FulBe Ngara'en	FulBe Yillaga'en
Increase in grazing intensity (Fig 4)	5.0%	8.4%	15.0%	24.3%	33.2%	14.1%
Increase in grazing intensity per herd	0.2%	0.09%	0.13%	0.18%	0.53%	0.53%
Increase in grazing intensity per head of cattle (10^{-3})	1.1	1.5	0.7	1.0	1.1	1.1%

reflooding, although this was biased by the low number of households accompanying the herds (Table III). FulBe Mare'en, who used to be numerically the most prominent pastoralists in the reflooded area before reflooding, were the only group for whom grazing intensity did not increase, meaning that their cattle did not increase and they did not stay longer in the study area. Overall, FulBe Mare'e benefited the least from the floodplain rehabilitation (Table III).

In the first year the increase in grazing intensity was largely due to a prolonged stay of pastoralists in the reflooded zone, reducing their stay elsewhere in the floodplain. This was most evident in the case of the FulBe Alijam'en who on their yearly migration to the northern floodplain, have increased their stay in the reflooded area. When grazing duration in the reflooded area increased, this did not lead to lower grazing intensities in other parts of the floodplain. We observed that other groups, some coming from Nigeria, have replaced groups in the northern and eastern parts of the floodplain that are now visiting the reflooding area.

Other Factors Affecting Transhumance Patterns

It is important to keep in mind that pastoralists' humance patterns are not only determined by ecological factors; sociopolitical factors may be important as well (Niamir-Fuller, 1999b; Stenning, 1957). We expected that this might also have been the case here, because the topic of cattle losses due to theft, diseases, or predation, was nearly always raised in our discussions with pastoralists. Moreover, pastoralists argued that insecurity threatened their access to the rehabilitated floodplain (Scholte *et al.*, 1996b). The start of the floodplain rehabilitation coincided with a period of insecurity, unparalleled in recent history (Issa, 2004), in which several pastoralists lost

their lives defending their herds. We anticipated that cattle losses might have influenced pastoralists' transhumance patterns, thereby potentially reducing the impact of the reflooding.

In 1997 we assessed the effects of cattle losses on transhumance patterns and the exploitation of the rehabilitated floodplain. In our annual visits to camps we asked about the number of cattle lost and categorized them as diseases, accidents, predation, and theft. We calculated cattle losses as a function of grazing duration in a particular part of the floodplain, following the equation below:

$$\text{Loss rate (fraction per week)} = \frac{\text{Reported losses}}{(\text{Number of herds}) \times (\text{herd size}) \times (\text{grazing duration})}$$

This survey shows the spatial distribution of risks in the floodplain (Fig. 5). We were unable to make a causal link between data on cattle losses with grazing intensities in particular areas of the floodplain and thus limit our discussion here to the following general observations.

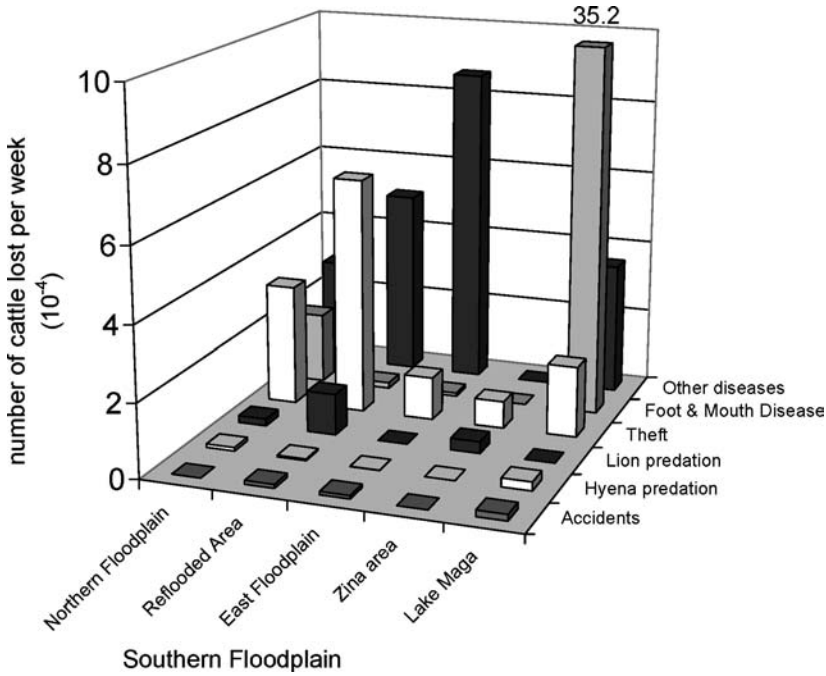


Fig. 5. Number of cattle lost in different floodplain areas in 1997. (For areas, see Fig 1).

When we recorded cattle losses in 1997, pastoralists reported the theft of 600 cattle. This was considerably less than they had experienced in the early 1990s before the Waza-Logone Project had undertaken action (Scholte *et al*., 1996b). A year later, cattle losses were even lower, as special governmental forces had been stationed in the area to counter the insecurity. In subsequent years losses to cattle theft continued to decline. Pastoralists frequently argued that the reflooded area was the area with the highest risk of cattle raids as confirmed by the reported loss rate in 1997 (Fig. 5). This may have inhibited some pastoralists visiting this area in the early years of reflooding. The fact that there was no sharp increase in the number of camps and herds after 1998, the year that the special forces practically halted cattle thefts, is an indication that insecurity did not influence transhumance into the reflooded area.

Later discussions with nomadic pastoralists focused on conflicts with fishers and agriculturalists (Kouokam *et al*., 2004). These conflicts concerned the blocking of transhumance routes into and within the Logone floodplain by agricultural fields and fish canals (Moritz *et al*., 2002). The Waza-Logone Project later assisted in the resolution of these conflicts through the demarcation of livestock corridors into the floodplain and establishment of conflict resolution mechanisms (Kari and Scholte, 2001). These conflicts did not seem to have had a lasting impact on transhumance patterns either.

Another factor that might have affected transhumance patterns in the reflooded area was livestock predation. Agropastoral FulBe Ngara'en frequently raised this problem in meetings with the Waza-Logone Project (Scholte *et al*., 1996b). Although predation by lions was a great concern for individual FulBe Ngara'en, the 155 cattle lost to lions in 1997 represent only a fraction of the total losses in the floodplain. Lion predation only occurred in areas adjacent to Waza National Park, and even there accounted for a relatively small percentage of the total losses (Fig. 5). Hyena predation was reported in areas far from the park (Fig. 5). Overall, predation accounted for only a small percentage of total livestock losses. It is unclear what exactly the effect of predation was on transhumance patterns, but the fact that FulBe Ngara'en continued to use the pastures in and adjacent to Waza National Park suggests that it affected their transhumance patterns only minimally.

Pastoralists suffered the largest cattle losses because of diseases, such as trypanosomiases, foot-and-mouth disease, and a variety of parasites. These diseases are endemic, but outbreaks more often affect areas with concentrations of herds, like the Logone floodplain. The impact of diseases on transhumance patterns is unclear, save in the case of serious outbreaks. In 1997, for example, an epidemic of foot-and-mouth disease struck the

borders of Lake Maga, where many nomadic pastoralists stayed towards the end of the dry season. The pastoralists there suffered high losses; 1,512 of their cattle died (Fig. 5). Other pastoralists, who used the pastures of Lake Maga as a transition zone to their rainy season pastures, waited as long as possible in the reflooded area before moving south, thereby increasing the grazing intensity in the reflooded area that year.

Pastoralists' Incursions into Waza National Park

One of the goals of the floodplain rehabilitation was to reduce the competition between livestock and wildlife in Waza National Park by stopping pastoralists' incursions into the park. The assumption was that reflooding would offer the pastoralists responsible for illegal grazing in the park alternative grasslands outside the park.

After the first year of reflooding, the Waza-Logone Project started a dialogue with informal leaders of the FulBe Ngara'en from the Pétté-Fadaré area, the pastoralists who were most frequently caught in the park. This resulted in a verbal commitment in October 1995 of one of the most influential and respected leaders that his herds and those of his followers would no longer enter the park. In December 1997, this commitment was formalized into a written contract between his group, the Waza National Park authorities, and the Waza-Logone Project.

In the period 1995–1997, the FulBe Ngara'en group showed a striking reduction in grazing duration in the reflooded area, following the decision of the (absentee) owners to send their herds further north during the early dry season to avoid any risk of entering Waza National Park. Other FulBe Ngara'en pastoralists followed this example, in part because their leader no longer intervened on their behalf in conflicts with the national park's authorities. But FulBe Ngara'en pastoralists from Pétté and Fadaré also argued that a major consideration for their commitment to refrain from grazing inside Waza National Park was the improved condition of grazing lands due to the reflooding. This left sufficient grasses in the reflooded zone for the hot dry season when herd mobility is limited. Nonetheless, pastoralists noted that they suffered major losses of newborn calves during the first year of changing transhumance routes and pastures, a situation that improved in subsequent years when herders acquainted themselves with the site-specific circumstances. The reduction in pastoralists' incursions into the park during 1995–1997 was confirmed by park authorities who only occasionally reported herds within park boundaries.

However, from 1997 onwards, pastoralists complained about the increasing number of cattle in the reflooded area and elsewhere in the

floodplain due to an influx of 'new' pastoralists, which left little forage for them towards the end of the dry season. These developments undermined the agreement between the FulBe Ngara'en and the Waza-Logone Project, which was already under pressure because of the illness of the FulBe leader and personnel changes at the Waza-Logone Project. In the end, despite the increase in perennial grassland productivity, FulBe Ngara'en pastoralists returned to graze their animals in the park.

DISCUSSION

Our data shows that risks of cattle losses are spatially distributed (Fig. 5). Pastoralists are aware of this and make decisions accordingly. Cattle losses due to predation were limited in both relative and absolute terms, and probably did not influence transhumance patterns. Cattle losses to theft were much higher, particularly in the reflooded area. But the effect on transhumance patterns seemed minimal; grazing intensities did not increase sharply when security improved. Outbreaks of contagious diseases, however, did affect transhumance patterns in 1997, but only temporarily.

Our data on pastoralist responses can be summarized as follows. During the first six years of reflooding, *grazing intensity* in the reflooded area has increased linearly, from 27 to 69 cattle km^2, contrasting with the density-dependent increase in the *number of camps* that, after a rapid increase in 1995, leveled off. The continuing increase in the *number of herds*, albeit slowing down to 7% in 1999, can be partly attributed to natural growth by splitting of current herds, but the influx of new herds accounts for most of the increase. The increase in *grazing intensity* in 1994 and from 1997 onwards is largely due to the increasing *grazing duration* in the reflooded area, because pastoralists spent more time there before they moved further north. The question is what this means for the three scenarios of pastoralists' responses to floodplain rehabilitation that we earlier postulated.

The **overshoot scenario** predicted social and ecological 'chaos,' triggered by a rapidly increasing number of pastoralists and their cattle. In 1995 the area indeed witnessed a rapid increase in the *number of camps* (Fig. 2). This was followed by violent clashes between Arabs and Musgum fishers. However, these conflicts did not continue in the following years, in part due to mediation by the Waza-Logone Project. The *number of camps* continued to increase after 1995, but at a much slower rate. Between 1993 and 1999 overall grazing intensity increased steadily, in part because of the influx of newcomers, in part because of natural growth of existing herds, and in part because some pastoralists spent more time in the reflooded area before they moved further north to their dry season pastures. There are no indications that the increase in grazing intensity has led to overgrazing as

from 1995 onwards perennial vegetation has increased with an annual 7% of the reflooded area (Scholte *et al*., 2000). We conclude therefore that the overshoot scenario has not taken place.

The **territorial scenario** predicted that pastoralists who used to exploit the area before reflooding would prevent newcomers from using the reflooded area. In the Logone floodplain, there is no system in which pastoralists ask formal authorization to access the floodplain as there is in the Inner Niger Delta in Mali (Legrosse, 1999). There used to be, however, a system in which pastoralists pay taxes and tributes to traditional chiefs in exchange for protection of access to pastures and personal safety (Moritz *et al*., 2002). This 'nomadic contract' has come under considerable pressure in the last decades. Contrary to what could be expected in a territorial situation, most pastoral groups have received proportional benefits from the reflooding, calculated as *grazing intensity* increase per household (Table III). FulBe Mare'en, who could have been expected to behave territorially given their dominant presence prior to the reflooding, have had even lower benefits, calculated per head of livestock, than the other pastoral groups (Table III). The limited increase in *number of camps* in the first reflooding year could be attributed to territoriality, but in view of the sharp increase in *number of camps* in subsequent years, it is more likely that lack of information was the main cause. The stabilization in *number of camps* in 1996, the low increase in *number of herds* and the prolonged stay in the reflooded area might suggest a territory effect. In 1997, however, the *number of camps* increased again, while the *number of herds* stabilized and *grazing duration* declined. In 1999, the 1996 pattern repeated. This fluctuating pattern is difficult to explain with a territorial scenario.

The fluctuating pattern seems to indicate the existence of a feedback mechanism between the *number of camps*, *herds* and *grazing duration*, the product of which, *grazing intensity*, fluctuates around the saturation level of a linearly increasing *grazing capacity*. We suggest the following mechanism. In a given year with a high number of camps and herds, saturation of grazing intensity is relatively quickly reached, leading to reduced grazing duration, i.e., early departure of pastoralists to other parts of the floodplain. This negative experience will dissuade potential newcomers from visiting the reflooded area the following year. In the following year, the reflooded area will have an increased carrying capacity because of its further developing perennial vegetation. With an equal number of pastoralists, the reflooded area offers more forage, meaning that they stay there longer. This leads to positive evaluations and an increasing number of herds in the subsequent year, etc.

This fluctuating pattern supports an **ideal free distribution scenario**, which assumes that any increase in perennial vegetation would be subject

of consumption by cattle. Apart from the lag in vegetation development in the first year (Scholte *et al.*, 2000), perennial vegetation and grazing intensity both increased linearly during the study period, suggesting optimal exploitation of grassland resources. Models of the ideal distribution posit different ways in which ideal distribution and thus optimal exploitation is achieved. The ideal free preemptive distribution model assumes that the first individual to use a territory can preempt it. Individuals first occupy the territories with highest quality and only move to lower quality areas when the population density increases (Pulliam and Danielson, 1991).[14] The preemptive distribution gives distinct advantages to someone who arrives first with his herds over his competitors in exploiting and depleting the vegetation around his campsite before moving on. The question is why our data on changes in grazing intensity fits the ideal free distribution scenario and whether there was a preemption effect, i.e., how did pastoralists adjust their transhumance patterns to achieve an optimal exploitation of the rehabilitating grassland resources?

Pastoralist Responses

The Logone floodplain is best described as an 'annual grazing area' for mobile pastoralists (Niamir-Fuller, 1999a), i.e., an area used by one or more ethnic groups in which land is not held in common and no action is undertaken against intruders (Casimir, 1992). However, in the case of mobile pastoralists in the Logone floodplain this does not mean that access to grazing lands is regulated by the principle of first-come-first-served, as Casimir suggests (1992, p. 160).[15]

Mobile pastoralists in the Far North Province of Cameroon have negotiated access to grazing lands through higher-level institutions, in what we have called the 'nomadic contract' (Moritz *et al.*, 2002). Compared to the rainy season transhumance area of the Diamaré, there is limited contact between mobile pastoralists and higher-level institutions in the Logone floodplain, although pastoralists pay taxes and tributes to the various authorities in the floodplain. The overall result is that no pastoralists are denied access, as long as they pay dues to the authorities. In the Logone floodplain, negotiations and coordination occur therefore primarily amongst pastoralists.

[14] The relatively uniform floodplain vegetation masks possible quality distinctions, an issue that has not been further studied.

[15] Although access to grazing lands for main camps is not regulated by the principle of first-come-first-served; it is the principle by which the *luci* herds gain access to pastures. There is increasing competition among *luci* herders to enter the floodplain as soon as possible, even though the partial flooding carries health risks.

Niamir (1990) calls this 'passive coordination' in which no formal agreements are made between pastoralists but where coordinated movements result from individual decision-making. When spatio-temporal distribution of cattle is determined by herders on the basis of social and ecological characteristics (Turner, 1999, pp. 104, 105), this does not automatically lead to competition over the same campsites or grazing lands, since individual herders weigh costs and benefits differently and consequently make different choices.

Passive coordination in the floodplain is likely also achieved through formal and informal arrangements or mechanisms. Preemptive use, for example, might be reflected in the customary rights that pastoralists have to campsites in 'sojourn pastures' that they have occupied for a long time (i.e., a first-come first-serve basis at a different time-scale). However, pastoralists have only limited usufruct rights over the grazing lands radiating from their campsite, the boundaries of which "expand and contract in response to the local availability of fodder" (Turner, 1999, p. 108). Because the radii of different campsites overlap, pastoralists from a number of different camps use the same grazing lands. When reflooding led to greater grassland productivity, this allowed newcomers to occupy new sites in proximity to existing customary campsites while avoiding conflicts over campsites and grazing lands. This explains how the number of camps in the study area could more than double without leading to significant conflicts among mobile pastoralists.[16]

The other major contributors to the increase in grazing intensity were pastoralists who use the reflooded area as a transition zone to pastures further north. These pastoralists use 'transit pastures' and occupy 'travel campsites' along the transhumance route that takes them further north. We did not find any timing conventions on these transit pastures, meaning that pastoralists can adjust the time they spend in the reflooded area depending on the resources available. The data presented above shows that pastoralists indeed adjusted their transhumance patterns primarily by shortening or prolonging the time they spent in the rehabilitated part of the Logone floodplain.

The development of pastoral exploitation of the perennial grasslands in the reflooded area confirms that mobility and flexibility are key adaptations to the African drylands (Behnke *et al.*, 1993; Breman and Wit, 1983; Niamir-Fuller, 1999b). More importantly, there is no evidence that the reflooding led to a 'tragedy of the commons' (Hardin, 1968). On the contrary, pastoralists adjusted their numbers and the time spent in the reflooded area quickly and effectively in response to changing productivity of perennial

[16] In all the years of working with mobile pastoralists in the Logone floodplain, we have not come across conflicts between pastoralists over campsites or grazing ranges.

grasslands through 'passive coordination' (Niamir, 1990). Our studies thus not only show the resilience of the Logone floodplain ecosystem (Scholte *et al*., 2000) but also the continued flexibility of mobile pastoralism.

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