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Ninety years of pastoralists land use change – a case study from Northern Kenya Horst Jürgen
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Abstract

We use three different data sets to reconstruct the past ninety years of land use patterns of the Rendille, a pastoral people in Marsabit District, Kenya. The first fifty-one years (1927 – 1978) are extracted from an oral history record of seasonal migrations of eight Rendille settlement units (*gobs*). The second period results from nine aerial surveys of South-Western Marsabit District carried out 1979-1980. The third stems from the analysis of Digital Globe images (Google Earth) of Marsabit District recorded between 2012 and 2014. The oral history record allows the placement of settlement sites within a 10 by 10 km grid, the aerial survey allows a 5 by 5 km grid, and the satellite image analysis uses accurate geo-referencing. All data sets facilitate, albeit with different accuracy, estimations of the frequency and distance of seasonal movements of the *gobs*. The two more recent surveys also permit counting of household numbers per *gob* as well as estimating size and number of animal enclosures, differentiated into those for small stock (sheep and goats), camels and others (mostly donkeys). Some striking changes in the land use patterns occurred during the period under observation: 1) the overall home range of the Rendille people shrunk by about two thirds since the 1940s; 2) migration distances and migration frequencies as an important aspect of pasture management diminished significantly; 3) distinct clustering of *gobs* in very small areas has become common; 4) the *gobs* became smaller in average, i.e. having lower numbers of households. We interpret these developments against environmental parameters such as rainfall, range condition, vegetation types, land degradation, and others which have been mapped during the 1980s for the Range Management Handbook of Kenya and with recently recorded corresponding results from remote sensing exercises carried out under AFSIS, and we present what the analyses show.

Keywords: Pastoralists, long-term land use change, migration patterns, Northern Kenya

Introduction

Marsabit District in Kenya borders Ethiopia. With the exception of a few mountain ranges up to nearly 3000 m a.s.l., its terrain is largely lowlands between 400 and 700 m a.s.l. Correspondingly, rainfall varies between 200 and to over 1000mm. Vegetation types vary between true desert through various grass- and bushlands to evergreen high biomass tropical mountain forest. The district, now county, amounts to approx. 75,000 km² and carries a population of some 300,000 inhabitants from several ethnic groups: Borana, Gabra, Samburu, Dassanech, Burji, Rendille and others. Livestock herding is the main agricultural activity in the District.

The South-Western Quarter of the District is the home range of the Eastern Cushitic-speaking **Rendille** pastoralists, who are predominantly camel herders but keep also sheep and goats. They number probably 25000 people and were well suited for this particular study.

The vegetation in this part of the district is rather varied. The larger lowlands are covered with thorn-bush savannah, dwarf shrublands and annual grasslands with some pockets of seasonal wetlands and salt pans. There are large areas covered in igneous gravel with considerable bush and shrub layers but of little use to

herding because of the rough surface. Mt. Marsabit, Mt. Kulal and Oldoinyo Mara carry substantial evergreen mountain forests.

Rain falls in two short seasons, i.e. March to May and October to November; the first season yielding 150 to 300 mm and the second one 100 to 150 mm with corresponding vegetation growth. The herding system is best described as opportunistic horizontal nomadism.

Historical Survey 1927 - 1978

As part of a history of the peoples who live east of Lake Turkana, a survey was conducted during 1978 among the pastoralist Rendille to better understand their pattern of migration. The research was aided significantly by the Rendille living in rather stable clan-based settlements, and their use of a calendar of years that can be correlated with Western dates. Elders from 7 clans were asked to name all the places in which they lived (settlements = *gobs*) and grazed their camels (herding camps = *fora*), beginning with the first time they personally went to *fora* camp (earliest date 1927) up to the present (1978). Each location (140 were identified) and migration from place to place was plotted on maps and summarized in 4 time periods. This showed clearly that in the earliest years, Period 1, 1927–1949, the Rendille followed a pasture management strategy of taking animals during the rainy season to graze as far away from natural permanent water as possible and only moving back toward permanent water as this temporary grazing became exhausted. With the colonial government’s water development project of constructing bore holes and sinking permanent wells, (Period 2, 1950– 1962) both the frequency and distance of migration decreased significantly. This pattern continued after independence (Period 3, 1963-70) until, with the establishment and growth of missions and shops at permanent water sites in Period 4 (1971 – 1978), the long-distance movement of settlements almost ceased, followed by an unmistakable increase in desertification around sites of permanent water.

Table 1: Number of Grid Squares (10x10km) occupied by seven clan settlements (<i>gobs</i>) and number of entrances by <i>gobs</i> into grid squares in four distinct time periods between 1941 and 1978					
Time period	Number of grids occupied	Approximate size of home range [km ²]	Total number of movements	Movements within the present day home range	
				Total period	Mean annual total
1941-49	81 (+30)*	8100	589	499	55.4
1950-62	70 (+24)*	7000	564	506	38.9
1963-70	61 (+8)*	6100	324	318	39.7
1971-78	35 (+1)*	3500	248	237	29.6

* Figures in brackets indicate movements outside the 1980 home range

Aerial Survey 1979 - 1980

In an effort to determine short term land use and migration patterns in the Rendille home range, 12 aerial surveys were carried out at approximately two-monthly intervals over two years in 1979 to 1980. Due to technical difficulties and bad weather conditions only nine out of the 12 surveys could be used for the analysis.

Site and size of settlements as well as numbers of households and numbers of domestic livestock present in the settlements were recorded. This involved total photographic cover of all settlements in the survey area from a low flying aircraft during the hour immediately after sunrise, when all stock was still expected to be retained in the night enclosures. All counts were accumulated within a map grid of 5 by 5 km squares.

The results show a pronounced seasonal variation in several key parameters of pastoral land use, like occupation density of *gobs* and households, size of home range, and number of animals kept within the *gobs*. *Gob* dispersal within the home range is largest during and immediately after the rainy season; occupation density by households is lowest during this period whereas the number of animals (TLUs)

retained in the settlements is highest. This pattern was broken during Survey 11 when a socio-cultural and ritual event, the circumcision ceremony for one male age set, took place which required most of the livestock to be present in the settlements.

Table 2: Survey season, number of grid squares* occupied and total count of households and livestock at nine aerial survey dates between August 1978 and September 1980

Survey number	Survey season	Grid Squares occupied	Approx. size of home range [km ²]	# Households	TLU/ Household	Households /grid square
3	late rainy	36	900	2646	10.15	73.5
5	early dry	32	800	3247	12.04	101.5
6	mid dry	24	600	3348	5.89	138.5
7	end dry	15	375	3040	3.95	202.6
8	late rainy	20	500	3315	8.79	165,8
9	early dry	32	800	2984	3.78	93.2
10	mid rainy	26	650	3743	5.8	143.9
11	mid dry	22	550	2328	13.8	105.8
12	end dry	28	700	3356	3.72	119.8

* grid square 5 by 5 km; total two years accumulated size of home range = 3350 km²

In an exercise parallel to the aerial surveys numerous ecological maps were produced of Marsabit District (GTZ Range Management Handbook of Kenya). One of them was a map of range condition which we superimposed with the *gob* distribution. The correlation between high settlement density and poor range condition is evident and indicates the detrimental effects of pastoral settlements on range vegetation.

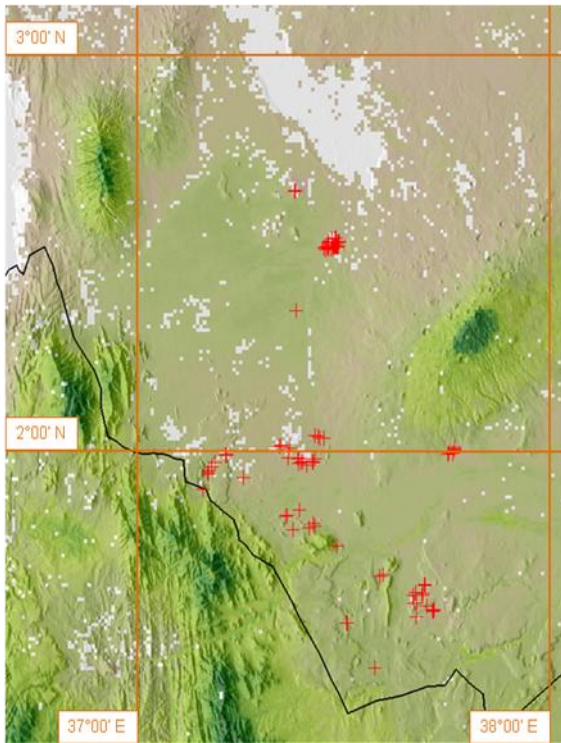
Digital Globe Survey 2012 – 2014

In an unrelated crowd sourcing exercise under <https://geosurvey.qed.ai/> of Marsabit District we noticed the potential of Digital Globe images to yield identification and quantitative description of Rendille *gobs* and *fora* camps. We carried out a mapping exercise for the home range of the Rendille as delineated through the aerial surveys of 1978 to 1980 using Digital Globe images recorded during 2012 to 2014. We obtained geo-referenced data on settlement location, settlement size by households, as well as numbers and sizes of animal enclosures. We recorded 116 *gobs* with a total of 4826 households, ranging from 5 to 135 households per *gob* and a mean value of 41.6. In about 50% of the records we could estimate the duration of site occupation through time series of Digital Globe images. In several instances duration of site occupation was more than five years. In others migration distances were less than 1 km over the same time period. Another observed phenomenon was the extremely dense clustering of *gobs*, particularly around high yielding and reliable permanent water sources.

Table 3: Descriptive statistics Rendille settlement Digital Globe survey

	Valid N	Sum	Mean	Minimum	Maximum	Std. Dev.
No of Houses	116	4826	41.6	5	135	24.9
No shoat enclosures	116	2658	22.9	2	60	11.8
No camel enclosures	116	491	4.2	0	26	4.9
No unidentified enclosures	116	220	1.9	0	14	2.6

As *fora* camps are much more numerous and more ephemeral in nature than *gobs* we could not count or geo-reference them. We could only determine certain areas as preferred sites. In comparison to the 1978/80 aerial survey the total area occupied by Rendille *gobs* decreased by approx. 55%, to about 1500 km².



Map 1: Rendille settlement sites (+) over a map of FPAR in South Western Marsabit District (Base Map: MODIS Terra & Aqua data)

With geo-referenced siting of the *gobs* it becomes easy to interpret site selection against spatial information on various ecological and other spatial parameters. In a first approach we have matched settlement sites against geomorphologic relief, surface temperatures, the probability of a 60% woody vegetation cover, and FPAR (Fraction of absorbed Photosynthetically Active Radiation). We found that preferred settlement sites were on flat ground, with high surface temperatures, and a low probability of woody vegetation cover. Map 1 shows that all settlements are located in areas with low to very low vegetation productivity. It appears that settlement site selection by the pastoralists is not motivated by forage availability but other factors. What these factors might be needs to be left to further investigations. Breakdown of internal security is probably a strong incentive for the observed clustering, but also the establishment of permanent and reliable water supplies together with development of social

amenities like schools, dispensaries, food aid stations and shops. Demographic changes in the Rendille population, particularly a reduction of the labour force through rural urban migration, might hinder stronger migration activities. Any recovery of the pastoral economy to earlier standards seems highly doubtful at present.

Data Sources

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