



Pastoral Mobility in a Spatially Constrained Environment: A Case of Butana locality in Northern Gedarif State, Sudan

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Author's contribution

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ABSTRACT

This paper is designed to explain the main constraints that hinder pastoral mobility in arid and semi-arid lands. It aims to investigate the main factors behind the decline of herd mobility. It also determines the implications of mobility constraints on pastoral farming. The data discussed in this paper were based on fieldwork, which involved the use of questionnaires to elicit information from 300 respondents in 19 villages located at Butana, Northern Gedarif State, Sudan. The paper shows that the top down approach in policy formulation has failed to address the needs of pastoral communities. Under the pretext of land reforms, several pieces of legislation have been introduced to privatize the communal land tenure system. These laws, particularly the Unregistered Land Act 1970, have impacted negatively on pastoral mobility. This Act has led to rapid unplanned expansion of farming agriculture at the expense of pastoral land and has become a point of departure in land grabbing. Conversion of the communal land tenure system into private property has prevented pastoralists from accessing their traditional land rights and hence disrupted pastoral livelihoods. It is recommended that the bottom up approach should replace the top down approach, and that Melville Herskovits' theory of the "East African Cattle Complex" and Hardin's theory of "the

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tragedy of the commons"; which have shaped planning in pastoral areas for several decades, need to be revised.

Keywords: Adaptive mechanism; constraints; planners; policies; top down approach.

1. INTRODUCTION

Pastoral communities, for centuries, have adopted herd mobility as adaptive mechanisms to cope with the scarcity of water and pasture in arid and semi-arid lands. The literature confirms that mobility is the best practice adopted by pastoralists in order to survive in the harsh living conditions of *immature* ecosystems in dry lands worldwide [1,2,3,4,5,6]. It has been one of the principal strategies employed by pastoralists to manage sociopolitical risks, adjust to climate variability, and adapt to the vagaries of challenging ecosystems [7]. This mechanism reflects their long experiences and practices, deep understanding of the surrounding milieu and their comprehensive traditional knowledge [8]. Mobility is not an easy task as it requires deep knowledge of the location and availability of natural resources, including spatial and temporal patterns, ecosystem types, responses to disturbances such as diseases, and formal and informal institutions that regulate transhumance [9].

In the context of ecology and environment, [6] states that mobility helps pastoralists to avoid the over-exploitation of the natural resources by reducing the concentration of livestock in an area, thus leading to conservation of the biodiversity. Moreover, he confirms that pastoral mobility results in the optimal utilization of the existing natural resources by taking advantage of temporal and spatial variations in the distribution and quantity of rainfall and forage, as well as the best nutritional status of the forage. Similarly, [10] indicate that through strategic mobility pastoralists find an asset in the existence of dynamic variability in the dry lands, where sedentary agriculture or mixed farming find a problem in their lack of uniformity and stability. Not only that, mobility is an efficient mechanism in managing risks as it helps pastoralists to recover from aftershocks [1]. This idea is supported by [11,12], who states that mobility has been argued to be the single most important factor explaining why some pastoralists do relatively well during extreme climatic events while others do not, because mobility works by taking advantage of the spatial and temporal

structure of resource failure by moving away from scarcity towards abundance.

The economic importance of pastoral farming and its vital contribution to the local, national as well as global economy is quite clear and it is adequately documented. It has been estimated that about 26 million km² of land worldwide are under the pastoral system. According to a recent estimate, the total number of pastoralists and agro-pastoralists worldwide is 120 million, of whom 50 million reside in sub-Saharan Africa (SSA) [10]. In the horn of Africa, arid and semi-arid areas account for more than 60 percent of the total surface area with a pastoral population estimated between 12 and 22 million people [13]. In Sudan, for example, 90% of the national herd is reared in pastoral systems, about 98% of which supply the domestic market [14]. Moreover, livestock managed in natural rangeland contributes 25% of national GDP, provides 20% of the hard currency and 40% of the total nutrition [15].). The number of animals in Gedarif State is always increasing, and it reached around six million in 2010 [16].

Despite the socio-economic rationality and ecological sustainability of pastoral systems, pastoral farming has not received the attention it deserves from planners and decision makers. There is still a deeply rooted apprehensiveness in rural development circles at national and international level that investments in securing pastoral farming hold back development rather than promoting it [10]. This led [17] to define the pastoralist as "a stranger who comes from elsewhere and goes somewhere else destroying everything in his path". [18] states that the growing pressure on the commons is changing the negative attitude of policymakers and rangeland management planners who had treated rangelands and their inhabitants over long periods as 'marginalized people in regions of neglect'. This negative view has been profoundly shaped by Melville Herskovits' theory of the "East African Cattle Complex" [19] and Hardin's theory of "the tragedy of the commons" [20]. These theories and associated myths, despite being discredited, still strongly influence governments' attitudes towards pastoral development [21].

According to Herskovits, pastoralists keep an excessive number of animals as a matter of prestige and wealth rather than for economic purposes [22] and even without due consideration of the carrying capacity of the land [23]. The wrong signal sent by Herskovits has led several scholars to consider pastoral farming as an environmentally destructive system [24], and this also inhibits its development [23]. The final message of Hardin is that a resource accessed by everyone and without individual control will bring ruin to all [25,5]. For Hardin and their supporters privatizing communal land is the best solution. This explains why the common policy towards pastoral farming worldwide is to privatize the communal land, adopt an anti-nomads policy, and to transform pastoral mobility into sedentary pastoral farming [22].

In Sudan, for example, several land laws have been introduced to privatize the communal land tenure system. Changes in the communal system have deprived pastoral communities of their historical land rights [1]. The Unregistered Land Act of 1970 was considered as the turning point in communal rights, and a point of departure in land grabbing [26]. The Act stated clearly that all occupied or unoccupied land (forest, waste and pastoral land) not as yet registered became a state's property [25,1]. The registration of communal land is technically difficult if not impossible, unlike land under the farming system. This Act provides the state with full powers to control and influence natural resource decisions in their favor [1]. Accordingly, the communal system has become an "open grazing land" accessed and used by all users without any of the tribal restrictions which existed in the past [25]. Moreover, farming agriculture, both rainfed and irrigated, has expanded rapidly at the expense of grazing land and over traditional animal routes. The Act is also responsible for the current conflict that is taking place over land resources in most parts of Sudan [27]. In the study area, Gedarif state, unplanned mechanized farming has expanded rapidly in areas that "traditionally" belonged to pastoral communities. This has led to a sharp decrease in natural rangelands, closed the traditional pastoral routes, blocked the permanent water points and thus affected pastoral mobility. With the lack of existing research on the impact of land legislation on mobility, the objectives of this paper are to examine the drivers of mobility constraints and to evaluate their implications for pastoral communities in the Butana locality of Gedarif state in Sudan. The paper tries to answer the

following questions: What is the logic behind the adoption of spatial mobility? What are the current constraints that face spatial mobility? And what are the implications of mobility constraints on the pastoral system? By answering these questions, the study will contribute to the current debate on pastoral farming, thus helping planners and decision-makers in formulating sound policy that might lead to sustainable development.

2. THE STUDY AREA

The study area is Gedarif state in the eastern Sudan, specifically Butana locality (Fig. 1). Internally Gedarif is bordered by four states of Sudan, namely Kassala on the north, Nahr Enil on the northwest, Gezira on the west and Sennar on the south. Butana locality is considered one of the seven localities that form Gedarif State. These are Fashaga, Faw, Gallabbat East, Gallabbat West, Gedarif, Rahad and Butana locality (*Mahalyat El Butana*). Butana is located between (13°N to 16°N latitude) and (34° E to 37° E longitude), and covers an area of 34000 km², 48 villages and 4 parties (*Ha*). Ecologically, Butana lies within an arid and semi-arid region where annual rainfall ranges between 75 mm in the far north to 400 mm in the south [25]. In 2008, the population of Gedarif had reached 1,348,378 inhabitants, with 78,000 in Butana [28], being composed of people belonging to several ethnic groups of Arab and non-Arab background.

3. DATA COLLECTION

A questionnaire and group discussion was used to collect the data for this study. To have an idea about the past and current situation of pastoral mobility, the area under study has been visited formally three times in different seasons. Three hundred households in 19 villages in Butana locality (Fig. 1) were randomly selected and interviewed. The fundamental questions are centered on the trend and pattern of past and current mobility, specifically before and after the introduction of the Land Act in 1970. Moreover, in each village researchers asked elderly people to recall the history of pastoral mobility, the introduction of mechanized farming, traditional rangeland regulation and the changes that they have witnessed. Secondary data were gathered from recently published articles on pastoral farming. The secondary data help to put the article in a regional and international context. Data have been analyzed using the Statistical Package for Social Science SPSS version 17.

Maps used in this study were drawn using Geographic Information System software, particularly Arcgis 9.3.

4. ANALYTICAL FRAMEWORK

To address the implications of land legislation on pastoral mobility, this paper develops an analytical perspective to guide the discussion (Fig. 2). The starting point is the role of the state, specifically its intervention in system of land tenure and use, as a major factor in limiting mobility. It shows that planners are neglecting the "new thinking" policy advocated by [29]. According to this thinking herd mobility is the crucial strategy in maintaining the productivity of a non-equilibrium environment. The neglect of this thinking might be due to the bad image of pastoral farming prevalent among planners who see it as a backward economic system, or as indicated by [22] to the widespread belief that there are more productive and efficient economic

modes of production than the pastoral system in arid areas.

This analytical framework presupposes that planners as well as decision makers are guided by the misconceived old theories of Hardin's "tragedy of the commons" and Herskovits' "cattle complex" in formulating policies. These theories have even guided international agents such as the World Bank and the United Nations. Today pastoralists worldwide are being forced into the remaining atrophied common grazing areas, with a shrinking resource base [22]. This situation has been aggravated by the prevalence of natural disaster such as repeated drought and other environmental risks. The adoption of open access land policies coupled with the fluctuations in rainfall inhibit pastoral mobility, forcing an increasingly large number of pastoralists to change to other means of livelihood such as cultivation in marginal lands, wage labour and outward migration [30].

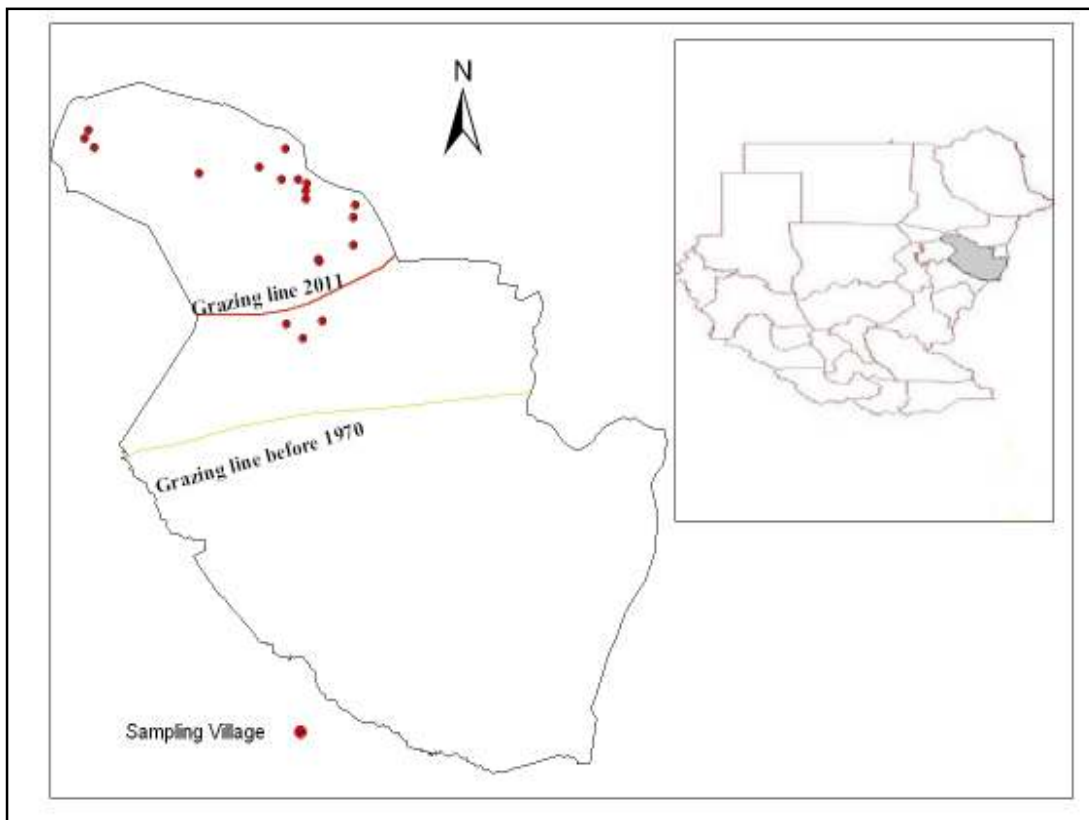


Fig. 1. The location of Gedarif State

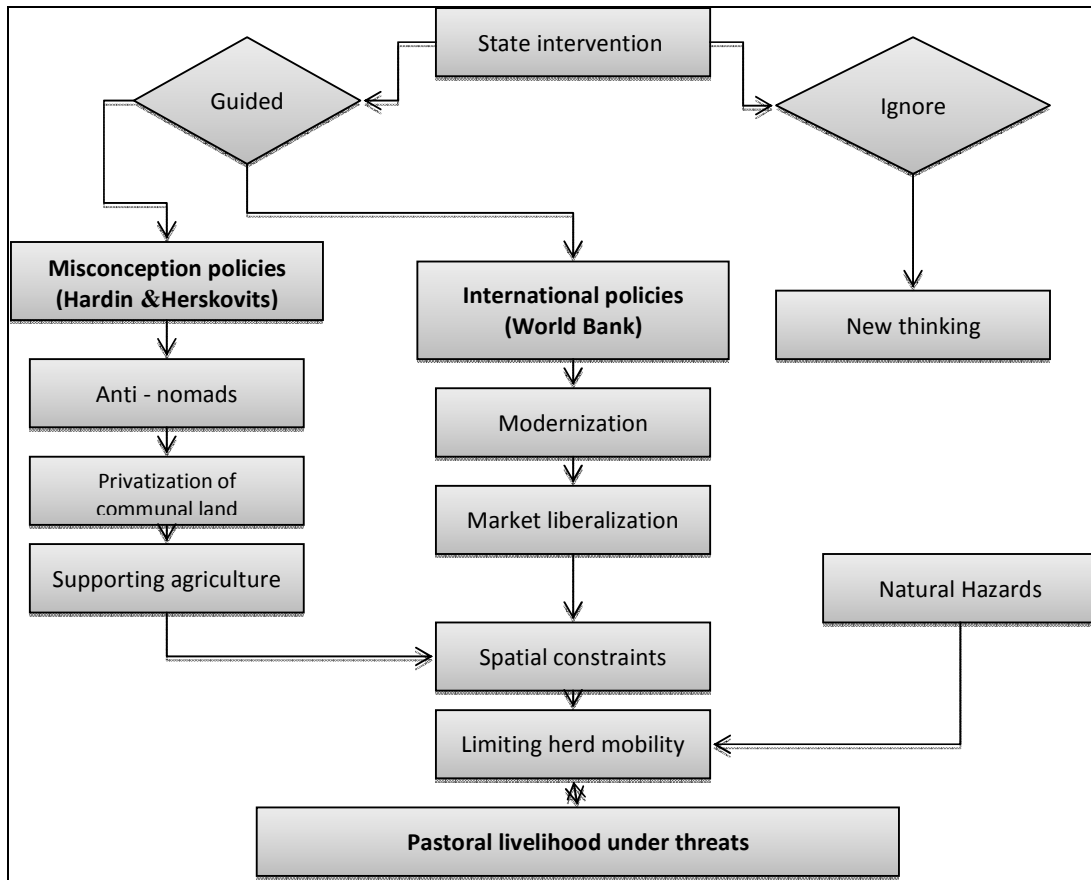


Fig. 2. Analytical framework

5. MOBILITY IN BUTANA: LOGIC AND PRACTICE

Herd mobility is not an end in itself, moving merely for the sake of movement, but a wise strategy. This strategy shows clearly that knowledge about the fragile ecosystem is not a scarce commodity among pastoralists, as some planners believed [8]. A variety of tasks need to be completed before pastoralists decide to move. When a movement is planned, expert herders or surveyors are sent out to evaluate the condition of the rangeland and to ensure that it is safe to move [31]. The expert or scout has to be an experienced person, hardy, intelligent and knowledgeable, in order to evaluate the condition of the rangeland [32]. This entails that the observer has the ability to measure what is known in the ecological studies as the “carrying capacity” of the rangeland. Then, an indispensable meeting is held to discuss the following: evaluate the information, take the decision to move, and make a division of tasks based on age and gender. When the decision to

move is made, pastoralists have to follow their traditional animal routes. The time and direction of the movement, therefore, are highly dependent on the availability of pasture and water. For example, in the case of Sudan, herds normally move to the north during the rainy season and to the south during the dry season. Departures from these cycles, however, can occur in the case of conflict and disease outbreaks [33].

Generally in the Butana, the study area, there are two types of mobility being practiced: internal and external mobility. Internal mobility is the movement of local tribes that inhabit the Butana area. External mobility is the movement of non-resident tribes (outsiders) that spent the rainy season in the Butana area. It has been noted that local pastoralists in Butana are on the move almost all year round. This allows them to access palatable grasses [8] and provides herders with the flexibility needed to survive in a patchy and unpredictable low-productivity environment [34]. Thus during the rainy seasons they move with

their families to the western part where water and pasture are available, particularly in the communal grazing land known as General Grazing Area (GGA) (Figs. 3 and 4). This movement allows resources to be shared with the outsiders in the western part, and reserves the rest of Butana for the use of local tribes during dry seasons. GGA is opened freely for both locals and outsiders to graze during rainy seasons. During summer time local pastoralists graze around their villages, and move to the permanent water sources such as the rivers Atbara and Blue Nile when the shortage of water becomes acute (Fig. 3).

Regarding outsiders, this group makes two types of movement. The first type is to the northern part of Butana, mainly to (GGA), during the rainy season and the second type is to southern Gedarif during the summer time. Traditionally, in Gedarif state there are eight corridors (*Maraheel*) to organize the movement to and from Butana. The size and length of these animal routes are well established (Fig. 4) [25]. Therefore, from late June up to the early July, most of the pastoralists in Gedarif State or around followed these routes to move to the Butana area, escaping from insects (biting flies) and muddy condition in the southern part and above all having access to the natural and highly nutritious grass called *Belpharis edulis* (Siha) in Butana [1]. Therefore most pastoralists in Gedarif state gathered in Butana from the beginning of early showers in June up to the end of October when the existing water sources dry up. This autumnal drought in the GGA was one of the push factors for outsiders to leave Butana and at the same time it benefited the local inhabitants by ensuring the departure of outsiders each autumn. Then the availability of water and crop residues in the southern part became one of the pulling factors behind the movement of herds from Butana towards the South. Immediately after harvesting, the farmers left the residues for pastoralists to graze freely. This type of mutual and symbiotic relation between farmers and herders is known locally as *TALK* (*take it for free*). By so doing, farmers also benefited from natural fertilizer of livestock (manure).

6. FINDINGS AND DISCUSSION

6.1 Pastoral Mobility under Constraints

Currently, the pattern and trend of mobility discussed above has been profoundly changed. A variety of reasons have been adduced for the shrinking of spatial mobility in most arid and

semi-arid lands. Modernization, collapse of local administration, privatization of communal land, change in land use and frequent drought are viewed as the main restrictions imposed on mobility. However, with reference to the analytical framework (Fig. 2), this paper believes that the State's intervention, especially in changing land tenure and use, is the sole factor that should be blamed for the decline the mobility in the Butana area.

Under the influence of Hardin's views and to facilitate land grabbing, most African countries have recently embarked on incorporating communal land into commodity markets. According to [10], privatization, especially in Africa, is legitimized, in ways that are disturbingly reminiscent of colonial times, by arguments that link entitlement to "natural" resources to the relative "potential" of production systems. The International Land Coalition (ILC) estimates that about 83 million hectares of rural land worldwide have been taken over by investors in large-scale agriculture. There is evidence that the true owners of these land parcels have been neglected and unlawfully evicted [35]. The presently observable process of selling-off vast tracts of agricultural land resources to powerful multinational, state and private investors in Africa and Asia is stimulating the land-grabbing and expropriation of weak communities lacking in lobbying power [18]. In Tanzania for example, large areas of pastoral land have been taken by corrupt officials, leading to forced evictions of the agro pastoralists [22]. In Sudan, in Butana as well as several other parts of the country, huge tracts of land belonging "orally" to pastoralists were taken and title vested in investors to grow cash crops under both irrigated and rainfed mechanized schemes. Under the guise of compulsory acquisition in the public interest with the rhetoric of encouraging national development, some agents of the state grab land from ordinary people and, in turn, give land to powerful interest groups such as investors, the rich, and cronies of governments [26]. More detail on land tenure legislation and its impact on pastoral mobility are discussed in the following section.

Historically in Sudan, the use of and access to land, particularly in rural areas, were governed by customary law. This implies that land is owned communally but under the supervision of the tribal leaders [25]. This system of communal access continued up to the 1970s, when the Unregistered Land Act was introduced in the country. This Act gives the state full authority to

control all the communal land all over the country [1]. According to this Act all pastoral land is reclassified as state property (open access). This transformation disrupted pastoral land tenure systems through alienation of customary lands to the state and to settled farmers [22]. The Act gives outsiders (pastoralists) the right to access and use land in Butana and elsewhere in Sudan, since they are paying animal tax to the government. This has given them the right to use "government land", ignoring completely the historical rights of internal pastoralists. Accordingly, the Butana area has been converted into "open grazing land" available and accessed by all users without any restrictions on utilization. However, even today some people in Butana believe in the continued existence of the traditional system of communal access and local

administration. This dichotomy in conceptions of land tenure has generated disputes over land resources and in some cases led to bloodshed, as in Butana, and to armed conflict in Darfur since 2003 [31]. The introduction of the Land Act 1970 was followed by the abolition of the native administration system, local bodies which were responsible for organizing access and use of land in many rural areas. The abolition of native administration has eroded the legitimacy of traditional decision making [22], and weakened the ability of tribal leaders to control and manage rural lands as they did before 1970s. This abolition was undertaken by the government to undermine community or individual attempts to resist the process of land grabbing and to disable their efforts [36].

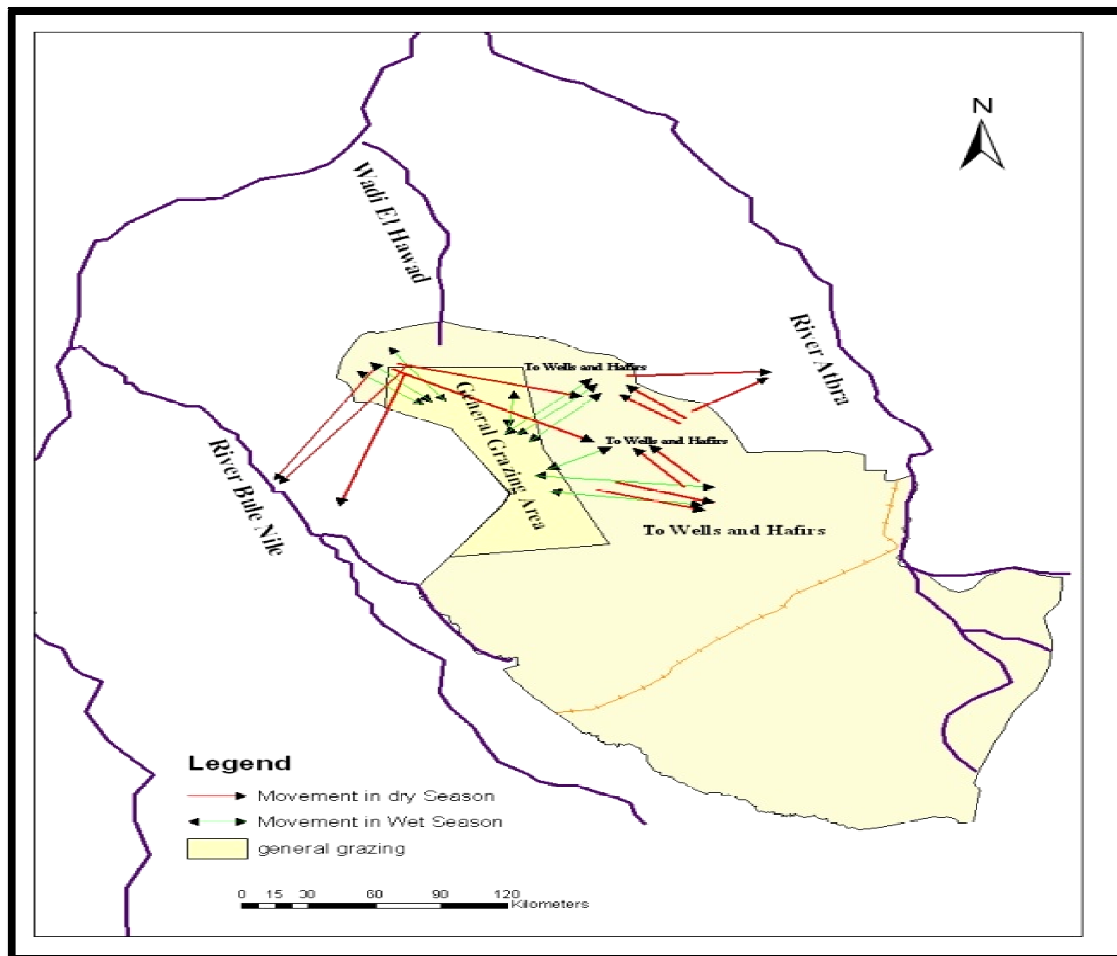


Fig. 3. Seasonal mobility in the Butana area

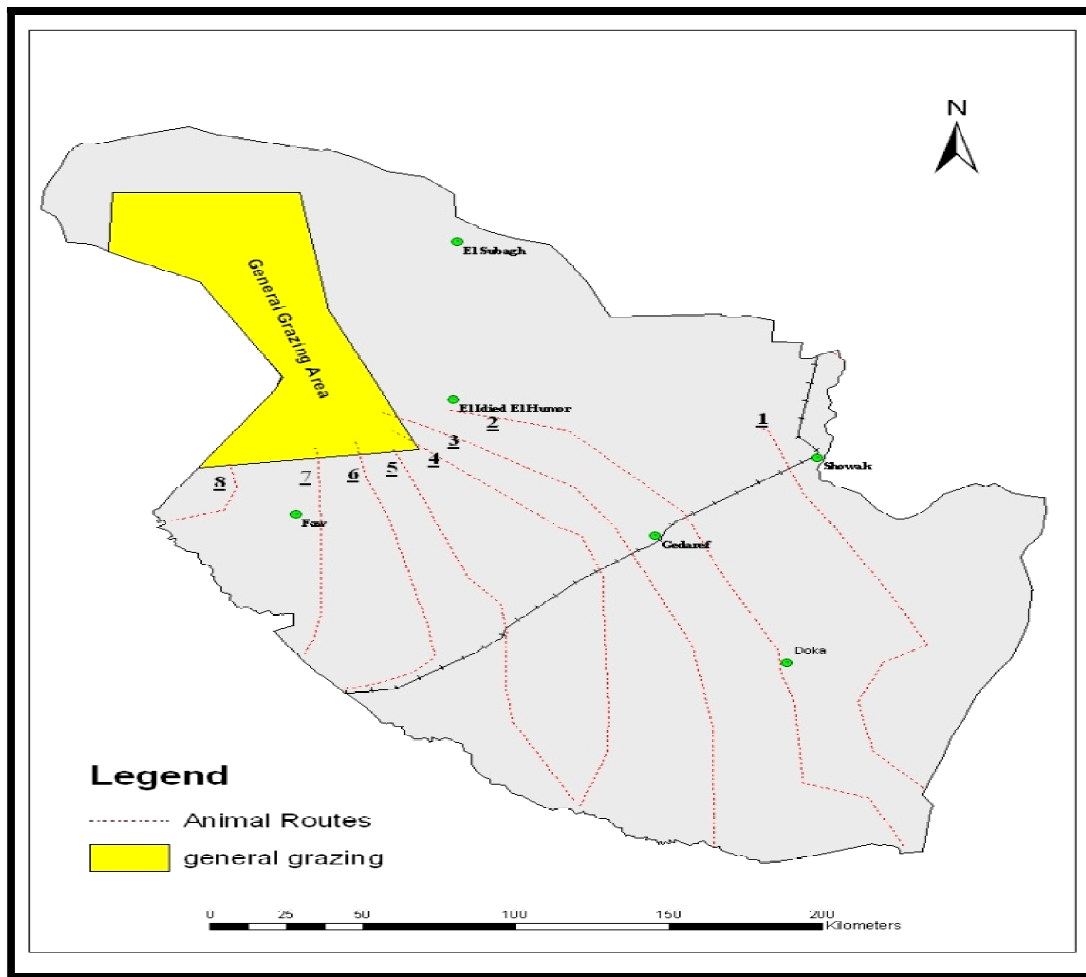


Fig. 4. Traditional Animal routes in Gedarif state

As indicated above the new Act introduced in rural land has speeded up the process of grabbing pastoral land and has led to the rapid expansion of crop farming. Unplanned mechanized farming has spread widely in several states of Sudan including Gedarif. Recently, the total area under cultivation in Gedarif state reached eight million feddan, compared to 21,000 in 1945 [37]. This expansion, has caused mobility constraints and pushed pastoralists to areas of low productivity, leading to what is known as "ecological marginalization". Whenever communal rangeland declines in size or changes into other forms of land use, it compromises mobility as access to resources becomes increasingly limited [38]. It is important to note that such expansion has been supported by the World Bank through its modernization policy (Elhadary, 2010). In 1968, the Mechanized Farming Corporation (MFC) was established by the government at the request of the World Bank.

Another World Bank initiative was the Structural Adjustment Programme (SAP), introduced in some developing countries including Sudan *on the eve of oil crisis of the early-eighties* after the oil crisis of the late seventies [39]. These economic reforms have ushered in new threats to pastoral and agro-pastoral systems, though they have also created some opportunities [22].

It is important to note that mechanized farming has extended even beyond the grazing line in the Butana area. This is an official line separating agricultural area from rangeland, as the northern part (arid and semi-arid) of Gedarif is reserved for grazing while agriculture is allowed in the southern part (humid). Fig. 1 shows the shift of the grazing line since 1970. Astonishingly, nobody has been held responsible for this illegal shift, but some rumours blame the lobby of the big farmers in Gedarif [1]. This invasion of mechanized agriculture into ecologically fragile

areas reflects two things: the power of big farmers (state inside state) in violating environmental laws, and no land left in the south for further horizontal expansion [40]. Although, the introduction of both mechanized and irrigated schemes were in pastoral land, pastoralists have never been consulted and in very few cases received fair compensation. The pastoralists were completely eliminated from the development process, despite the fact that the schemes were established in their traditional grazing lands [1]. And even the old system whereby schemes were open freely for pastoralists to graze after harvesting has completely changed. Today only a few pastoralists can access residues, but only after they have payed cash to the scheme's owner. In most cases farmers used residues for feeding their own livestock.

It is not only mechanized farming that has constrained mobility, since the establishment of irrigated schemes has also had a negative impact on pastoral mobility. Two big irrigated schemes have been introduced in pastoral areas, the Rahad and New Half schemes. New Half was established in the Butana area in the 1960s on an area of half a million feddans. This scheme has cut out large areas of grazing land and blocked mobility to the permanent water resources of the river Atbara during the dry season. The Rahad Scheme was inaugurated in 1977 on an area of one million feddans, again at the expense of the richest pasture in Gedarif state. This scheme was financed by a loan from the World Bank.

6.2 Implication of Mobility Constraints on the Pastoral System

The restrictions imposed on mobility have had serious implications for the pastoral system. For the purpose of this paper the focus will be on the current trend in mobility, changes in herd composition, and livelihood diversification. More details on these implications are discussed in the following section.

6.3 Recent Trend and Pattern of Mobility

Due to the rapid expansions of both mechanized and irrigated schemes, the regular movement of the internal pastoralists in Butana has been restricted. These changes have forced many pastoralists to graze all year round in Butana close to their settlements and rarely move to Gezira, Halfa State and to southern Gedarif as was the case in the past. According to the

survey, more than half of pastoralists, particularly during summer, graze their animals inside Butana (Fig. 5). Only (18%) of pastoralists who inhabit the north of Butana cross the State's boundary with Gezira State. This is due to the sharp deterioration in the rangeland of the region. It has been observed by the researcher that there is not even a single tree in an area where one expects some *Acacia Nubica* (Laout) scattered along the seasonal stream of Wadi El Shebiek. (7%) of pastoralists who inhabit the southern part of Butana prefer to move to mechanized schemes in Gedarif locality. There are two main reasons why such a small percentage choose to move. The first is the good condition of the pasture in Butana and the availability of palatable grasses such as *Schoenefedia gracilis* (Gebbash) even at the beginning of the rainy season. The second is the difficulty in passing through the massive concentration of mechanized agriculture. Halfa in the eastern part of Butana received only (21%) of pastoralists during the summer, due to the presence of the Halfa scheme and the spread of *Prosopis Glandulosa* (Mesquite) trees. During the winter the rangeland situation in Butana is better. Thus around (94%) of the pastoralists graze their animals inside Butana and the rest move to Gezira, mechanized schemes and irrigated schemes.

Regarding the external mobility (outsiders), it was found that six out of the eight animal routes were closed or their limits were unclear. The remaining routes are too narrow and no services are provided along them. During the discussions, unauthorized expansions of mechanized farming were repeatedly accused of closing routes and thus putting pressure on the remainder. This situation and the difficulty of passing through have also generated problems for the farmers. Some open their schemes even before harvesting, but only if the pastoralists are prepared to pay. Where farmers own animals, a phenomenon widely spread in Gedarif state, pastoralists have no option other than to graze inside the schemes and to fight with farmers over their traditional rights [8].

6.4 Change in Herd Composition and Size

The abandonment of mobility has forced pastoralists to shift from a more varied herd composition and to limit the herd to just one or two animal species. Having different kinds of animal (camels, cattle, sheep and goats) was one of the traditional strategies adopted by pastoralists living in arid and semi-arid lands [1].

Camels and goats prefer browsing while sheep prefer to graze grasses [25]. Besides its efficiency in the ecosystem, this strategy provides pastoralists with diverse animal products and can be used as a risk management strategy. In response to the question about the type of animal before 1970, around (83%) said that they used to graze all four types of animals (camels, cattle, sheep and goats) and the rest (17%) mentioned more than two types. This strategy is no longer valid and today pastoralists generally restrict their herds to one or two types.

Livestock numbers have been steadily decreasing and there is a clear tendency towards small ruminants mainly sheep (Table 1). The table shows that only 58 households were having camels in their herds compared to 172 and 177 households who owned sheep and goats respectively. It shows also that three hundred sheep is the maximum number owned by households compared to 100 for cattle and camels. Moreover, the table shows that the mean herd size was around (28) camels, (18) cattle (30) goats and (111) sheep. The shift in herd composition is connected with the constraints imposed on spatial mobility. The increase in the number of goats is due to the fact that goats can eat everything and do not need to move long distances for that. Moreover, goat is considered as a main source of milk for households in Butana. This idea appeared in the discussion as

one of the old people explained the current situation. He said they had lost everything, even the “goat for the morning tea”. Cattle are held in smaller numbers as cattle are sensitive to drought, need more water and require more fodder compared to other herd species like sheep. In addition, people in Butana have attributed the sharp decrease in cattle to an unknown disease brought by outsiders. The constraints in mobility coupled with the shift towards a market economy have forced pastoralist to get rid of large animals (cattle and camels) and concentrate on small ruminants like sheep and goat. This current trend has both negative and positive consequences.

A negative consequence is the degradation of natural vegetation, mainly grassland, due to the concentration of sheep and goats in restricted areas all year round. Having smaller herds reduces insurance against shocks and makes any recovery process more difficult and time consuming. Moreover, concentrating on sheep will disturb the ecosystem, since bushes or trees are not suited for sheep rearing [38]. The positive consequences include faster reproduction and easier access to market. Sheep need less herding management as they can graze around the settlement or in the schemes without many people to guard them. Moreover, this shift has led pastoralists to diversify their income sources to secure their livelihoods in a changing world.

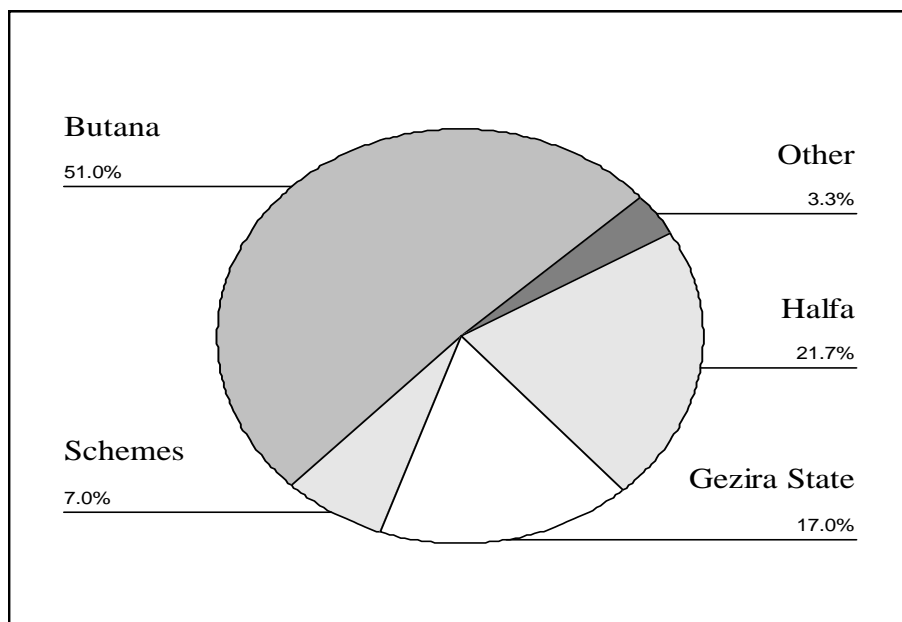


Fig. 5. Grazing areas in summer-Butana area

Table 1. Distribution of animals among households

Animal species	Number of households	Minimum	Maximum	Mean
Camels	58	1	100	28
Cattle	102	1	100	18
sheep	172	5	300	111
goats	177	1	200	30
Donkeys	234	1	3	2

Source: fieldwork

6.5 Livelihood Diversification

Regarding their current main job, (71.1%) of the total households surveyed in Butana were farmers, an activity which was considered as a secondary job in the past, and only (9%) mentioned pastoral farming as their primary job. The rest were teachers (13%), daily workers (1%), nurses (3.3%), drivers (1%) and traders (1.7 %). These figures have confirmed the sharp decline in pastoral farming and at the same time indicated that crop farming has become a dominant economic activity in Butana. This decline in pastoral farming has been confirmed by governmental data. According to the official censuses, the number of pastoralists in Sudan decreased from (13%) of the total population of the country in 1956, to only (2%) in 1993.

The constraints imposed on mobility have forced pastoralists to diversify their livelihood and create additional income sources [38]. In responding to the question of what was their secondary job before 1970s besides herding, the respondents mentioned activities closely related to the pastoral economy, such as making handicrafts and selling animal products. Recently, the secondary sources include daily workers (33.3%), petty traders (45.2%), and drivers (7.5%) animal sellers (4.3%), water sellers (3.2%) butchers (3.2%), watchmen (2.2%) and teachers (1.1%). These figures confirm the shift in pastoralism from a subsistence to a market oriented economy. This shift has eroded most of the good social values related to the communal system such as collective work, solidarity and peaceful coexistence. Poverty, conflict and socio-economic stratification are rapidly increasing among pastoral communities. Mobility constraints have exacerbated the vulnerability and socio-economic inequality of rural communities who traditionally derived their livelihood from livestock rearing in an arid and semi-arid ecosystem where climate is uncertain [38]. Table 1 shows the huge variation in the number of animals per household in Butana. A small number of people owned more than (300) sheep while the majority

had only five and 128 households had none. Those who have few or none are increasingly dependent on local markets, serving the wealthier people as hired herders and working as wage labor in the surrounding centers. The widening gap between rich and poor has reshaped most pastoral communities in Sudan.

7. CONCLUSION

This paper concludes that spatial mobility is the best practice strategy for pastoralists to survive, given the harsh nature of dry lands. In the Butana area this strategy has been constrained by the encroachment of mechanized farming on grazing land and traditional animal routes. The conversion of communal land into state property has significantly decreased the amount of grazing land and restricted the pastoralists' freedom of movement. This ongoing process of pastoral land grabbing will continue if no serious action is taken to address the issue of land tenure in the country.

To survive despite mobility constraints, pastoralists have diversified their income-generating activities and shifted from a subsistence to a market economy. There is a clear tendency towards smaller ruminants, mainly sheep, instead of having four livestock species as was the strategy in the past.

In the view of this paper Hardin confused two different terms: "open access" and "communal access". Perhaps he would have been right if the title of his theory had been "the tragedy of open access". This paper rejects Hardin's view that communal access brings ruin to all. In Butana the land was accessed communally and governed by customary rules respected by all. Herskovits's and Hardin's views need to be rejected, along with their distorted image of pastoral farming. Recognition of pastoral farming as a valuable form of livelihood in dry lands should replace the still predominant view which sees pastoral farming as a system of "no hope". The top down approach needs to be rejected and pastoralists'

voices need to be heard. If not, poverty, inequality and tension within pastoral territories will increase.

COMPETING INTERESTS

Authors has declared that no competing interests exist.

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