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Babiker Abbas and Peter Tilley

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Pastoral Management for Protecting Ecological Balance in Halaib District, Red Sea Province, Sudan

Babiker Abbas & Peter Tilley

The inhabitants of Halaib District are agropastoralists who practise an extensive ranch-like production system. There are three major features of this system: Mixed herd structure; immobility; and rain-fed agriculture. This paper concentrates on two significant trends in the area, that is, attempts towards specialization and towards permanent agriculture. Such trends imply imbalances. These could, generally speaking, be countered through diversifying income sources, through assisting in maintaining environmental balance, and lessening urban-bound emigration. Technical inputs, such as reseeded, goat improvements, the use of concentrates, better marketing, etc. should be undertaken with such goals in mind.

Introduction

The majority of studies on pastoralism are centered around sociological or political issues, despite the realization that the life of pastoralist groups is entirely dependent on livestock. Therefore, more emphasis should be placed upon animal ecology in any study aiming at highlighting the components of the pastoralists' way of life. This paper describes the results of surveys conducted in Halaib District, one of the most arid regions in the Sudan, with the purpose of illuminating the interactions between the inhabitants and their hyper-arid environment in relation to livestock keeping. The aims of the study included: a) determination of herd size and herd composition per family; b) patterns of pastoralism and herd management; c) sources of fodder/feed, especially during the critical dry season; d) other professions practiced; e) livestock marketing, and f) problems and constraints facing livestock husbandry.

Study Area

Halaib District occupies the north-eastern corner of the Sudan, bordered by Egypt to

the north and the Red Sea to the east (21–23°N, 34–37°E), having an area of approximately 80,000 square kilometers. The District is traditionally the home of five subtribes all of Beja heritage. These, in order of dominance, are, the Bishariin, the Atmaan, the Amarar, the Hunner, and the Ababda. The Rashaida Tribe visit Halaib district, with their rather large herds of camels, for a short period from March to May to graze the "winter pastures" of the coast. They never stay permanently, nor do they venture deeper inside the district. Bishariin, the dominant ethnic group in the area, are a very peaceful people and the area is politically stable.

The District is longitudinally divisible into four distinct areas; the coastal strip, the hills area, the flat lands, and the Tamarab, an area constituting the confluences of the major *khors* (waterways flooding during a rainy season) which run throughout the district. The coastal strip is occupied by small towns or settlements, the largest of which are Sala Asir, Dungunab, Mohamed Qol, and Halaib. The hills constitute the bulk of the district and begin at about 50km from the coast, then extending for another 30–50km in the form of countless mountains transversed by numerous *khors* which drain

into the Diib, a large confluence which carries most of the mountain drainage to the Red Sea. Whereas the coastal strip is almost completely devoid of trees and has very little pasture, the hill areas hold good stands of trees (*Acacia* desert shrub) and grasses (*Panicum*, *Aristida* sp.), the latter abounding especially in the khor beds. The flat lands or plains are low lying lands of excellent (volcanic) soils, and are characterized as the confluence of major khors, some of which do not proceed to the sea. This area of easily flooded land (especially the Diib) is actively utilized for the cultivation of sorghum during a good rainy season. "Tamarab" refers to the area occupying the south-western corner of Halaib district and is characterized by larger rainfall than all other areas receiving rains during both winter and summer. The Tamarab is richer in forests than the rest of the district. It also receives run-off small khors which do not proceed to the Red Sea.

Rainfall in Halaib District is very erratic and unpredictable, although the area, as part of the Red Sea Province, is assumed to have an annual mean of 150mm, during the winter season (October–February). However, during the last two years the area did not receive more than 60–70mm of rain on average.

In 1987, Euro-Action Acord started a development project in Halaib District, with emphasis on improving the existing life-support systems, as well as studying possibilities of innovation. Since the area is traditionally dependent on livestock, efforts were undertaken to evaluate the situation of livestock keeping, and to study the interaction of the inhabitants with their environment. Although the project is interested in the district as a whole, a smaller area, referred to as the Programme Area, has been selected for intensive study and action. This area is located near a central spot in the foothills and close to a rather large settlement called Sufayya. Therefore, much emphasis was placed on this area, although the study to be described was conducted throughout most of Halaib.

Mixed Herd Structure and Agro-Pastoralism

A total of 311 herds were surveyed. Of these, 304 were mixed herds, in which camels, sheep, goats and donkeys were raised. Only 7 herds did not contain camels. The grand mean herd structure consisted of 6.8 camels + 19 goats + 17.5 sheep + 0.5 donkeys. However, in Sufayya the mean herd structure consisted of 4.2 camels + 6.3 sheep + 11.4 goats + 0.09 donkeys in the 94 herds surveyed. It is clear that these pastoralists in the programme area raise less animals than the adjoining areas (Table 1), with the difference being decidedly significant in the case of both sheep and goats. An explanation might be offered if we consider the data in Table 2, which shows that cultivation and professional activities accounted for up to 59% of undertakings, in comparison to 41% of the activity relating to livestock raising. This pattern of "agropastoralism" of the population in the area is made more obvious by Table 3 where 74.5% are agropastoralists, as opposed to 19.1% who are pastoralists "livestock only", and 6.4% farmers "only cultivators" (for the classification, see Hjort, 1988). This is in sharp contrast to the other survey areas where 67% to 100% of livestock keepers are "pastoralists". The pattern of pastoralism practiced in the area is unique in that it involves very little or no mobility from the homestead. The 89% of the livestock keepers in this area are sedentary. Their manner of pastoralism resembles one of communal ranching. Natural pasture is the main source of livestock feed, supplemented in the dry season by purchase of concentrates (74%), or by gracing the residues of the Diib valley cultivation (18%). Few people (1.25%) take their livestock as far as Tamarab or the coast. People who managed larger herds in Sufayya area had more mobility, especially during the rainy season in Tamarab, lying further south (June–September), or into the coastal plains during the winter rains (October–March). This is a brief period of pasture grazing similar to that practiced by nomadic pastoral-

Table 1. Herd composition by sampling site in Halaib District

SAMPLING SITE	MEAN NUMBER OF ANIMALS/HERD			
	Camel	Sheep	Goat	Donkey
Sufayya	4.2	6.2	11.4	0.1
Salala Asir	7.9	35.0	32.7	1.4
Halaib	10.0	18.0	16.0	0.3
Jebet Elmaadin	5.6	16.0	20.8	0.1
Whole study area	6.8	17.5	19.0	0.5

Table 2. Activities of single livestock owners in Halaib District

SITE/ ACTIVITY	Halaib		Salala Asir		Jebet Elmaadin		Sufayya	
	No.	%	No.	%	No.	%	No.	%
Animal rearing	38	74.5	30	68.2	39	60.0	42	41.2
Cultivation	00	00	00	00	10	15.4	42	41.2
Professions	10	19.6	9	20.5	3	4.6	18	17.6
Wage labour	2	3.9	4	9.0	13	20.0	00	00
Other	1	2.0	1	2.3	00	00	00	00
Total number of respondents	51	100	44	100	65	100	102	100

ists of western and central Sudan, but is of very little real effect since 89% of the pastoralists in Sufayya area do not move anywhere. Besides the rainfed agriculture of sorghum, a considerable number of respondents in

the programme area are practicing date palm and citrus cultivation along khors which have good water potentials. This has been discussed previously (Abbas, 1988), but it is important to note the excellent

Table 3. Patterns of pastoralism in Halaib District

PATTERN/ SAMPLING SITE	Sedentary		Transhumant		Nomadic		Total number of respondents
	No.	%	No.	%	No.	%	
Halaib	111	58.2	40	20.9	40	20.9	191
Jebet El-Maadin	139	63.5	18	35.6	2	0.9	219
Salala Asir	66	62.3	24	22.6	16	15.1	106
Sufayya	218	89.3	26	10.7	00	00	244
Whole area	534	70.3	168	22.1	58	7.6	760

contribution of this emerging practice as a source of stability in the area. The full benefits, however, will be realized later in the future, and if consultation and material assistance is provided. Besides "tying people to the land", agriculture supplements the simple Beja diet and provides a highly valued exchange product.

Herd Management

The division of ownership into single/multiple owners is apparently of no practical value in this area. This is clear from the observation that 80% of multiple owners in fact belong to one single family. This is a herd management procedure rather than true multiplicity of ownership, including decisions concerning sale and/or slaughter by various families. It is clear that a flock of goats, herded as one unit and attributable to a certain family, is indeed owned by several adult female and male individuals. This principle further emphasizes the cooperative or communal ranch concept within the method of pastoralism practiced in this area.

The majority of herds are managed by the owner (83%), a few by a son (8.5%) or relative (5.3%), and about 3% of the herders in Sufayya area are hired. The usual way of paying is with money and/or camels. On the average, a herder is paid 600 Sudanese pounds/month. Under these circumstances, the hired herder also receives some coffee and clothes, but on rather infrequent occasions. When the pay is in camels, it usually consists of one young camel per 50 camels herded per year. In the latter circumstances, the herder usually had his sheep going with the herd and was assisted by another family member. The practice of hired herders is rare in Sufayya and is apparently adopted by absentee owners. The search for owners of large herds for interviews was unproductive in the Programme Area, as the herder is mainly hired to look after animals for someone who is necessarily non-pastoralist, and most likely has a job or occupation outside the area. Most of the labour in herd management is spent in watering animals by drawing water manually from wells dug in khor beds. Other activities included the burning of trees, collection of Acacia pods and making mats, bags, or ropes. Since these latter activities are undertaken by females,

no precise figures could be collected. This, however, could indeed be an aspect for innovation when more information on the subject is gathered, such as level of expertise, equipments used, and marketing opportunities.

Livestock Marketing

The two major markets for livestock are Egypt and Port Sudan. A few animals are marketed locally, especially in Jebet Al Maadin. Estimates of market commerce are always subject to underestimation because of the inherent admittance of success or for fear of taxations. Of 94 persons interviewed in Sufayya area, 68 sold livestock in the preceding year. This, as a mean per person, consisted of the sale of 0.8 camels, 2.1 goats, and 1 of sheep. In total, 270 animals were sold by 68 respondents, approximately 4 animals per person, giving an off-take rate of 13% of the total herd. This is an excellent marketing rate in comparison with previous trends in other pastoralist communities, but still below the recommended rate of 20–25% (cf. Abbas, 1987).

However, the need for more marketing of small ruminants is obviated by the marginality of land, the resident pattern of pastoralism, and the lack of economic diversity. Another consideration is that only male goats are marketed, a factor which leads to uncontrolled population growth. A factor preventing the sale of productive female goats could be the active extraction of butter and the preparation of a good supply of ghee both for sale and family consumption. As the milk production per female goat is appreciably low, one has to raise a rather large flock of goats in order for ghee production to become a surplus. This is a very important consideration, because if this trend is to be maintained, range production should be increased or upgrading of native stock should be instituted, so that the same (or indeed less) number of goats need to be kept per family over time. Ghee is the principal product of the hill population and is used for conversion to grain, as cultivation

is negligible. Supportive activities to ghee shortage included wood cutting and charcoal production, and should be viewed with dire caution. Thus, as the survey demonstrated, such activities as charcoal production were a main activity (56%) during the summer, possibly as a result of failing rains.

The possibilities for increasing off-take through marketing can be encouraged by incorporating additional costs to production. An obvious cost item, in the absence of livestock taxes, is the option of using concentrates for finishing-off stock for sale. As the interviews demonstrated, about 68% of the pastoralists in Sufayya already use concentrates in the form of sorghum during the summer, as pastures diminish in quality (Table 4). Pastoralists in the mountains do not use grains, and depend on pods collected from Acacia trees. These pods, although highly nutritious (containing a high amount of proteins), are not available except during a very short period between March/April and June/July, and obviously not in sufficient amounts. The group earlier referred to as the "Hills Shepherds" (Abbas, 1988), is the main one of concern when discussing the need for increasing off-take through sale. Range can rarely be improved in this area because of the lack of khors large enough to be developed. The only option is for provision of concentrates in the form of cakes (cotton seed, sesame, groundnuts, etc.) at market price, in the area. Obviously, this will be resisted in the beginning, and efforts should be undertaken to explain the advantages of an earlier sale. After the use of concentrates is established, upgrading of the native goat stock can be arranged by introduction of bucks of the larger Nubian goat from accredited centres, featuring both milk and meat hybrids.

It is clear that the Beja are highly aware of the sharp competition between the different age groups in a flock for food, especially for Acacia pods. It was frequently observed that a man or a woman will be leading a band of goats (e.g. milking goats one year old) separately, and fetching pods for them by shaking branches from several trees. Other

Table 4. Dry season feeding in Halaib District

Sampling site/ Feeding	Pasture only		Purchase fodder + pasture		Scheme residue + pasture		Concentrates + pasture		Total number of respondents	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sufayya	6	8.1	00	00	13	17.6	55	74.3	74	100
Salala Asir	19	43.2	9	20.5	6	13.6	10	22.7	44	100
Halaib	7	8.6	19	23.5	00	00	55	67.9	81	100
Jebet Elmaadin	6	10.3	00	00	13	22.4	39	67.3	58	100
Whole study area	38	14.8	28	10.9	32	12.5	159	61.8	257	100

animals from the same flock are promptly kept away. It is thus hoped, and indeed expected, that the availability of a source of concentrates would offer an opportunity for better feeding. Additional benefits of a wider use of concentrates include the possibility of some clans or individuals specializing in sheep fattening. It is worthwhile to consider the prospects of a fattening cooperative in which willing participants supply the unfinished stock and participate in labour and marketing. The cooperative supplies concentrates, animal holding pens, and arranges sales with the participation of selected members. Cost of finishing animals is deducted from the participant on per capita (animal) basis, after sale of stock. The same arguments apply to sheep owners, who can be expected to realize the benefits of better feed more quicker than goat owners, as sheep are non-browsers and rely mainly on grasses and grains, both in short supply.

The establishment of a weekly market, in a central location can augment animal marketing. The "market day" can be an opportunity for exchange of products between the two or three ecologically distinct groups, as well as introduction of rare items from

outside. There is always the reservation, truly justified, that markets "open up" too much, and could lead to alteration of the conservative Beja habits in regards to consumption. But we should remember that the inhabitants do indeed travel a lot to Port Sudan (at least) and participate commercially in various way. A local market reduces the gap between urban consumers and rural producers in as far as availability of commodities; circulates money inside the rural community; decreases dependence on specialized agents (livestock dealers, grain dealers etc.) by direct contact between consumer/producer; and promotes bartering which is virtually nonexistent in urban markets.

Camels

The vast majority of surveyed pastoralists (304/311) in the study area raised camels together with sheep, goats and a few donkeys. Because of camels' adaptability to the harsh arid conditions, their survival on very marginal lands and tolerance of lengthy trecks while browsing, these animals are obviously the most suited species in the area.

Also, the mild impact of camels on vegetation (top-cropping) and browse (wide circumference of grazing/browsing zones) match very well with aridity, in relation to the slow regenerative capacity of such areas.

Two principal sub-breeds of camels are raised, both of them of Bishariin origin; the Aririit, suited and adapted to salty herbage, and the Hipklot, a tree browser, adapted to high fiber and legnin diet.

The camels are utilized mainly as a capital (breeding stock) source (81%), but other uses include riding (9%), and pack camels (0.1%), sale (6-7%), and specifically for races (2.9%). The figure obtained for camels specifically bred for sale (6-7%) gives an indication of off-take rate, which is far below the admitted "actual" off-take rate of 14% (for Sufayya area). From a comparison of actual sales of camel (1987) it is evident that people in Sufayya and Jebet have sold 14% and 17% of their camels, respectively, whereas people in Salala Asir and Halaib have sold 5.3% and 6.8% of camels, respectively. These variances could be due to true differences in the mode of living between pastoralist and agropastoralist groups in response to differences in their environments. For example, the pastoralists in Halaib and Salala Asir are less dependent on cultivation, as they are more mobile and

invariably keep larger flocks or herds of animals than the agropastoralists of Sufayya and Jebet. The latter have cultivation, keep fewer animals, move very little (or do not move at all) and can thus be more active in trade. This was clearly reflected by information related to the patterns of Diib utilization. Between 26% and 66% of the respondents came to Diib from Jebet or Sufayya for cultivation/grazing, whereas only 5.9% from Salala Asir, and none from Halaib, came into the Diib for that purpose.

The low percentage of camels (0.1%) used as burden animals is in line with the relative immobility of the population and the smaller sized breeds of camels raised.

Problem and Constraints

This part of the survey was meant to make the pastoralists voice their own conception as to what they consider problems in their livelihood. The original idea was for the problems to be graded (by the surveyor) beginning with what the pastoralist considers as his first problem and so on. This was not strictly followed and a list of complaints was compiled instead. Accordingly, these were graded on a percentage scale, and complaints attaining 10% or more were considered significant.

The main problems were as follows:

Complaints	% of respondents of all the study areas	% of resp. in Sufayya
Predators (on livestock)	25.2	48
Skin diseases (all animals)	19.7	16.9
Calf mortality (camels)	14.5	14.3
Water supply	10	10.3
Pneumonia (goats and sheep)	10.3	5.2

A total of 290 herdsmen participated in this part of the survey. There was a noticeable agreement from all the survey sites on these problems, with a few exceptions related to the frequency of complaints of the same problems rather than voicing a different problem. The only exception is the complaint from Salala Asir about pastures (15.6%) and digestive-tract diseases (10.9%), which were not shared by the rest of the area.

An encounter with the predator problem was made from the hills surrounding Sufayya. Observations over four days validated the complaint of the inhabitants. Although direct sighting was not made, evidence was collected for the existence of a wild carnivore species that killed regularly at the rate of 1-2 domestic animals a day. The animals were apparently a nomadic band because it completely abandoned the Sufayya site for somewhere else, most likely in the neighbouring camps.

Predator control is needed, but it must follow better efforts to determine the species involved, in order to adopt the best procedure. The several diseases mentioned by the herdsmen can all be cared for by an adequately trained para-vet. The area suffers a shortage in this aspect, as well as in the classical aspect of remote areas and their deprivation of even the meagre quota of animal medicines. A short intensive field course can fill this gap. To make the best out of such an effort, herdsmen should be recruited for training in simple health procedures. Young men from the scattered camps can be asked to join and be given a preliminary exposure in basic health procedures. This will have benefits in the future when more selective action (livestock upgrading, cooperative feed lots, cheese making) may be contemplated.

Discussion

In Halaib District in general, and in the Sufayya (Programme Area) in particular, people keep a mixed herd of livestock by combining variable numbers of animals. Tribesmen living near the coast are predomi-

nantly "true pastoralists", relying mainly on animals. In contrast, the inhabitants of the Programme Area are predominantly "agro-pastoralists", keeping less livestock, largely immobile, and are more actively involved in livestock trade. In addition, they actively cultivate grains, sorghum, and have started to establish permanent plots of fruit trees on certain locations where water potential is exceptionally good. The aridity of the area, and its relative isolation, have acted as ecological imperatives, allowing no trial and error approaches to self-improvement of the conditions. A state of balance with the environment seems to exist and in the absence of climatic or severe demographic/geopolitical changes, the area apparently needs very little from the outside world. However, this balance is very fragile, and is maintained by a diversity of tactics e.g. social networks of solidarity, prohibition of "unnecessary" expenditure, and conservative use of the environment. Since animals are the mainstay of family stability, extra sources for cash in the face of an unexpected rise in grain prices would involve more drastic use of the environment, particularly the cutting of trees (viewed as "collection of wood") and charcoal production. Other forms would be emigration to urban centres, which is in effect a total disuse of resources (Morton, 1988).

The forgoing analysis does not include any notion of those who do not own livestock. The crux of the study's averages have been obtained for the various species, which in the absence of a general animal census should be used as a "worst situation" estimate. Any family or group owning less than these amounts, and residing in the area on permanent basis, should be considered as the most disadvantaged. This group could form the basis of surplus labour, waiting to be utilized or to emigrate. The general trend of "mixed herds" means that true professionalism or classification as livestock breeders does not exist. There is, however, the finding that a small group of pastoralists are owning only camels (7 out of 311). This has been considered in the general pastoralist

literature as an indication of emerging trends towards specialization; and especially in camels, it has been observed elsewhere as well (Abu Sin, 1982). The significance of this observation is its indication of changing adaptation in opposition to stability of land use. Some people are finding that this area is ideal for camel raising.

However, the sole production of camels is not entirely possible for a family residing in the area, due to the needs for milk. The breeds of camels for which this area is most suitable are the light breeds, which have low or negligible milk yield. This could mean that these emerging professional camel owners do not reside in the area. The value of this observation is that such a trend could be guided and (technically) applied to camels. This will indeed add a vigorous dimension to camel keeping and will allow for an adequate occupation for numerous herdmen, with good rewards.

The authors of these notes are truly impressed by the great potential of this area for race camel breeding, both climatically and socially. With racer camels, one never need worry about overstocking as the herd is always a small group of breeding females, and includes a single bull which could be used by several breeders. The rewards, both material and social for the area are great, because of the high demand for race camels and the attraction into the area of racing organizations from Sudan and the Arabian markets. If well utilized, such activities could localize this profession in one of the coastal towns bringing obvious vigour to these areas and an accessibility by the tribesmen from the more western plains.

Goats are the principal household animals, and are kept by almost all families. In the hills surrounding Sufayya to the east and north they are virtually the only animals raised. Goat keeping is characterized by the following features: a) high rate of inbreeding—the concept of introduced males is unknown (or unused); b) overstocking—since only males are marketed, or under-marketed, there is always a semi-exponential rise in a goat keepers' herd. Inbreeding

further exasperates the inferior traits of this already weak, dwarf goat breed which predominates the area. Over-crowding causes unnecessary competition for food and jeopardizes herd health. The inputs in herd management are watering (an obviously laborious task) and pruning or depodding of trees.

The immobility of the population, raising mixed species of animals in the same locale, and supplementing livestock husbandry with some cultivation, very much resembles a basic form of ranching. The trend towards "group-herding", practiced throughout the area, further illustrates the possibility of cooperative ranching developments. A first step in probing this possibility is the pilot establishment of a sheep (and male goat) fattening project of a cooperative nature, the results of which (feasibility, social impact etc.) can be judged within one year. Additional fodder could be grown in Diib during sorghum cultivation, in addition to the collection of post-harvest residues. The establishment of a market town could add a catalysing effect to these endeavours. The need for diversifying occupations in this area is obvious from the survey of seasonal activities, as well as from the existence of surplus labour. In addition, providing income alternatives which match with the ecosystem, is a safeguard against further attacks on the weaker assets of this highly fragile system, namely, trees. Other resources of the area, in a horizontally-oriented primitive industry, such as the small-scale "iron ovens" for melting cast iron could be adopted. These ovens are cheap, can be installed in several camps, and people trained to operate them. The ovens can be used locally for the making of basic farm tools for use in the area or in other areas in the Red Sea Province.

Other potentials include two goat products; hairs for the making of mats, bags, etc., and the diversion from ghee cheese production, at least partially. The manufacturing of hair will benefit the women groups directly, and goat keepers could realize an additional income which could be used in increasing

the nutrition of their herds. Research is needed into the present situation of hair manufacturing, but it could very well be started with a call for goat hair to be purchased by the project, thus appraising the potentials of supply. The raw material can be sold in Port Sudan, Kassala, or New Halfa towns where pastoralists from other areas often come for supplies. The activity of goat shearing will be a resourceful occupation for some, and will also have positive health implications by directly reducing skin diseases. If, however, spinning sheds or some sort of industrial organisation is established, the raw material can be used at home, which further augments the value of this activity. The product can be marketed in Port Sudan or Khartoum.

Cheese making from goat milk requires a good source of fodder, and a better breed of goats. Both are long term or medium term projects, but should be contemplated especially in view of the intended developments in the Diib (Agricultural Project under consideration by EEC and Sudan Development Corporation). The other technical implements are quite simple and can be adopted by receptive herdsmen. It is also possible to prepare cheese from milk after butter extraction, since the method of extraction now used leaves about 30-40% of milk fat unharvested. The upgrading of the local goat stock is relatively easy and efforts could begin now with the introduction of goats from Khartoum, Shwak or the Nile Province, so that when better dairy type of goats are needed, most of the need can be met locally.

References

- Abbas, B. 1987, *Survey of Camel Husbandry in the Northern Butana*. Addis Ababa: International Livestock Centre for Africa. Group Document No.12.
- 1988, *Preliminary Report on Livestock and Ecology in Euro-Action Acord Red Sea Hill Programme Area*. Khartoum: Euro-Action-Acord.
- Abu Sin, M. E. 1982, "A Change in Strategy of Animal Rearing among the Nomads of the Butana, Eastern Sudan: A case study in adaptive response to change in the semi-arid areas of the Sudan", in Gunther Heinritz (ed.), *Problems of Agricultural Development in the Sudan*. Ettingen.
- Chabeuf, N. et al. 1988, *Ecology of Camels in Butana Plains of the Sudan. 1: Herd Structure*. International Symposium on Animal Production in the Sudan, Khartoum, January 1988.
- Hjort, A. 1988, "Sustainable Subsistence in Arid Lands; The case of camel rearing", in A. Hjort (ed.), *Camels in Development*. Uppsala: Scandinavian Institute of African Studies.
- Morton, J. 1988, *The Decline of Lahawin Pastoralism*. London: Pastoral Development Network Paper 25c.

Babiker Abbas, B.V.Sc. Vet. Medicine from the University of Khartoum, M.Sc. from the Colorado State University (natural resources), M.Phil. from the University of California Davis (biomedical statistics), Ph.D. from the Davis University (epidemiology). Dr Abbas works recently as an associate professor in veterinary medicine at the University of Khartoum.

Peter Tilley, B.Sc. in engineering and M.Sc. in agricultural and rural engineering from the University of London. He has worked as a programme coordinator for the Red Sea Hills Development Project of Euro Action Acord 1986-88.