1. INTRODUCTION TO RED SEA PROVINCE

The section below is intended as a general introduction to the papers that follow for those unfamiliar with the Sudan and Red Sea Province. It is not a literature review and was not written for the specialist. Those with some expertise on the Sudan and Red Sea Province may skip over this section.

The Sudan, the largest country in Africa, is composed of nine Regions: Bahr al-ghazal, Central, Darfur, Eastern, Equatoria, Khartoum, Kordofan, Northern, and Upper Nile. The Red Sea Province, the northern half of the Eastern Region, located in the extreme northeast of the Sudan, is almost the same size as Britain; they measure 217000 and 230000 km^2 respectively. The Province is situated between 17 and 23 degrees north of the Equator and 33 to 38 degrees east of Greenwich. Through Red Sea Province is the only outlet for Sudan to the sea (see Map 1.1 below). The mountainous province rises like an island out of the monotonous plains of southern Eastern Region and descends abruptly onto a narrow coastal strip.

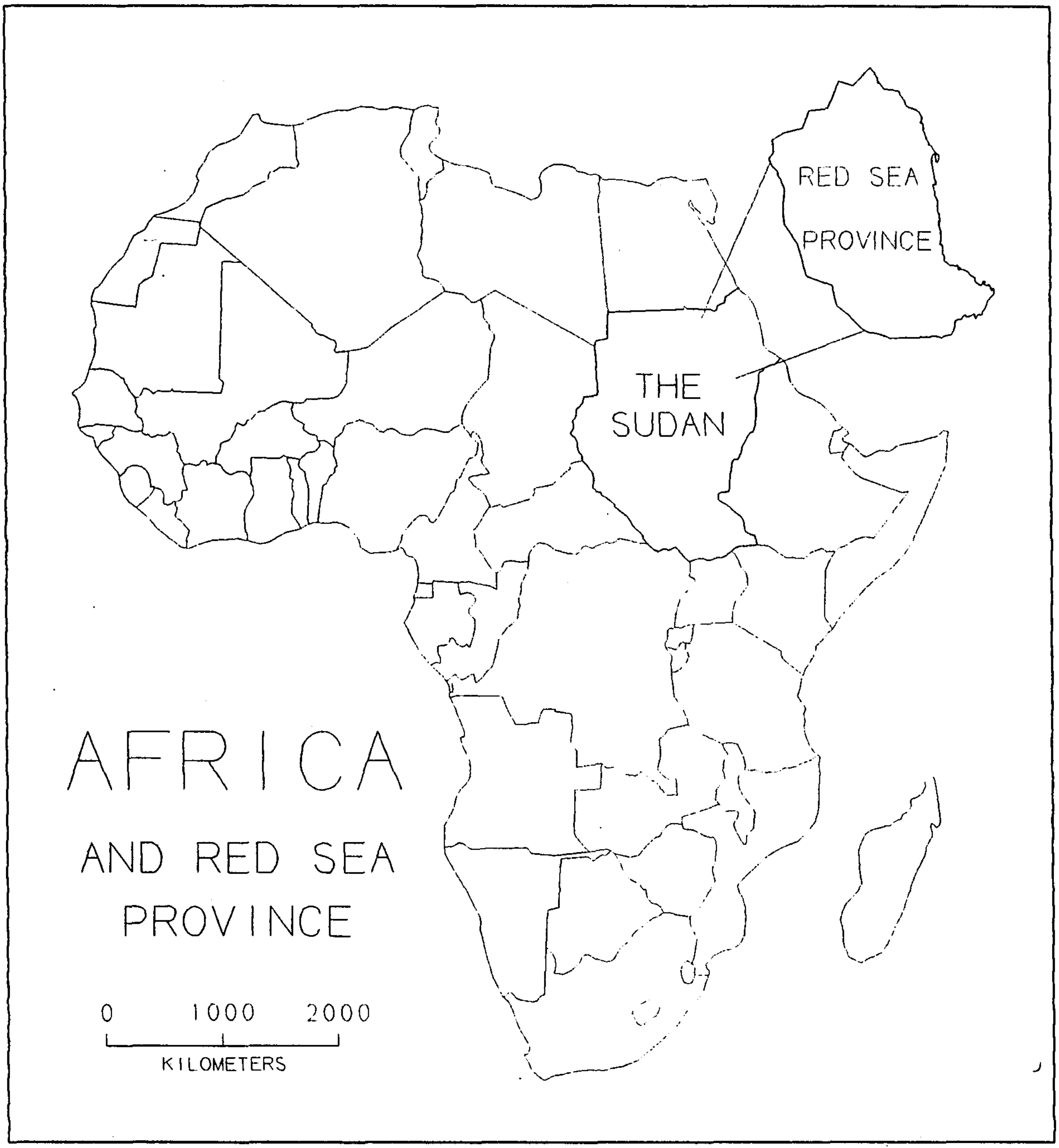
Physical Geography

The Red Sea Hills are located from Egypt to Eritrea in a belt that runs in a north-south direction from about 15 km west of the Red Sea coast to about 150 km inland. The highest peaks of the mountain range are found along the Eritrean border (9100 feet), northwest of 'Aruus at Jebel Oda (7412 feet), southwest of Muhammed Qul at Jebel Erba (7274 feet), and southwest of Halaib town at Jebel Asoteriba (7272 feet). West and southwest of the Red Sea Hills leading to the Nile and 'Atbara valleys are vast monotonous plains sometimes punctuated by tall solitary mountains.

The Red Sea Hills are part of the Red Sea Rift Valley formed by the divergent movement of the Arabian and the North African crustal plates. These plates, units of crust floating on a bed of heated, plastic mantle, are being pushed apart by the formation of new crust along the mid-Red Sea ridge, located at the bottom of the Red Sea aligned in a north to south direction.

The Red Sea Hills are commonly referred to as being composed of Pre-Cambrian crystalline rock. This means that the rock is of the oldest known on earth, formed in the geological era called the Pre-Cambrian over 570

Map 1.1. Africa and Red Sea Province.



million years ago. The Red Sea Hills are composed principally of gneiss and granites shot through during more recent times by vertical wall-like structures of other igneous rock in what are termed "dykes" by geologists. Many dykes are easily visible on the surface. Particularly picturesque pink granite dykes are found along Khor Sitareb in

North Tokar District. Gold, mined in Red Sea Province since Pharaonic times, is found only in the dykes. Emeralds are also found in such formations, however, there are no currently working emerald mines in Red Sea Province. Columnar basalt is visible throughout the province particularly in the south and southwest.

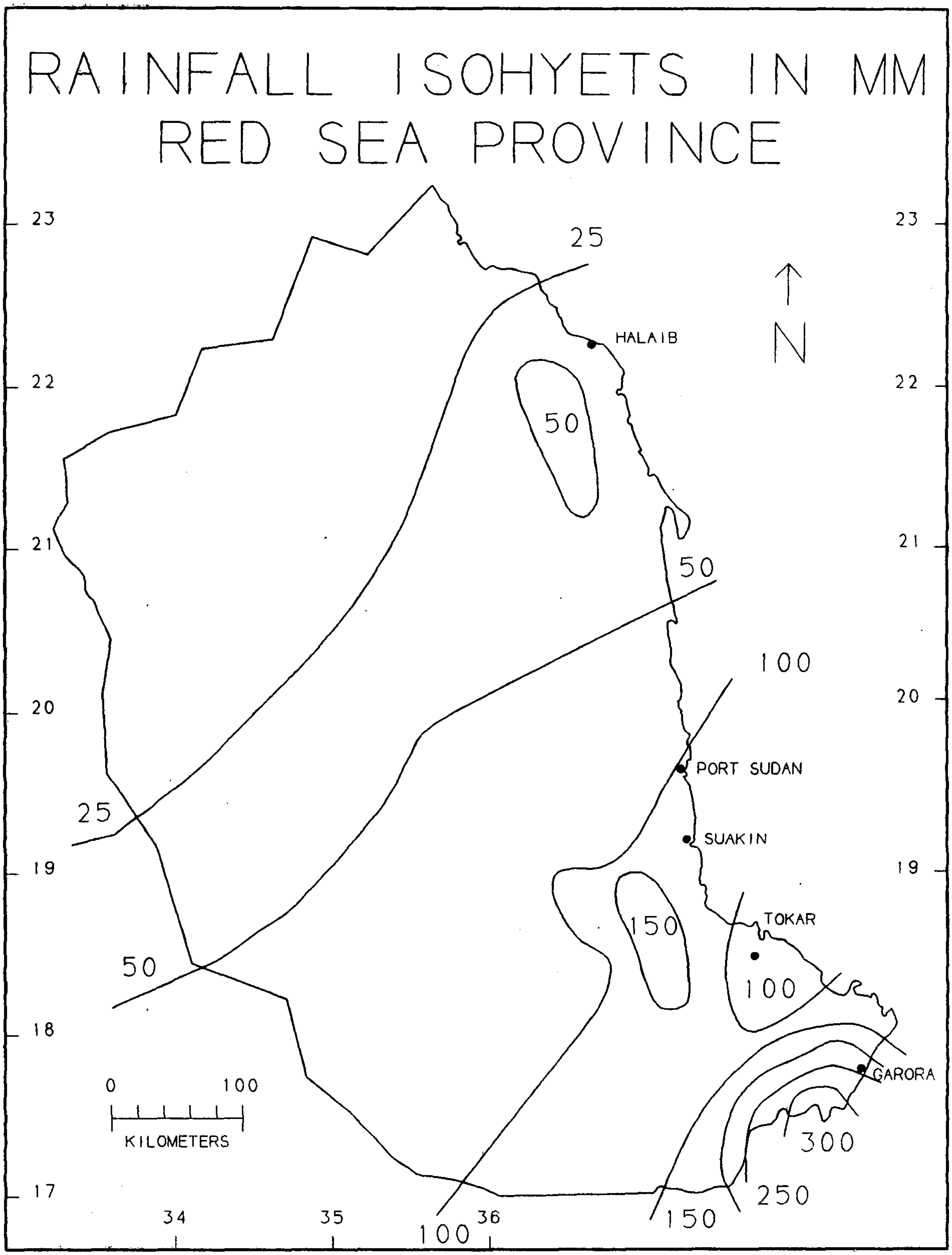
There are two alluvial fans of note in the province located along the Red Sea coast: the Arba'at and Tokar deltas. The Arba'at delta is located just north of Port Sudan and the Tokar Delta is located 150 kilometres to the south of Port Sudan. Although both deltas are used for agriculture and pastoralism and provide a measure of security against adversity, the Tokar delta is by far the more important of the two resources. The delta soil is particularly rich. It has been estimated by the Tokar Board that an average of four inches (about 9 cm) of new silt is deposited on the delta every year. This reduces the necessity for the use of fertilisers in farming.

Precipitation

Precipitation in Red Sea Province is light. The heaviest rain falls in the southern portions of the province. The Red Sea Hills, running in a north-south direction about 15 kilometres on average from the Red Sea Coast and extending about 150 kilometres inland, exert a positive influence on condensation and rainfall.

Rain falls in Red Sea Province as a result of two atmospheric mechanisms: the northward movement of the InterTropical Convergence Zone (ITCZ) in the summer and the dominance of the Northeast Trade winds in winter. The map below illustrates the rainfall isohyets for Red Sea Province in millimetres.

Map 1.2. Rainfall isohyets in Red Sea Province.



Political Organisation

Political organisation in the Sudan observes the following hierarchy: the State (al-dawla), the Region (al-iqliim), the Province (al-muhaafazha), the District (al-majlis), District Council (al-baladiyya), and the Village Council (al-qariyya). The Red Sea Province is divided into seven administrative districts exclusive of Port Sudan: Derudeb, Halaib, Haya, North Tokar, Rural Port Sudan, Sinkat, and South Tokar. District areas vary enormously (see the map below). The head of each District is the District Officer (dhaabit al-majlis) who administers the District through the District Councils. The District Council is administrated by the Administrative Officer (dhaabit al-idaara). Below this level are two more levels of representation at the village level. The 'umda represents the maximal lineage (the tribe) which may be composed of more than one village or settlement and the shaykh represents the minimal lineage which may also include more than one village or settlement. The principal official duty of the shaykh is to collect taxes on animals. In Red Sea Province deliberative bodies are situated at the Village, District Council, District and Provincial levels.

Infrastructure, Economic Activities, and Employment

The transport infrastructure of Red Sea Province is weak but good compared to the rest of the Sudan with the exception of Khartoum Province. Port Sudan is the rail terminus for the whole of the Sudan. Rail lines snake across the province from Port Sudan to 'Atbara and then to Khartoum to the south and Egypt to the north. Another rail line runs from Haya, between Port Sudan and 'Atbara, to Kassala and then to Khartoum. All weather road linkages between Port Sudan and the rest of the country are good. Local infrastructure, with the exception of Port Sudan itself, Halaib town which is linked to Egypt by a tarmac road, and the rail and road links designed to service the central part of the Sudan, is poorly developed. Travel is difficult and sometimes impossible during the rainy season. Map 1.3 below presents the road and rail infrastructure of Red Sea Province in graphic form.

Markets in and around Red Sea Province provide goods, buyers for rurally-produced commodities, and employment. There are seven formal markets around Red Sea Province and four outside the province boundaries of importance. These markets are Port Sudan, Tokar, Sinkat, Haya, Derudeb, Gebeit, and Halaib in Red Sea Province and Kassala, 'Atbara, and Aswaan outside the province. Port Sudan is by far the largest market in the province and a variety of domestic and imported commodities can be found there. There are a variety of informal markets around the province. Most of these specialise in certain goods, for example the roadside market south of Delay station where artisanal goods made from duum palm leaves (sa'af) may be found and local sorghum. Another example of a common form of market found along the coast in small settlements such as Ashat Souk, Abu Ramad, or Shalatayn are the small shops selling goods brought into the Sudan outside the auspices of the government.

Most towns in Red Sea Province have secular single-sex primary schools. Gebeit, Haya, Port Sudan, and Sinkat have secular single-sex intermediate schools for boys and girls. Port Sudan has the only higher secondary schools; one for each sex and the Comboni School.

Religious schools (khalwas) are ubiquitous throughout the province. Teachers in Red Sea Province come from all over the Sudan. Teaching posts in the province are coveted because Red Sea Province is considered a hardship post. Two years teaching in Red Sea Province qualifies a teacher to be seconded to Oman where the pay is much better than in the Sudan (Cole 1988).

Barriers to the education of rural and many urban children exist in Red Sea Province. There are not enough schools around the province to satisfy demand, the language of instruction is Arabic rather than Tu Bedaawi, uniforms are required, and, with the exception of a few boarding schools and Tokar town school, no meals for children are provided. Any one of these hurdles alone would pose a difficult obstacle to the enrolment and successful completion of primary and secondary school; together they mean almost no rural children go to secular school. In addition to these barriers, the rural people have themselves placed obstacles in the way of secular education; they regard secular education as sinful. They prefer instead to send those of their male children whom they want to educate to religious schools (khalwa). With the exception of one khalwa near Gebeit, female children are not educated in religious schools.

Manufacturing is for the most part concentrated in Port Sudan where an oil refinery, tire factory, textile mill, flour mill, bottling plant, salt production plant, and motorised vehicle assembly plant are located. Shipping and activities related to the port are the principal economic activities carried on in Port Sudan. Most goods are shipped from Port Sudan to other parts of the country by lorry or train. Oil is transported by lorry and pipeline to Khartoum. Warehousing is a major activity in Port Sudan.

There is a large informal service sector in Port Sudan that provides goods and services to the Port Sudanese. The most notable of these services are the vast cattle feedlots located just north of Daym al-wuhda which provide milk and other livestock products for the city. Other services are the well-articulated system of water distribution, the many small shops, bakeries, coffee houses, and restaurants and the numerous fuel and rural products retailers scattered around the city. Post Sudan has a large quarter, Daym al-warsha (Workshop Quarter), dedicated to minor industry. Here such trades as vehicle repair, welding, blacksmithing, and other metal-using industries are practised. Suakin, in decline since the bulk of trade, warehousing and shipping moved to Port Sudan in the early part of this century, has been the object of a recent renovation effort since the port in Port Sudan has become crowded.

There are three prisons in the province, two located in central Port Sudan and the other in Suakin, sixty kilometres to the south. There are four gold mines in the province, three in Halaib District and one in Haya District north of Musmar at Hasay. In Halaib District, there is an abandoned iron mine near Tumaala, an abandoned iron mine near Fudikwan, an abandoned chromium mine near Khor 'is, an abandoned manganese mine, and several abandoned emerald mines. There is an abandoned lead mine north of Haya town and an abandoned copper mine near Khor Arba'at in Rural Port Sudan District. These mines, with the exception of the emerald mines and the Fudikwan iron mine, were ordered closed when Numairy took power in 1969 and have never reopened. These mines are apparently still workable and the quality of the ore is reputed to be good. For example, the iron content in the ore at the mine near Tumaala is 78 percent. There is a gypsum quarry in Derudeb District and Halaib at Ait, two salt evaporation plants outside of Port Sudan, a brickworks in Tokar, an agricultural scheme in the Tokar Delta that provides thousands of jobs, and a fishing industry along the Red Sea. Oyster beds exist along the coast and were once farmed near Dungunab near Muhammed Qul. The Japanese firm that was exploiting the oyster beds closed down because of a disease-related decrease in the oyster population. A cement factory is scheduled to be built in Derudeb in the near future.

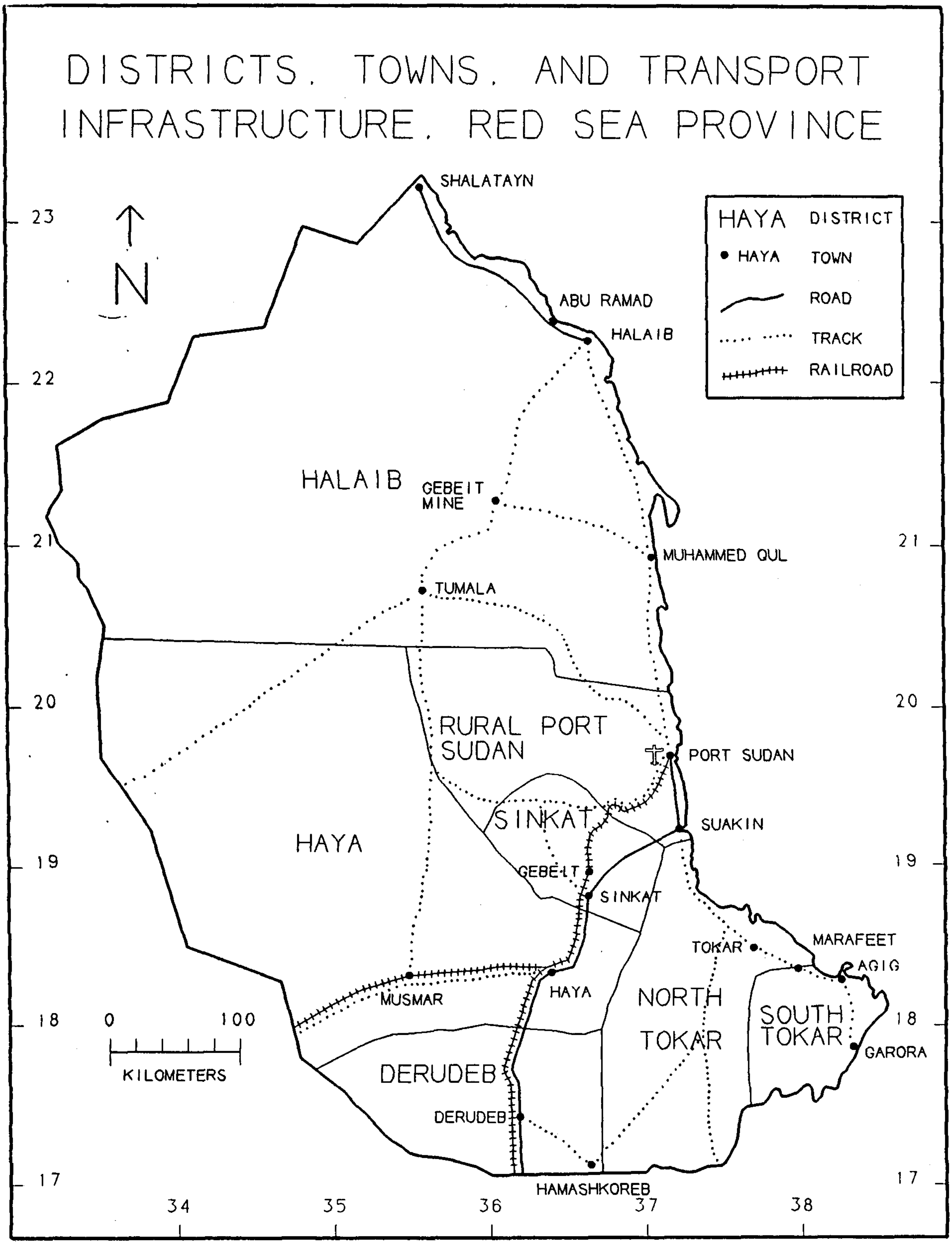
The transport industry has a large service sector built around it that extends from the servicing of vehicles in Port Sudan and along the highway to Khartoum to providing food and shelter to the crews of the lorries and other motorists. This industry has grown considerably since the construction of a surfaced, all-weather road from Port Sudan to Khartoum in the early 1980s.

Employment for the people who live in the rural areas revolves around herding, farming, artisanal production of commodities, and migratory wage labour to the city, towns, or the Tokar, Gash or Khashm al-girba agricultural schemes. It must be stated that the majority of the people in Red Sea Province live in the towns (ERGO 1989) and move from town to country to farm, graze their livestock, or obtain charcoal, fuelwood, et cetera. A minority migrate seasonally to the Nile River. Artisanal industry predominates in rural Red Sea Province. In the south of the province where the duum palm grows a artisanal industry of mat, basket and rope making exists. Duum nuts as well as the fruit of Ziziphus spina-christi are sold in most southern and central markets as snacks and, in the case of the duum nut, as animal food as well. Duum trunks are transported by camels (increasingly by lorry) to bulking points along the Port Sudan to Khartoum highway for eventual sale for use in construction. The Duum palm trunks are prized because they are termite resistant. In the Khor Baraka and Khor Langeb basins where tamarisk grows, an industry based on forest products has developed in addition to mat, basket and rope making. Fuelwood and charcoal are produced as well as beds and poles suitable for constructing the typical Beja rural dwelling, a loaf-like tent made of duum palm mats supported by a framework of tamarisk poles. Small numbers of individuals manufacture charcoal and produce firewood throughout the province. Charcoal making is done on a commercial scale in the 'Udrus and Agwamt basins and in the more wooded areas of the Red Sea Hills within approximately 100 kilometres of urban demand. In northern Red Sea Province people collect and export medicinal plants (harijan) to Egypt.

A word must be said about smuggling. It is a very important industry in the province. The rural areas are crisscrossed with deeply incised smugglers' roads. Smuggled goods into Red Sea Province include consumer goods such as televisions, radios, household goods, and clothes, as well as vehicles, alcohol, drugs, and weapons. Goods smuggled out of Red Sea Province include livestock, cereals and cotton. The government is making courageous efforts to stem this loss of revenue.

Map 1.3 below presents the political districts, towns and transport infrastructure of Red Sea Province.

Map 1.3. Districts, towns and transport infrastructure, Red Sea Province.



Agriculture

Agriculture is one of the two principal land uses in Red Sea Province. With the exception of Khor Arba'at and the Tokar Delta, cultivated area is extremely variable around the province from year to year. Principal crops grown are sorghum (durra), millet (dukhn), cotton, and vegetables. The greatest area is devoted to the principal staple, sorghum. Planting is done by two men using a dibble stick (saluuka). Two medium sized floods are needed before planting takes place. In general in arid and semi arid areas about 100 cm of soil moisture is necessary for millet to complete its growth cycle. Sorghum, less drought resistant than millet, requires slightly more soil moisture. The growth cycle of the variety of sorghum used in Red Sea Province is four months. The growth cycle for millet is about three and one-half months. Planting, particularly in the interior of the province, is done on bunds, or sand dams, called teras (from the English "terrace"), built against the flow of water to impede its flow in order to increase soil moisture. In good years cultivation is done along the general course of a khor but in poor years cultivation is restricted to the sand dams.

In the interior of the province planting begins in September or October, depending on the floods; it can even begin in August. In the Gash Delta, planting may begin earlier. Harvesting in the interior of Red Sea Province begins at the end of November or December and extends for about two months. It may continue until March in the Gash if the year is particularly good. Depending on the soil moisture plants are spaced from 0.75 to 1.5 metres apart. Plants are generally spaced at 0.5 m in the Gash.

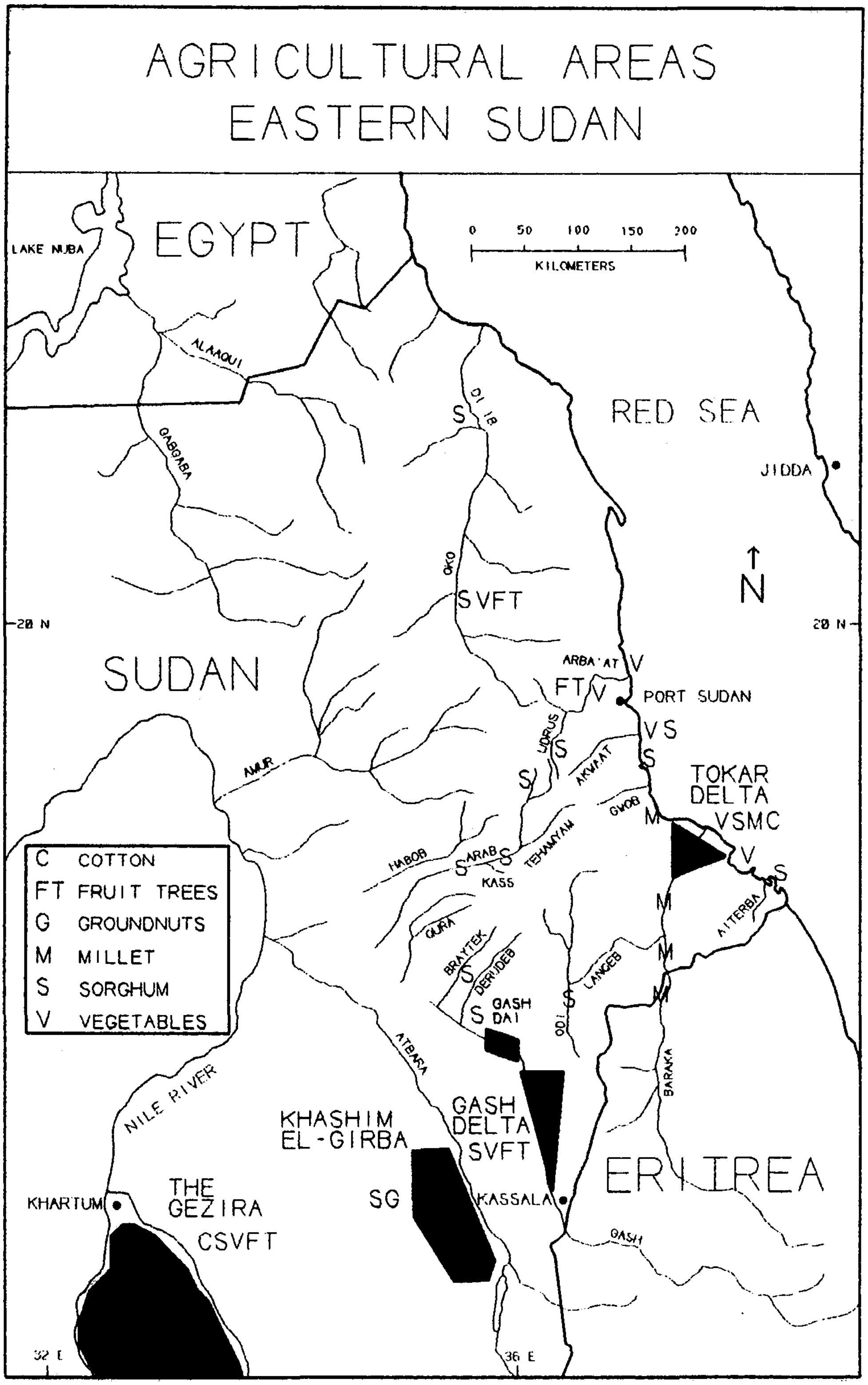
Coastal agriculture, with the exception of the Tokar Delta, is somewhat different from that practised in the interior of the province in that the principal period of cultivation is the winter. If there is good rainfall high in the Red Sea Hills during the summer, early floods will irrigate agricultural areas along the coast, thereby lengthening the agricultural year considerably. Spacing of plants is from 1.5 to 2.0 metres. Along the coast, principally along Khor Akwaat, vegetables are increasingly being grown along with the traditionally grown sorghum.

Vegetables are also grown along Khor Arba'at and in the Khor Arba'at Delta. Pumps and mechanical water diversion are used to irrigate the vegetables. The gardens along the khor are located in the areas of deposition; along the inside of bends in the streambed. Dates and citrus trees are also grown along the khor.

In the Tokar Delta a variety of crops are grown: cotton, sorghum, millet, and vegetables (see paper 8 for further details). Agriculture is more reliable in the Tokar Delta than elsewhere in the province because there are floods from June to September (or October) and also winter rainfall. Soil moisture from the floods is used to bring a crop to about mid-way through its growth cycle and the rains bring the crop to maturity. The origin of Khor Baraka (as well as Khor Gash) is high in the Eritrean mountains and this assures greater reliability of flow from year to year. The map below presents the distribution of agricultural areas in and around Red Sea Province.

Cultivation in Khor Baraka is principally of millet, although some vegetables are grown for home consumption. Planting is done after farmers have

Map 1.4. Agricultural areas in Eastern Sudan.



estimated that the highest flood of the season has occurred. This period can range from August to October, depending on the year. The usual planting month is September. The fringes of the floodplain are planted first, then closer to the main stream as the flood season comes to a close. Harvesting begins at the end of December an can extend to March. Spacing between plants is from 1.50 to 2.0 metres.
There are several commercial vegetable gardens located at the apex of the delta at Dulubiay.

Port Sudan is the principal market for the agricultural products of Red Sea Province. Agricultural products are imported from Kassala and Wad Medani in the Sudan and from outside the country as well. Cereals are locally produced and/or may come from the Gash Delta, Khashm al-girba, or Gedarif. There are four sources of vegetables for the Port Sudan market: Tokar, Khor Arba'at, Kassala, and Wad Medani. From the Wad Medani area tomatoes are imported to Port Sudan for most of the year. Tokar and Khor Arba'at tomatoes and other vegetables become available in the autumn. Vegetables become difficult to find in the summer.

Pastoralism

Pastoralism is the second principal land use in Red Sea Province. It should be considered with agriculture as a unit because the major activity of people in the rural areas of the province is agropastoralism. Both activities form the economic basis for survival, although there are other important economic activities. Many of the products of agriculture are used in support of livestock. Indeed, if the harvest fails one still has the stalks from the crop to either sell or feed to the livestock to help get them through the dry season.

There are several strategies employed by herders in semiarid and arid environments to minimise the risk of losing their livestock and to recover if they do. There are other strategies than those listed below. For further information see Cole (1982) and Widstrand (1975).

1. Movement.
2. Herd splitting.
3. Herding different types of livestock.
4. Mutual aid.
5. Social mechanisms of wealth redistribution.
6. Economic diversification.

Pastoralism in most areas of the arid and semiarid world would not exist without movement. The greatest strategy a herder has to minimise risk is to spread risk over space by moving his animals to areas of good and varied grazing. Annual movement, or transhumance, can be classed as either vertical or horizontal. Vertical transhumance is from lowland to mountain and back again while horizontal transhumance is from, for example, river grazing to rainfed grazing on the plains. This classification has been made to better understand pastoralism and is by no means absolute. Some herders practice both types of movement depending on the distribution of rains and floods. An example of vertical transhumance are the Beni 'Amer who descend from the Eritrean highlands in the summer to graze in the Gash Delta; later to return to the mountains in winter. An example of horizontal transhumance are the Fulbe of Mali who leave the Niger Inland Delta in central Mali with their livestock and travel north following the new growth of grass produced by rains associated with the northward summer movement of the Inter-Tropical Convergence Zone.

In Red Sea Province both types of transhumance are practised. The Red Sea Hills and coastal strip are used for winter grazing and the interior of the province, particularly the southwest corner, are used for summer grazing. There is a vertical movement from coast to mountain to interior and back and a horizontal movement from the Gash Delta to southwest and southcentral Red Sea Province. These movements are dependant on the year. In some years the herds do not leave the Gash-Butana area and in others, like 1988, where thousands of head entered Red Sea Province to utilise the excellent grazing. There is also a delta to delta (coast to plain) movement from the Tokar Delta in June to the Gash Delta. This is called "grazing the two autumns" in Arabic.

Herders also use space to minimise risk in another way. They routinely keep one part of their herd in one place and other parts of it elsewhere. In case of disease, local drought, or raiding they have something to fall back on by employing strategy two, herd splitting.

The third common economic strategy employed by herders is herding different types of livestock. This strategy is useful in maximising the use of varied pasture and in combatting heavy losses of one breed due to disease. Each type of animal has different grazing and watering requirements and different types of animal are grouped to minimise labour requirements. The most common combination in Red Sea Province are sheep and goats, while in the Gash it is sheep, goats and cattle. In more arid areas of the province camels, sheep and goats are herded. Although goats are more drought resistant than sheep, sheep have a higher market value. In addition, the market value of sheep to cereals appears to be more stable than the value of goats to cereals. Some groups of herders, for example the Rashayda and Nurab, specialise in camels and sheep and shun goats. In general, people raise goats because they have to. Sheep, camels, and cattle are much preferred to goats.

The fourth common herding strategy is mutual aid. Mutual aid in Red Sea Province has two forms according to Hassan Mohammed Salih (1976). The first form is the loan of an animal to a relative so that he or she benefit from the milk. This loan has to be repaid. The second form of mutual aid is the outright gift of an animal or animals to an impoverished relative. This assistance does not have to be repaid. Hassan Mohammed Salih does not mention mutual aid between non-kin among the Beja. In this family-oriented society assistance to non-kin may be rare or nonexistent,

The fifth herding strategy are social mechanisms, or institutions based on the redistribution of livestock wealth. This sort of redistribution involves the transfer of livestock between families being united by marriage, the gift of livestock for a birth, coming of age, death, and the payment of livestock as penalty for unlawful conduct. In the precolonial period, the price of murder was paid in camels. This practice has fallen into disuse today, perhaps because camels are no longer as important as they once were before the decline of the caravan trade. Raiding also once was a mechanism for the redistribution of wealth and ecological adaptation (see Sweet 1965).

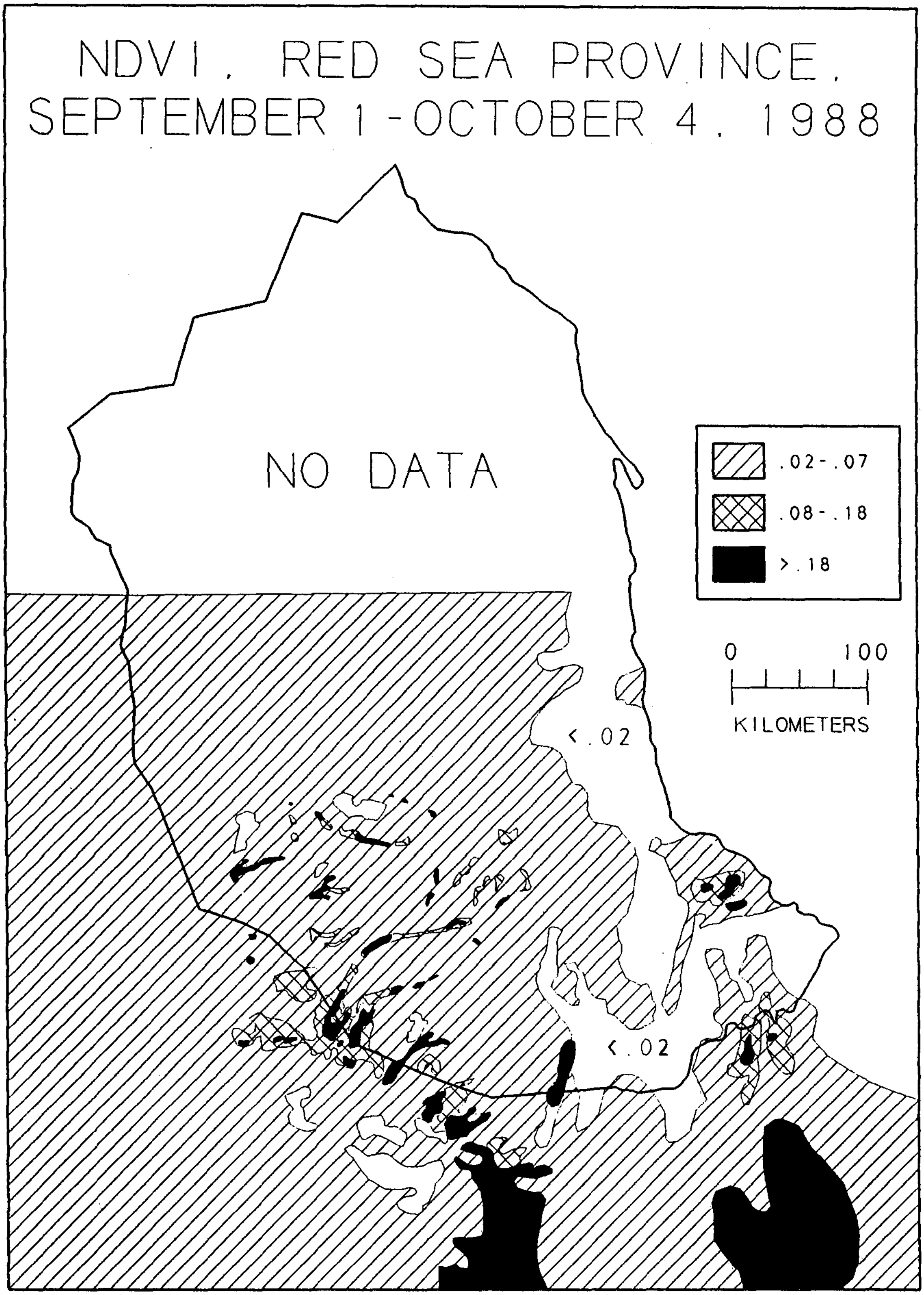
Social mechanisms of livestock redistribution can play an important role in recovery from livestock loss. For example, the livestock recovery rate of families with several daughters who became marriageable after the drought of 1983-84 in Red Sea Province was good because many livestock are given as a dowry in marriage.

The sixth common strategy practised by herders is economic diversification. By diversification is meant involvement in activities other than herding of some member or members of the herding family. Agriculture, for an example discussed above. Herders are also periodically involved in the wage labour economy on a seasonal or stress-period basis. Other activities include making charcoal or selling firewood, selling rural products like Duum nuts or the fruit of Ziziphus spina-christi, making mats, blankets, baskets, and leather bags.

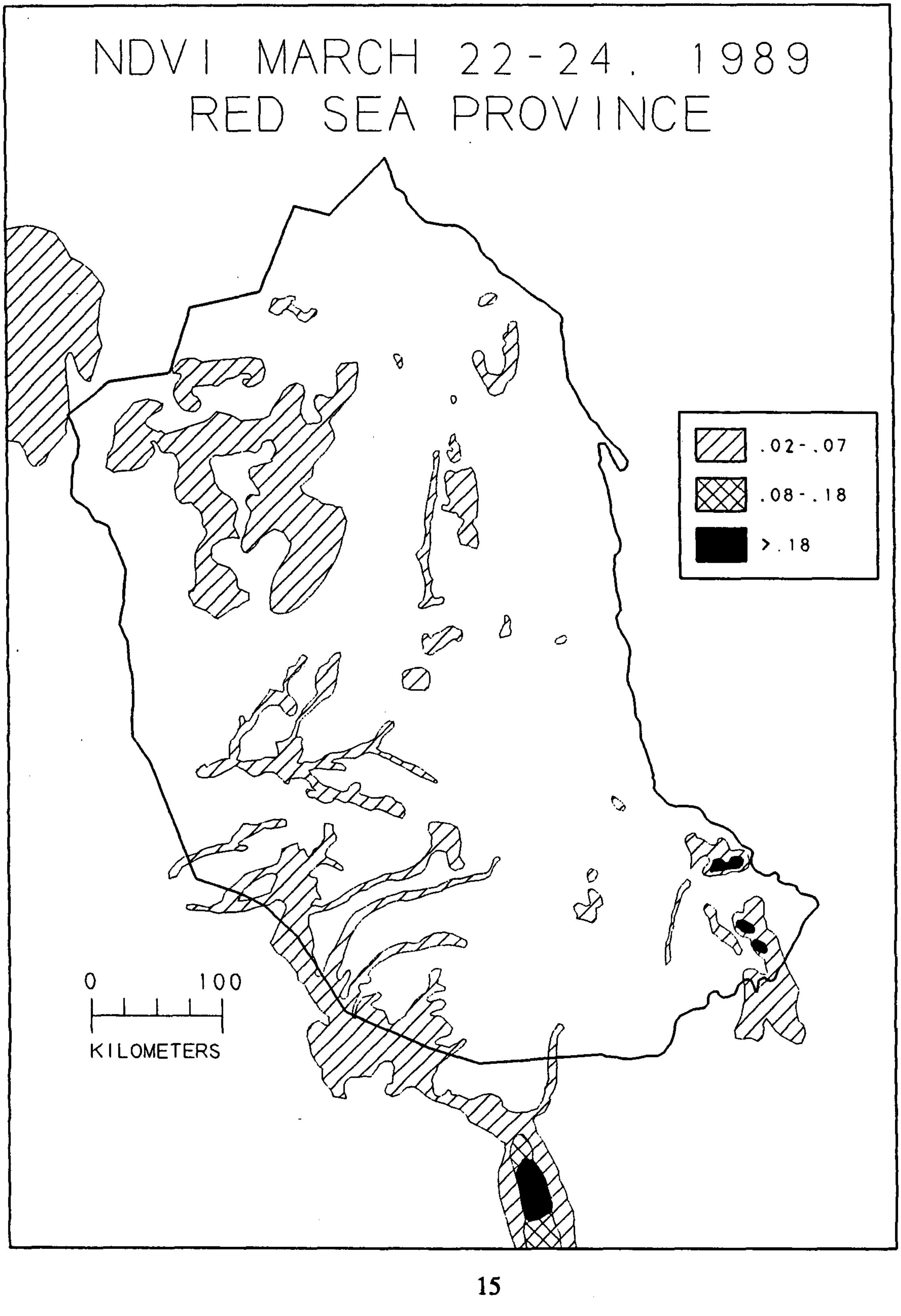
Pasture distribution in and around Red Sea Province is presented in the following two maps of Normalized Difference Vegetation Index (NDVI) data. These maps are made from analyzing data on the greenness of vegetation from satellites. The two maps should be examined in conjunction with information from the section discussing Beja groups and migration. Values for the most mountainous parts of the Red Sea Hills are uniformly low because the cell size of the NDVI is 1 km^2 and as most of the khors in the hills are less than 1 kilometre in width they are not perceived by the sensors on the satellite. The NDVI index is on a scale of -1 to 1. This represents bare rock to high amounts of vegetation. The NDVI scale was divided into three classes to produce the two maps below: .02-.07, .08-.18, and greater than .18. These classes represent sparse (diagonal hatching), medium (cross hatching), and high (filled) densities respectively. On the map produced from the September-October image the dense vegetation (including agriculture) of the Tokar Delta, Eritrean highlands, the Gash, Gash Dai, Braytek basin and Khor 'Arab basin is clearly visible. Of importance is the distribution of vegetation in the category .02 to .07. This was a result of the high and uniformly distributed rains of 1988. Parts of the province looked like fields of wheat.

The map produced from the NDVI image for March 1989 presents a different story. This is the driest time of the year and only residual grazing is left. Nevertheless, there remain three areas of high vegetation: parts of the Tokar Delta, parts of the Eritrean highlands, and part of the Gash Delta.

Map 1.5. NDVI, September 1 - October 4, 1988, Red Sea Province.



Map 1.6. NDVI, March 22-24, 1989, Red Sea Province.



Drought-Coping Strategies

People practice a variety of drought-coping strategies in Red Sea Province. Most of these involve intensification of activities they already perform, for example, labour migration. These strategies are characteristic of the early onset of stress. Others strategies employed when stress is acute is migration to urban areas, camps, or the roadside to obtain relief from government and international donors. Cutler (1986) depicted a three-stage sequence of drought coping in Red Sea Province of adaptive strategies, sale of assets, and mass migration. Based on Cutler's work and work of the Research Section of Oxfam Port Sudan, the following sequence of drought-coping strategies can be formulated.

1. Initial response: intensification of activities already occurring in some form. This response stage involves food consumption reduction, the consumption of bush foods, borrowing from kin, storage rather than sale of household cereal production, the increased sale of livestock, new or increased involvement in artisanal production, and greater and longer labour migration. At this level great consideration is paid to such herding strategies as herd splitting and travelling to or remaining in the favoured herding areas such as the Gash or Tokar Deltas, the Nile valley, the Atbara valley, or the Gedarif area rather than risk movement under uncertain prospects for pasture production.

2. Medial response: calling in of loans, the sale of assets such as gold, silver, tools, breeding stock, borrowing from traders.

3. Terminal response: out-migration in search of assistance. Mostly old people, women and children ever employ this strategy in Red Sea Province. By the time conditions get this bad, most men of working age are no longer present. They are with livestock or seeking employment in towns.

The ability to respond to stress is conditioned by a variety of factors. These factors, or variables, interact on the micro and macro levels. The ability to respond at the micro level, the level of the individual or family, is conditioned by the economic and social circumstances of the individual, age, gender, family size, and location. The ability of individuals or families to respond is affected by several trends and processes at the macro level. These trends or processes are the level of development, economic instability, political instability, environmental variation, environmental degradation, and population growth.

Population and Human Geography

Until recent times the population of Red Sea Province has been predominantly rural. Urbanisation can be said to have begun with British administration during the first half of this century although settlements at Suakin and Tokar had developed before that time during the period of Turkish control (al-turkiya). Towns were established for a variety of reasons in the province, most often to service the railway. Over fifty railway towns were built in the early part of this century. Many of these towns have remained insignificant, some have developed into small centres, and a few into towns. Other towns were founded as border posts (Garora), military settlements (Gebeit, Halaib, Muhammed Qul), agricultural settlements (Tokar, Ma'arafiit), smuggling centres, ports for mineral exports (Abu Ramad), and as religious settlements (Hamashkoreb and Tumaala). Today, towns of notable size in Red Sea Province include Derudeb, Garora, Gebeit, Halaib, Haya, Port Sudan, Sinkat, Suakin, Tahamyam, Tokar and the two religious settlements of Hamashkoreb and Tumaala. Other towns of smaller size but still of note are 'Agig, Gebeit al-ma'adiin, Ma'arafiit, Musmar, and Sallum. The following table presents town populations for Red Sea Province.

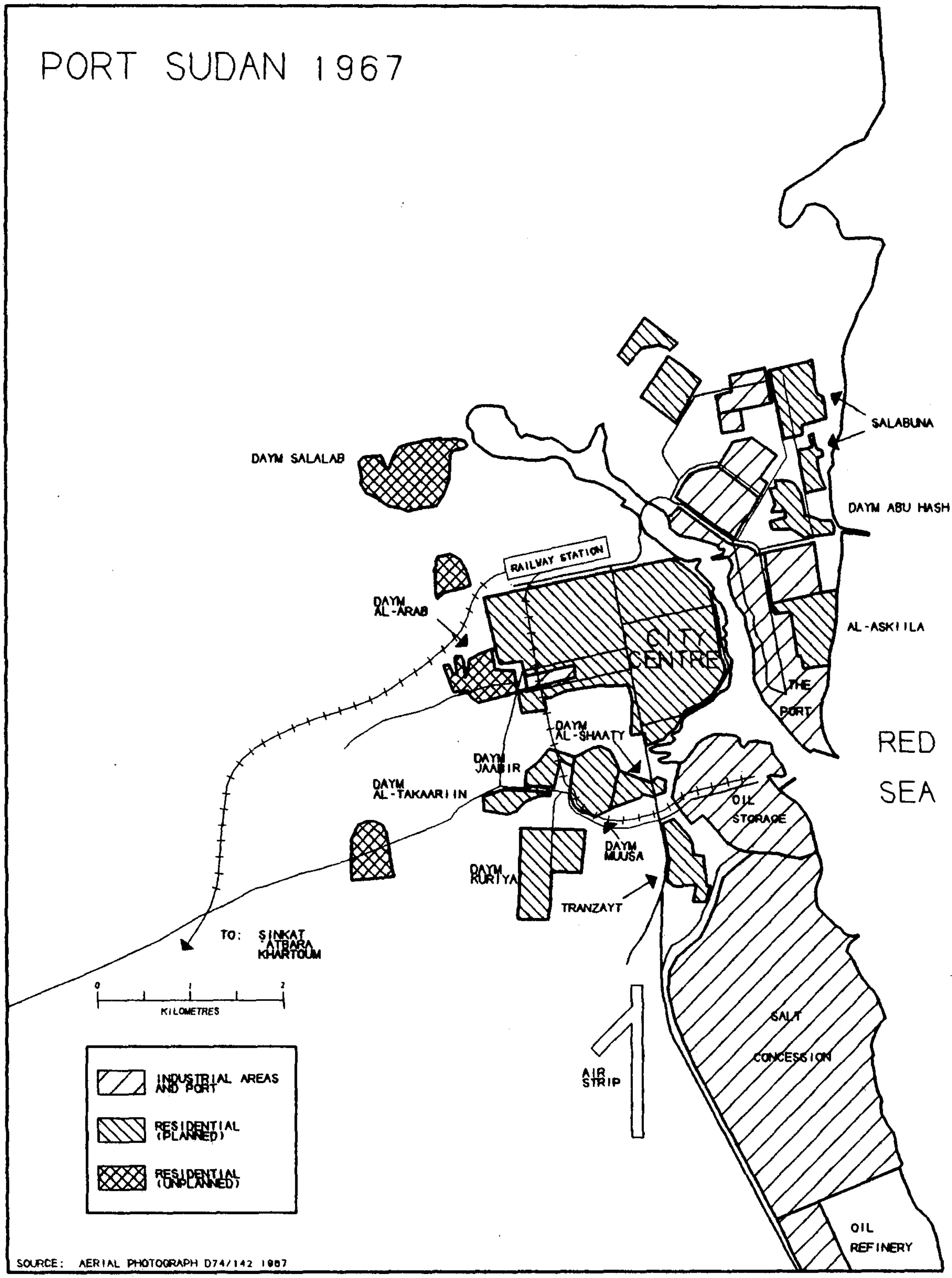
Table 1.1 Town population of Red Sea Province, various dates.

Town	Population	Date
Gadem Gafrit camp	14400	1988
Garora	11000	1988
Gebeit	7002	1983
Hamashkoreb	15000	1989
Haya	3795	1983
Musmar	2000	1986
Port Sudan Town	273436	1987
Sinkat	7918, 15000	1983, 1989
Tokar	12190	1983

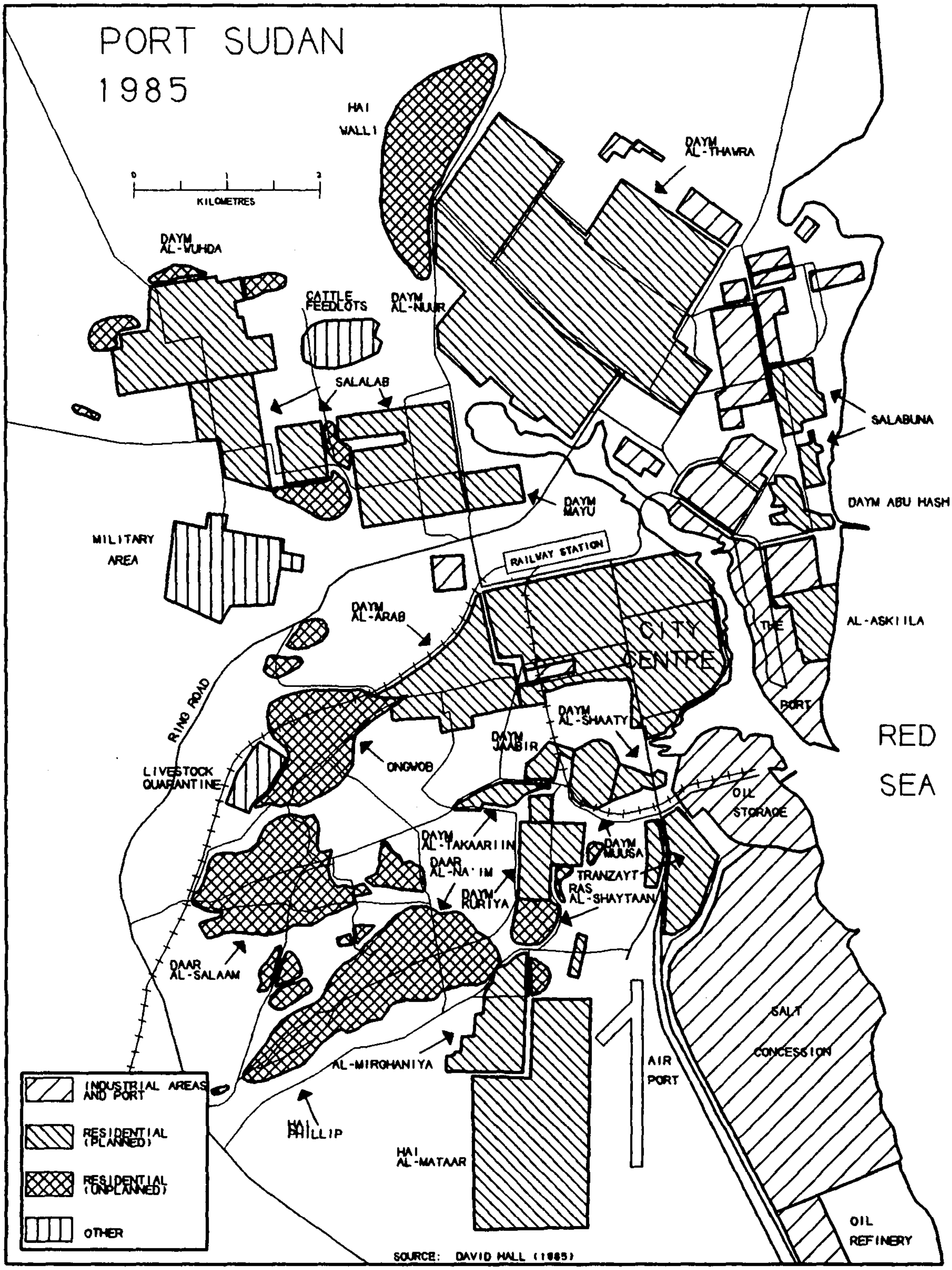
The figures for Gadem Gafrit and Garora in Table 1.1 were obtained from the United Nations High Commission for Refugees (UNHCR). The Hamashkoreb population was estimated by the Environmental Research Group Oxford (ERGO). The Musmar population and the Sinkat population for 1989 were estimated by the Norwegian Red Cross.

Port Sudan, as well as most other centres in the Sudan, has changed considerably in the past 20 years. It has grown in population and has expanded spatially. Maps 1.7 and 1.8 of Port Sudan in 1967 and 1985 illustrate its spatial growth (see James 1969). The size of Port Sudan has doubled since 1967. The bulk of this growth has been in the unplanned settlements, or dayms. The maps below illustrate the growth of Port Sudan as well as the transformation of unplanned to planned settlements.

Map 1.7. Port Sudan in 1967.



Map 1.8. Port Sudan in 1985.



Port Sudan has continued to grow since 1985. Today the dayms have grown and there are new settlements around the town. Appendix 1.2 contains a list of all the dayms in 1989, the settlement dates of recent dayms, and ethnic composition of the dayms.

The size of the population of Red Sea Province has always been a subject of speculation. There have been three censuses of the population of the province. The first census was in 1955, the second in 1973 and the last in 1983. Total enumerated population in 1983 was 695854 people. In 1987 there was an update of the census done through the calculation of fertility rates and projecting the 1983 figures forward in time.

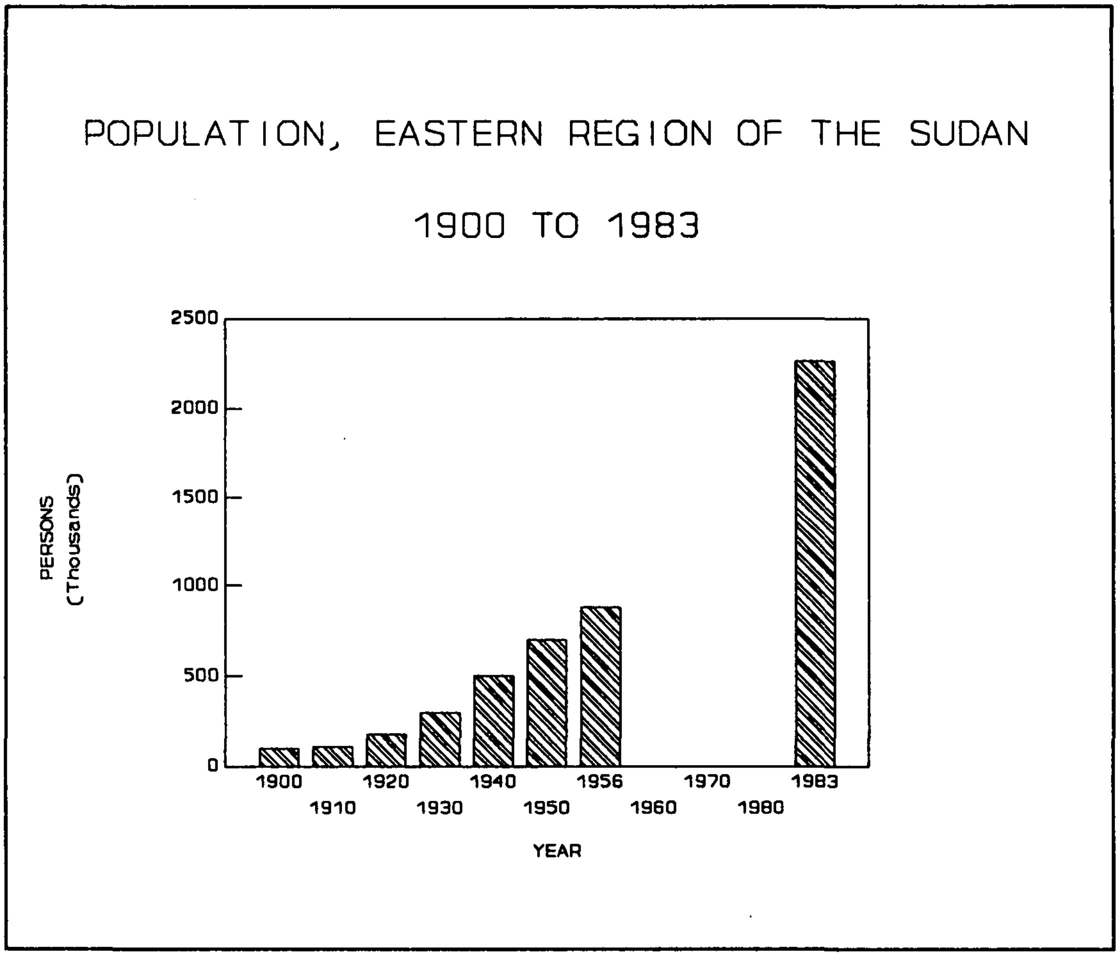
Table 1.2. Red Sea Province population by District, 1983 and 1987.

District	1983 Population	%	1987 Population	%
Derudeb	49299	7	59371	7
Halaib	80537	12	96999	12
Haya	42412	6	51008	6
North Tokar	102749	15	123757	15
Port Sudan Town	227968	33	273436	33
Rural Port Sudan	48104	7	57696	7
Sinkat	63072	9	76095	9
South Tokar	81713	12	97835	12
TOTAL	695874		836197	

SOURCE: Department of Statistics 1987 and 1983.

Rural population according to the results of an aerial survey by Watson (1976) in December 1975 was 234259 people. The figure used by Oxfam and the World Food Programme for the allocation of relief food is 400000 rural people. The Environmental Research Group Oxford in an aerial survey done in January 1989 found a rural population of 272000 people (standard error of ±9%). Although these figures provide a rich basis for debate, what is probably more important for most people is the population trend rather than specifics. The following figure illustrates the trend in population growth in Eastern Region since the beginning of this century. Although growth has been great, it should be borne in mind that the population of the Sudan, particularly the central and westerns portions, declined during the last century to an unknown but significant extent because of war, disease, and slavery.

Figure 1.1. Population, Eastern Region of the Sudan, 1900 to 1983.



The Red Sea Province is inhabited principally by the Beja, a Cushitic-speaking group of people that traditionally practised herding, farming, and trade but now practice a variety of activities many of which involve the urban economy. The Beja are subdivided into five groups[1], the 'Ababda, the 'Atman (Amarar), the Beni 'Amer, the Bishariin, and the Hadendowa. Minor groups include the Artayga, Ashraf, Halenga, Kumaylaab, Melhitikinaab, Sigulaab, and Shi'ayaab (see Ausenda 1986, Hassan Mohammed Salih 1976, Nadel 1950, Newbold, 1935, Owen 1937, Paul 1954, 1950, Sandars 1933, 1935, and Seligman and Seligman 1930).

[1] The word "tribe" is increasingly falling into disuse because of its pejorative connotations. The words "lineage group" and "maximum lineage segment" and "minimal lineage segment" or "section" are increasingly being used in the place of "tribe" and tribal segments.

Further information about the ethnic groups of Red Sea Province and their seasonal movements can be obtained in ERGO (1989).

With the exception of the 'Ababda and the Beni 'Amer, the Beja speak a common tongue, Tu Bedaawi, although there are identifiable regional differences. The 'Ababda speak Arabic and the Beni 'Amer speak predominantly Tigré. There are questions regarding the inclusion of the 'Ababda and Beni 'Amer with the Beja group. Morton holds that the Beni 'Amer and the 'Ababda should be excluded from the Beja group for ethnic and linguistic reasons. The 'Ababda should not be included for linguistic reasons. He states (1989: 11) that the Beni 'Amer are

> ... a confederation of tribes, formerly united under a single ruling aristocracy, a system marked by many caste-like practices (Nadel 1945, Paul 1950). This system was only abolished in 1948. The aristocracy was Arabic speaking, the vassal groups mainly speakers of Tigré although some spoke Beja. Beni Amer are not now normally considered Beja by themselves, Beja, or others.

Beja society is segmented. Each group claims descent from a common ancestor and traces his or her descent typically four or five generations into the past. For example, for the Hadendowa the common ancestor is Baraakwiin. According to Hassan Mohammed Salih (1976: 38), the Hadendowa social organisation is based on a "... patrilineal genealogical structure which constitutes a segmentary system of sections and subsections." The section, or maximal lineage, is called the 'adaat, and the subsection is called the diwaab. The diwaab vary in size and may be scattered over a wide area.

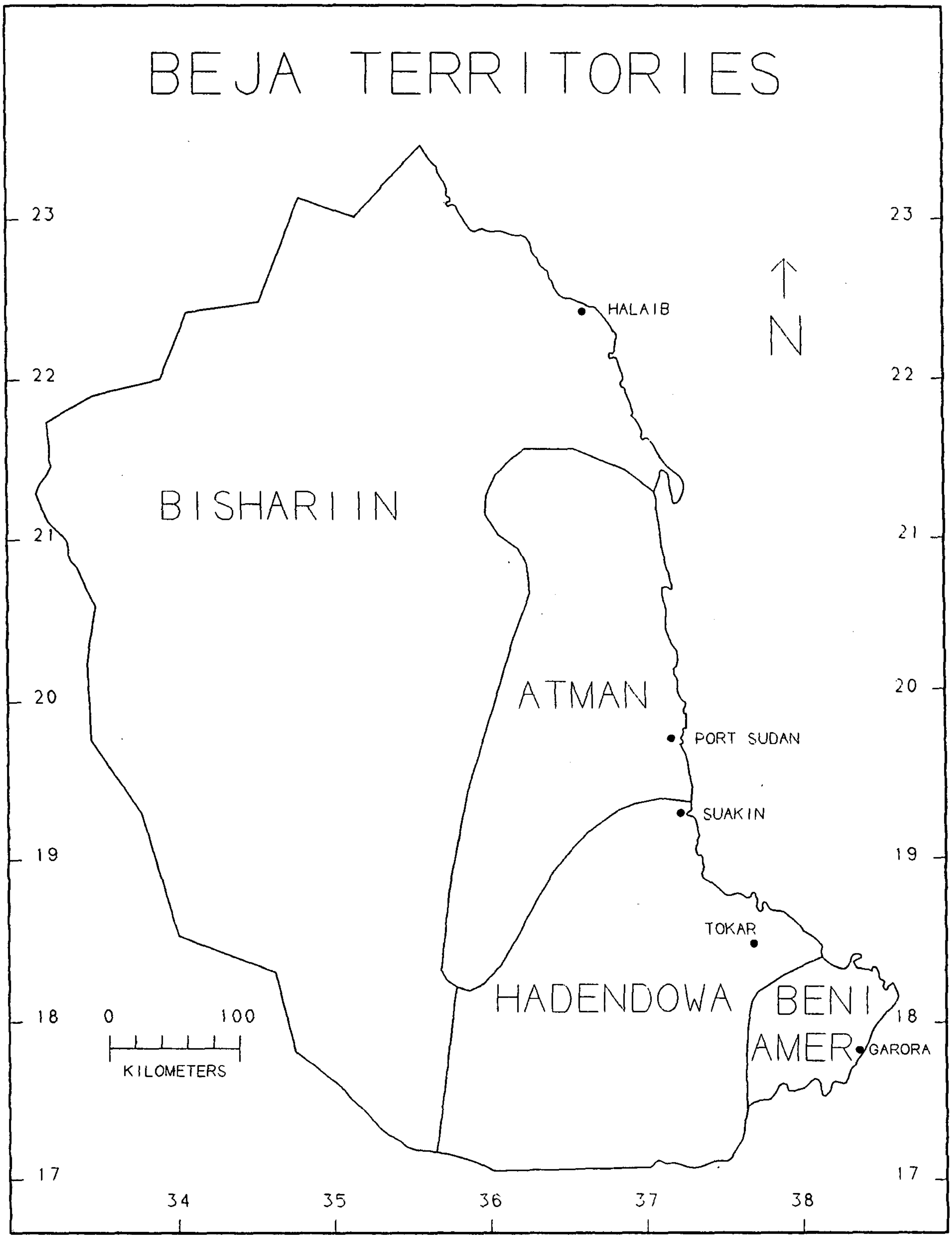
The most populous of the five Beja groups are the Hadendowa. The 'Ababda are found principally in Egypt, the 'Atman inhabit a broad strip that extends from the Red Sea coast north of Port Sudan and south of Muhammed Qul to Musmar on Khor 'Arab in central Red Sea Province. The Beni 'Amer are divided between South Tokar District in Red Sea Province, Kassala Province and Eritrea. The Bishariin are divided between Red Sea Province, Kassala Province and Egypt. The Hadendowa are split between Red Sea Province, Kassala Provinces and Eritrea. Although a group may be said to be split between two or more areas, it does not mean that there are no links between them. On the contrary, there is much movement across zones and borders in the search for grazing, agriculture, or employment.

The Beja are not the only group that lives in Red Sea Province. Other groups which live there are the Rashayda and Takaariin. The Rashayda are Arabs who began migrating from the Arabian Peninsula about 130 years ago. The migration of the Rashayda, traditional enemies of the House of Sa'ud, increased in the 1920s and 1930s as King 'Abd al 'Aziz consolidated his power over the peninsula and drove out his enemies. The principal occupations of the Rashayda are trade outside the auspices of government regulation and camel herding. The Rashayda have no land rights in the province. They pay land owning Beja for the right to camp and graze their animals. The Takaariin are West Africans who live principally in Tokar and work on the agricultural scheme. They are also found throughout the Sudan principally in areas where agricultural schemes are located. Their ancestors were pilgrims to Mecca who settled permanently in the Sudan (Al-Naqar 1972, Paul 1954, Salih El-Din 1988).

Map 1.9 below presents territories belonging to Beja groups in Red Sea Province. What is immediately evident from the map is that there is a north-south alignment of the territories. This is in fact the general pattern of transhumance for all of the groups living in the Red Sea Province. Most lineage groups possess territory in the north and in the south - in the Gash Delta, along the 'Atbara River, or even on the Nile River. Perhaps the best exemplification of the spread of risk over space in and around Red Sea Province is provided in Hassan Mohammed Salih (1976) in his discussion of the distribution of 'adaat, or maximal lineage section, territory or the Hadendowa. Most Hadendowa 'adaat, or as they are increasingly being called, qabiila (plural qabaai°l), possess territory in Red Sea Province as well as in the Gash Delta. Their seasonal movements are, for example, to the north along the Red Sea Hills or coast in the winter and to the Gash Delta or all the way to the 'Atbara River during the summer and fall. Hassan Mohammed Salih (1976) lists 14 Hadendowa maximal lineages and their territories. Ten of the lineages possess territory in Red Sea Province as well as in the Gash or on the 'Atbara River.

In the following discussion of migration patterns, the most northerly of the Beja groups are discussed first. The 'Ababda, principally concentrated in Egypt and not numerically significant in the Red Sea Province, are not discussed. It should be borne in mind that with the exception of well-known cases of ongoing intergroup feuds and land use competition, there are no strict boundaries to land use in or around Red Sea Province; anyone can come and graze his or her animals at any time in any place providing that the rightful owners of the land are recognised and paid a small symbolic tribute. Use rights are completely different from ownership rights in Red Sea Province. Because of the unpredictable amounts and distribution of rainfall, enforcing strict territorial rights in grazing would be a poor survival strategy. This is not to say that this has never been done; in the past there was much intergroup raiding and conflict (see Sweet 1965, Thesiger 1984).

Map 1.9. Beja territories in Red Sea Province.



The Bishariin are divided into two broad groups: the Bishariin Umm 'Aly and the Bishariin Umm Nagy. The territory of the Umm 'aly is situated in the central mountain areas of Halaib District. These are high mountains where precipitation is greater than surrounding areas. The Umm 'Aly move between the coast and mountains in the winter to the Sinkat, Musmar, and Khor Arab and Nile River areas in the summer.

The Bishariin Umm Nagy move longer distances than the Umm 'Aly. They graze in the mountains of central and northern Halaib during the winter and move south to the 'Atbara River and west and southwest to the Nile River. Many of the Bishariin who had land use rights along the Nile near Wadi Halfa were given tenancies in the Khashm el-Girba agricultural scheme located on the 'Atbara River southwest of Kassala. During the winter rainy season the Bishariin graze their animals along the coast and eastern Red Sea Hills. The Bishariin are also involved in trade with Egypt, principally Aswaan. Morton (1989) found that the principal regional economic centre for the Bishariin Umm Nagy is Aswaan.

The bulk of the 'Atman (Amarar) territory is located in the central Red Sea Hills. During the summer rainy season the Amarar move with their animals to the 'Udrus and 'Arab basins where there is good grazing and cultivable land. During the winter rainy season, the Amarar graze the coast and eastern portions of the mountains which receive rain.

The Hadendowa, the most populous of the Beja groups, move south during the summer rainy season to the Braytek basin, the Gash Dai, the Gash Delta, the Khashm el-Girba scheme on the 'Atbara River, and to the Gedarif area (Abdel Hamid M.A. Bakhit (1988). Sometimes, depending on the distribution of the rainfall they move south into Eritrea. During the winter months when the coast receives rainfall the Hadendowa graze their animals from Suakin down to and into Eritrea where they have grazing agreements with the Beni 'Amer.

The Beni 'Amer move in many directions from their mountains. During the summer they move into the Kassala area to graze their animals and to pursue other activities in the agricultural schemes. In the winter rainfall season there are two movements: one group of Beni 'Amer moves down to the Tokar Delta for grazing and agricultural labour and another group of more pastoral Beni 'Amer remains in the mountains or descends to the Eritrean coastal areas if grazing is abundant.

There are two groups of Rashayda that use pasture in Red Sea Province. The first group migrates from the Tokar delta in May-June along Khor Baraka to the Kassala area where higher and earlier precipitation makes good general grazing outside the khors. The Rashayda move to the 'Atbara River and into the Butana Plain. Sometimes, when conditions warrant, they will move all the way into Eritrea. Another group of Rashayda migrate to Egypt from Halaib District's coastal area in the winter. This group migrates down to the 'Atbara area in the summer.

The relations between the 'Ababda, 'Atman, Beni 'Amer, Bishariin, Hadendowa, and Rashayda have in the past been hostile and are today sometimes tense. The major source of conflict in the past and at present are land rights and land use. These groups may be said to exist in a state of competition for scarce resources. The following table, taken from Hassan Mohammed Salih (1976: 135) illustrates the nature of the competition for scarce resources.

Table 1.3. Cases of animal thefts, injuries and homicides among the Hadendowa in the Gash Delta, 1969-70.

Month	Animal Theft	Minor Injury	Major Injury	Attempted Homicide	Homicide
June	145	114	34	2	8
July	27	32	3	1	0
August	36	42	6	1	0
September	69	43	6	1	2
October	104	47	17	2	5
November	68	54	8	1	4
December	67	63	12	1	4
January	58	63	19	0	4
February	50	53	26	0	4
March	91	45	30	1	5
April	58	65	31	2	5
May	116	115	30	2	7

Two points emerge from the table: the conflicts are seasonal and they are violent. The lowest months for murder and all other conflict, excepting attempted homicide, are the months of July and August, periods of plentiful fresh pasture production by floods and rain. The worst periods are those leading up to the new flood and rain year: the driest season of the year, when available grazing and browse is at its lowest level.

Land Tenure

Land is held by the maximal lineage, 'adaat. Two rights in land are observed: a'amara and asl rights. A'amara rights are usufruct rights of land for pasture, agriculture, and other activities such as cutting wood and imply no ownership of the land. A payment, called gwadaab is made annually to the diwaab that possesses full ownership rights of the land being used. This payment, sometimes only nominal, may be in animals or grain.

Asl rights, in contrast, are full ownership rights. Individuals and families have the right to maintain possession over particular plots of land for as long as they use them. Their descendants have the right to use the same parcels. Only asl possessors have the right to sink or repair wells or to cut trees.

Land use arrangements for agriculture such as sharecropping exist in Red Sea Province and the rules governing such arrangements are more complicated than those governing pastoral land use between a'amara and asl tenure holders. There are three levels of sharing in general: landowners, half sharers, and quarter sharers. These levels are called in Arabic saahib adh-dhimin (saahib al-hawaasha or saahib al-ardh), saahib an-nuus, and saahib ar-ruba' respectively. The landowner in theory takes one-half of the products of the land and the half sharer takes the other half. In practice this can vary considerably. The half sharer is responsible for hiring of labour and the payment of labour in kind or, less commonly, in cash. A sharecropping system such as the one described can exist where land is "collectively" owned by the maximal lineage because the minimal lineages, diwaabs have established customary rights of usage over specific parcels of land. These rights are inheritable. Land may be let as well.

In the precolonial period rights to land in Red Sea Province were established by conquest and maintenance of those rights involved war. Insofar as the land ownership status quo before the British established their administration in the early part of this century can be considered traditional land ownership and violence accepted as a means of negotiation, we may say that land ownership has changed since the precolonial times. Traditional land rights in Eastern Region have changed as a result of policy decisions made by the colonial administration and the independent central government in recent times. In the Tokar Delta in the early part of this century land was given to individuals who could clear it of trees and scrub and cultivate it. Large tracts of land passed (peacefully) to local people who previously had no asl rights to the land and some land passed to outsiders. In the development of the Gash Delta beginning in the early 1920s, in contrast, land remained in the hands of the local people who themselves had seized it violently from others a century before.

The central government in Khartoum has legislated that all land belongs to the state. This has been contested in the Eastern Region. Further information on this subject may be found in the forthcoming graduate theses from the Red Sea Areas Programme of the Universities of Khartoum and Bergen.

Gender Relations in Beja society

There is a clear sexual division of labour in Beja society and it may be said that gender is one of the most important issues in Beja life. The table below presents the sexual division of labour of rural Beja people in Red Sea Province.

Table 1.4. Traditional sexual division of labour in Red Sea Province.

Task	Performer	
	Men	Women
Basket making		X
Wool blanket weaving		X
Charcoal making	X	
Domestic chores*		X
Erecting tent		X
Fetching water*	X	X
Food preparation		X
Fuelwood collection*		X
Harvesting cereals	X	X
Harvesting cotton		X
Herding camels	X	
Herding goats**	X	
Herding sheep**	X	
Labour in Gash	X	
Labour in Tokar	X	
Leather bag making		X
Marketing	X	
Mat making		X
Milking livestock	X	
Planting cereals	X	X
Raising chickens		X
Rope making	X	X
Temporary shelter construction	X	
Trade	X	
Wage labour in Port Sudan	X	

* Also performed by children around the tent.
** Performed by women around the tent with the milk herd.

In addition to the sexual division of labour there is a strict division of between public and private life that is based on gender. Women's roles are private and domestic while men's are public. As in many traditional societies, the Beja women's role is principally related to food preparation, homemaking, and reproduction. Women's roles are totally rural and home oriented while, men enjoy a mix of rural and urban activities.

Although women do own property in animals, they are not allowed to milk them and their ownership has to be seen in context. If an animal needs milking, even if it is her own, she must call a male relative to come and milk it for her. Women accumulate assets in livestock and jewellery earned from a variety of economic activities depending on location, however, women are dependent on their husbands or male relatives to market all goods and crafts they produce. Although shar'iyya law stipulates that women should inherit one-half the share of her brothers, women generally cede all their rights of inheritance to their brothers. An exception to this is the inheritance of the tent and the implements belonging to the tent. These are passed down from woman to woman. Adobe and wooden houses, in contrast, are built and belong to men and form part of their inheritance.

The woman's domain is rural and she rarely in her lifetime visits the towns of Red Sea Province; it is the man's role to act as the interface with the outside world. The practical implication of this system is that men, entitled to be public creatures, obtain the benefits of the towns and women and their children do not. An example of the implications of the dichotomy between the public world of men and the private world of women is the more varied and nutritious diet of men who eat in roadside restaurants and in Port Sudan where lentils, beans, meat and other nutritious foods are available at little cost. In normal times, however, rural women are poorly nourished (Anonymous 1968) and in times of drought or economic inflation the food stress problem is critical. The irony is that women's nutritional needs during their reproductive years are greater than those of men.

Education for women is viewed by rural people as sinful and dangerous because it leads to public life and dishonour. Town dwellers normally only educate their daughters, if they educate them at all, to primary level. There is much social pressure against the father who wants to educate his daughters above the primary level. It is commonly believed that women will become uncontrollable and dishonour the family if they are educated. Traditionally, women are not permitted to enter the market in the town of Sinkat, one of the most conservative areas. Destitute women forced from the rural areas into the periphery of Sinkat by drought and the breakdown of their families sell mats and other goods along the road several hundred metres from the men's roadside service centre and a kilometre from the market. In urban areas women go about veiled and they travel in pairs to ensure each other's honour and presumably to act as witness to the conduct of the other. In areas of comparable conservatism women are sometimes killed because they were believed to have brought shame upon their families by their conduct (see Antoun 1968, Al-Sada'awi 1982).

Women are excluded from political affairs in Beja culture. For example, women were forbidden to go to vote in the last election for the National Assembly (Mohammed Osman Omer 1989). The reasons advanced for such action were:

1. Women's duty is to reproduce and rear children.

2. Women have no understanding about public affairs.

3. It is sinful for women to be with men in public.

The historical basis for Beja gender relations may be related to extreme resource scarcity and the property relations that have developed over time under such conditions of scarcity in Red Sea Province. Fear of alienation of land from the kin group (loss of control) goes far in explaining the genesis and development of gender relations in Beja culture.

To understand the Beja system it is useful to first consider the reproduction of the family, the control over the reproduction of the family, and the control of scarce resources. There are two methods of controlling individuals: social and physical. In general, social controls extend from internal controls developed during socialisation, to mild sanction, to ostracism. Physical controls extend from mild punishment, to imprisonment, to amputation (in cases involving theft under shar'iyya law), to execution. Control of resources involves restrictions on use and access and sometimes physical presence. In earlier times it required violence. Control over the reproduction of the family is similar to control of resources in that it involves restrictions on use and access.

The Beja system minimises the contact of the female with all outside males who possibly could have a sexual interest in her and who could interfere with the preferred first cousin marriage. The purpose of this practice in the highly competitive Beja tribal society is to minimise land claims and keep the little agricultural land and meagre pasture with the smallest and most closely related familial unit (see Hassan Mohammed Salih 1976, and Abdel Hamid forthcoming).

The family unit is not without competition and conflict. Control of resources within the family and even the composition of the family unit itself is a gender issue. Basically, the family is divided into two groups: the herding unit and the tent cluster (Hassan Mohammed Salih 1976).

The herding unit, a cooperative, patrilineally segmented unit of production designed to overcome labour constraints is composed of one of three groups of men.

1. The household head and his married sons.

2. Brothers and their married sons.

3. A man and his brother's sons.

This group may not have collective rights to the herd but may be instead an "anticipatory inheritance group" (Hassan Mohammed Salih 1976). Brothers will usually keep their herds together unless one of them is particularly industrious, in which case he keeps his animals separately and hires herders.

The tent cluster, in contrast, is composed of females of the family. It is a cooperative group for female tasks. The tent cluster is made up of the mother's tent and the tents of her married daughters and/or sisters with their husbands. The tent cluster expands as its daughter's get married and begins to dissolve after the last daughter's marriage. The reason for this is that at marriage the rules of residence are uxorilocal; this means that the new husband resides at his wife's residence. Control of livestock and livestock products expands with the marriage of daughters as bridewealth is brought to the tent cluster by the sons-in-law. Later, when the daughter's daughters are ready for marriage, she moves her tent away from her mother's tent in order to establish a new tent cluster of the diwaab. This move away from the family is accomplished in this resource-scarce society through the gaining of bridewealth for her daughters. Bridewealth is normally in animals and has the potential to represent for a family the most significant contribution to the family members' lifelong food security. Ownership of animals, however, is not the ultimate arbiter of food security in Beja life. Control of animals, use of the bridewealth, is more important. This is because there is an inherent conflict of interest and competition over the control of animals between the herding unit and the tent cluster. This competition is at the household level between the patrilineal family and the tent cluster that a man joins after marriage. The woman's family attempt to increase the resource transfer (bridewealth) from the son-in-law's family as much as possible while at the same time, the male siblings of the prospective son-in-law attempt to minimise it as far as possible in order to enhance their command over bridewealth for their own marriages. Ultimately, conflict is avoided through the use of first cousin marriage which maintains close relations and minimises the alienation of animals.

An alternative explanation of the Beja system of resource use is resource spreading in a resource scarce environment. Divested of its competition and conflict the Beja system may be explained as a strategy or mechanism, although this explanation is not complete. The herding unit/tent cluster dichotomy, however, may be what remains in this isolated corner of the world of a once-prevalent matriarchy which was replaced by a patriarchal system, later codified in Christianity and Islam. Morton (1989), however, presents a convincing argument against the existence of a matriarchy in ancient times. This matter deserves further investigation.

Overview of Famine Relief in Red Sea Province

In 1985, a World Food Programme famine relief programme began in Red Sea Province. The initial rationale for the programme was to improve the malnutrition rates in the province. When the WFP, feeling that the programme had achieved its objectives, indicated that they were ready to withdraw from the programme in late 1986, Oxfam, feeling that food aid was still needed in the province, advanced the concept of general pastoral economic recovery, or Food for Recovery. The thinking was that the relief food would act as a boost to recovery at different levels of economic life in the province. In this view the relief food contributed to the economy in the following ways.

1. It was used as livestock feed and saved many herds from starvation during the dry season.

2. Grain, sugar, and oil were sold for cash. This had a doubly beneficial effect because it provided ready cash for household needs and also enabled people undergoing economic stress to retain breeding stock which they probably would have had to sell without the WFP commodities.

There was a multiplier effect related to the sale of the foodstuffs on several levels of value-adding exchange based on the input of a free good: from the food aid recipient, to the town based merchant, to the end user. Much of the relief grain and, in particular, oil and sugar distributed in the southern half of Red Sea Province as part of the World Food Programme's relief food assistance has been sold through a value-adding network to Eritrea although no precise figures are available. According to reports in early 1989, a fifty pound sack of sugar is sold for from £400.00 to £600.00 Sudanese in

Red Sea Province. This same sack is resold at the Eritrean border for over £2000.00 Sudanese.

The average family ration per day was two kilograms of sorghum (sometimes wheat) and quantities of sugar and oil were also provided. The object of the relief effort was the entire rural population of Red Sea Province at that time who were judged to be at risk. Just over 400 delivery points, or 1 for every 1000 persons, located around the province were created as points where designated representatives of the estimated 400000 rural dwellers could receive the commodities allocated to their area. The programme continued unchanged until 1989 when areas deemed recovered were gradually cut from the relief rolls. There were, however, two exceptions to this: the Arba'at and Suakin areas were cut in 1988. Arba'at is an area of market-oriented agriculture associated with Khor Arba'at and Arba'at delta and Suakin is a town. It is projected that the relief effort will be terminated by the end of 1989, however, there is some discussion by the World Food Programme about continuing free food deliveries, food for work, and vulnerable group feeding.

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Appendix 1.1. Other current research in Red Sea Province

This section is a summary of the current research undertaken by the Environmental Research Group Oxford (ERGO), and research in preparation or currently under way by the Universities of Khartoum and Bergen collectively called the Red Sea Areas Programmed (RESAP). The ERGO research is presented first abstracts of the RESAP research follow. More detailed information about the research is available in ERGO (1989) and RESAP (1989).

Environmental Research Group Oxford (ERGO)

The Environmental Research Group Oxford was commissioned in 1988 by Oxfam United Kingdom to conduct a two-season aerial survey of livestock, human population, vegetation and agriculture in Red Sea Province and in adjacent areas that are used heavily by residents of Red Sea Province. At present, only a preliminary report of phase one of the survey has been prepared. It is envisioned that the final report will be finished in December 1989.

Red Sea Areas Programme Research (RESAP)

Eleven Masters and Ph.D students are involved in the RESAP programme. The research topics are listed first and then a brief description of each topic is presented at the end of the list.

Assessment of resource use and management activities in arid lands and reflections on the human and natural environments: a study from the Red Sea Region of Eastern Sudan. Omer Abdalla M. Egemi.

Biotic and abiotic factors in the secondary succession in Erkowit, Red Sea Province. Ole Reidar Vetaas.

Dockers of Port Sudan. From pastoralists to urban workers. Omyma Said Ahmed Gutbi.

Land rights systems in the Red Sea Hills and their compatibility with a sustainable development in the area. Ingunn Notoy.

Landscape ecology and vegetation history in the Red Sea Area, Sudan. Ylva Blomberg and Gunnar Alstad.

Land tenure among the Hadendowa of the Red Sea Hills. Abdel-Hamid Mohamed Osman Abdel-Rahim.

Red Sea District women in processes of marginalization. Vibeke Vågenes.

The impact of drought on Beja women. Amal Hassan Fadlalla.

The impact of drought on the demographic structure of three Eastern Sudanese settlements. Mohammed Osman Omer.

Commercial fuelwood production. Anne Christensen.

Vegetation in the Red Sea Hills. Alawia Abdalla El-Awad.

Biotic and abiotic factors in the secondary succession in Erkowit, Red Sea Province. Ole Reidar Vetaas.

The purpose of this research is to determine whether secondary succession vegetation in the Erkowit area will continue to degrade or reach an equilibrium. To do this the author uses work done by Kassas in the 1950s in the Erkowit area for a comparative study. Three stages in the author's research must be accomplished to realize the main research purpose: quantify the change in floristic composition from 1953 to the present, analyze the physical and chemical qualities of the soil, and quantify moisture accumulation under tree canopies. Preliminary findings of this research are that there have been significant changes in the vegetation (particularly the trees) in the Erkowit area since 1953. The principal factor identified as responsible for the changes is human land use: tree harvesting for fuelwood, charcoal or other uses and grazing.

Botanical research. Babiker Fadlalla.

The purpose of this research is to augment our understanding of vegetation and vegetation change in the Erkowit area. The study has the following objectives.

1. To collect plant material for identification.
2. To identify and map natural vegetation.
3. To compare present vegetation maps with those made in the past.
4. To photograph the natural vegetation and the different ecological zones.
5. To produce descriptions and illustrations of the vegetation.
6. To examine several possible causal factors that may be responsible for the distribution and type of natural vegetation. For example, altitude, temperature, atmospheric humidity, rainfall, wind direction and human activities such as fuelwood production and pastoralism.

7. To measure the seasonal change frequency of occurrence and density of ground cover and forage composition.

8. To study the life cycle of grazing species.

9. To collect seeds for experiments under controlled conditions in the greenhouse.

10. To investigate local cultivated crops and fodders and to submit them to chemical analysis to determine their nutritive value.

11. To collect soil samples for chemical analysis and greenhouse experiments.

12. To estimate the seasonal yield in dry matter of the main pasture plants and to determine from this carrying capacity.

13. To examine the possibilities for the introduction of exotic plant species.

14. To examine the human-environment relationship in the study area. This includes vegetation use and annual transhumance.

The impact of drought on the demographic structure of three Eastern Sudanese settlements. Mohammed Osman Omer.

Three settlements in the Sinkat area were selected to examine drought and family structure. The author has identified three factors which relate to the impact of drought and the degree of change in family structure. These factors are:

1. The Environment and location.

2. Diversification of the economy.

3. Occupational linkage to urban areas.

The impact of drought on Beja women. Amal Hassan Fadlalla.

This study uses life histories of female migrants to Sinkat in reconstructing the lives of these women prior to the drought and making the comparison with their present circumstances. This work is in its early stages and results are forthcoming.

Dockers of Port Sudan. From pastoralists to urban workers. Omyma Said Ahmed Gutbi.

In this study dockworkers in the Port Sudan port were interviewed using questionnaires and informal techniques. Preliminary findings indicate that drought-induced impoverishment in the rural areas has increased migration to Port Sudan dramatically. People are increasingly replacing seasonal migration to Port Sudan with permanent settlement.

Assessment of resource use and management activities in arid lands and reflections on the human and natural environments: a study from the Red Sea Region of Eastern Sudan. Omer Abdalla M. Egemi.

The purpose of this research is to study the use of natural resources in Red Sea Province, to evaluate present development activities in the Province, and to investigate the social and cultural factors that influence the use and management of natural resources.

The author hypothesizes that:

1. Resource degradation did not suddenly occur in the early 1980s as a consequence of drought. Instead, it is the result of a long process of degradation.

2. Successful development builds and improves on what people are already doing.

3. The traditional territorial system in the area is a major barrier to development.

4. Relief food offers no long-term hope for the area and instead may form an obstacle to efficient management and development.

Land tenure among the Hadendowa of the Red Sea Hills. Abdel-Hamid Mohamed Osman Abdel-Rahim.

The purpose of this study is to describe the Hadendowa land tenure system. The following topics provide the focus for the research.

1. The evolution of the Hadendowa customary land use law.

2. The system used by the Hadendowa to manage land-use conflict.

3. Continuity and change in the land tenure system and the role of local, regional and national institutions.

4. The appropriateness of the Hadendowa land tenure system in development planning.

This study is in its preliminary stages and no results have been made available to date.

Vegetation in the Red Sea Hills. Alawia Abdalla El-Awad.

This study is in its preliminary stages and no results have been made available to date, however, the purpose of this study is to:

1. Obtain a reference collection of the flora of Red Sea Province for the herbarium in Khartoum.

2. Examine and map the distribution of vegetation types using aerial photographs and satellite images.

3. Identify plant species to serve as indicators of environmental change.

4. Document the status of post-drought vegetation in Red Sea Province.

Commercial fuelwood production. Anne Christensen.

In this study the impact of Port Sudan demand on charcoal production in Red Sea Province is examined. Areas studied include Khor Dahant, Khor Agwamt, Khor Udrus, and the coastal plain. This study is in its preliminary stages and no results are as yet available.

Land rights systems in the Red Sea Hills and their compatibility with a sustainable development in the area. Ingunn Notoy.

In this study the impact of the national government on traditional land ownership. In the precolonial and colonial periods, tribal shaykhs were responsible for land allocation and the resolution of land disputes. In 1970 the Unregistered Land Act was passed. This Act stipulated that all land not registered belonged to the national government. In 1971 the Local Government Act was adopted by the Sudanese government. This Act removed the power of tribal shaykhs to allocate land and adjudicate ownership disputes. This power was given instead to civil servants at the District Council and Village Council levels.

Red Sea District women in processes of marginalization. Vibeke Vågenes.

The purpose of this research is to describe the current and past status of women in Red Sea Province with particular emphasis on their involvement in the market. Three areas are to be examined in the study:

1. Women in the traditional female structure.

2. Women in the female-headed household.

3. Women involved in the Sinkat Centres for Women.

There are as yet no results from this research.

Landscape ecology and vegetation history in the Red Sea Area, Sudan. Ylva Blomberg and Gunnar Alstad.

The focus of this research is on the quantitative study of the present vegetation of Red Sea Province, vegetation history and soil analysis. LandSat data, aerial photographs, and ground data will be used in the study. The study is in its preliminary stages and no results have been made available to date.

Appendix 1.2. Port Sudan 1989, class of housing, settlement dates of unplanned areas, and ethnic composition.

NAME OF AREA	DATE	GROUPS
Housing quality 1:	Cement block flats	
Hai al-'azhima		Northerners, Yemenis
Tranzayt		Foreigners, Yemenis
Hai al-mataar		Northerners
Daym al-shaty		Yemenis
Housing quality 2:	Principally cement block flats	
Daym al-madiina		Northerners
Tarab hadal		Northerners
Al-thawra		Eritreans
Al-askiila		Northerners
Housing quality 3:	Wood construction	
Salalab		Northerners, Beja, Eritreans
Daym al-'arab		Beja
Sikka al-hadiid		Northerners
Al-marghaniya		Eritreans, Beja
Daym al-nuur		Northerners, Beja, Beni 'Amer, Eritreans
Daym kuriya		Northerners, Kordofanians
Abu hashiish		Northerners
Salabuna		Northerners
Daym al-takaariin		West Africans
Daym muusa		West Africans
Daym jaabir		West Africans
Daym mayu		Nubians, Beni 'Amer
Housing quality 4:	Shanty	
Daym al-wuhda	(fringe areas 1983-84)	'Atman, Beni 'Amer
Daar al-salaam	(1975-76)	Beni 'Amer
Daar al-na'im	(1983-84)	Tokar people, Beni 'Amer
Ongwob		'Atman, Beja
Hai phillip		Nubians
Hai walli	(1984)	Beja
Salalab shanty		'Atman, Hadendowa
Ras al-shaytaan		Ethiopians
Daym al-ramla (N Daym muusa)		Eritreans
Barcelona (SW Daym al-nuur)		Eritreans

2. MEASURING DROUGHT AND FOOD INSECURITY IN RED SEA PROVINCE: IN 1987 AND 1988: A TECHNIQUE FOR THE RAPID ASSESSMENT OF LARGE AREAS. Roy Cole

Summary

A system of rapid areal assessment of drought impacts and food insecurity was developed in Oxfam Port Sudan for use in 1987 and 1988. The system was designed to be used in the absence of sophisticated technology such as satellite imagery and extensive quantitative data. Experienced field workers used six variables related to drought and economy to assess the impact of drought and food insecurity in the province. Results indicate that the greatest drought impacts and food insecurity in 1987 were in the southwestern interior of Red Sea Province and in the South Tokar coast. The former area is one where the floods failed for two consecutive years, 1983 and 1984, and where destitute people moved to the roadside in 1985 to beg for food. The latter area is a destination of war refugees from Eritrea and people trapped by the war in Red Sea Province and prevented from pursuing their normal patterns of transhumance from the Red Sea lowlands to the Eritrean highlands. Low drought impacts and food insecurity scores appear to be linked with relatively reliable agriculture such as that practised in the Tokar Delta or linkage to an urban area. The unprecedented rainfall of 1988 was felt principally in the southern and central parts of the province according to the evaluation. The northern areas stayed the same or declined.

The results of this study indicate that drought and drought risk must be re-examined in Red Sea Province. Two things must be looked at: the potential for change in an area (interannual variability) and the existence of intervening, exogenous variables (for example, war) that affect the ability of people to respond to drought and economic adversity. Where environmental variability has historically been greatest we found the worst and the best results from year to year. However, for those areas that remained the same during both periods, we found a relative lack of potential for improvement. Locusts had an important impact on the scores only in the southwest of the province and southwest of Suakin in 1988.

The technique could be improved if the following conditions are met:

1. The unit of analysis should be smaller.

2. More variables should be included.

3. To minimise differences in observers only one person should do the classification.

Introduction

In early 1988 the Research Section at Oxfam Port Sudan developed a system for rapid areal assessment for relief food allocations for the Oxfam Food Monitors. The assessment system was part of some early explorations into changes of the Food Monitoring procedures and was also intended to provide information about drought impacts and food insecurity for 1987. The intention was to provide a spatial unit and structure for the Oxfam Food Monitoring Team's evaluations of areas for relief food allocations as well as criteria for a more systematic and accountable evaluation than had been done previously. The work was repeated at the end of 1988 to provide additional data for comparison.

Methods

Experienced field workers[2] were asked to rank on six variables each of the subecozones ("strata") defined by Watson (1976) in his study of livestock and human population in Red Sea Province. Some of the field workers had been involved for the three previous years in touring the districts of the province making relief food allocation assessments and others touring for nutritional assessment of children under five years of age. Assessments of the zones for the purposes of the present study were done while assessments for relief food or nutritional surveillance were being made. The assessments were not done at one moment in time but reflect repeated visits and are a composite of the conditions prevailing in or around each zone throughout each year of study.

Watson's subecozones are a subset of his ecozones ("ecotypes") which were defined from satellite imagery and ground observation using variables relating to vegetation, geomorphology, soils, drainage, and topography and fall into the classes presented in the following table.

Table 2.1. Ecozones used in Watson (1976).

Ecozone Number	Name	Area (km^2)
1	Coast	20896
2	Mountain	66276
3	Interior	112412
4	Khor 'Arab watershed	12611
5	Khor Baraka and Osir watersheds	4624
6	Tokar Delta	1136
	TOTAL AREA	217955

[2] The Oxfam Food Monitors and Nutritional Surveillance Team Leaders.

Watson's 25 subecozones were used as the basis for the present study. They were slightly altered for the 1987 data and changed considerably for the 1988 work. This was done because Watson based his classification on physical features of Red Sea Province. Our purposes involved people in addition to the environment. Zones were altered, for example, to reflect tribal territory, migration patterns, or the presence of significant towns. Watson's strata may be grouped into the following classes.

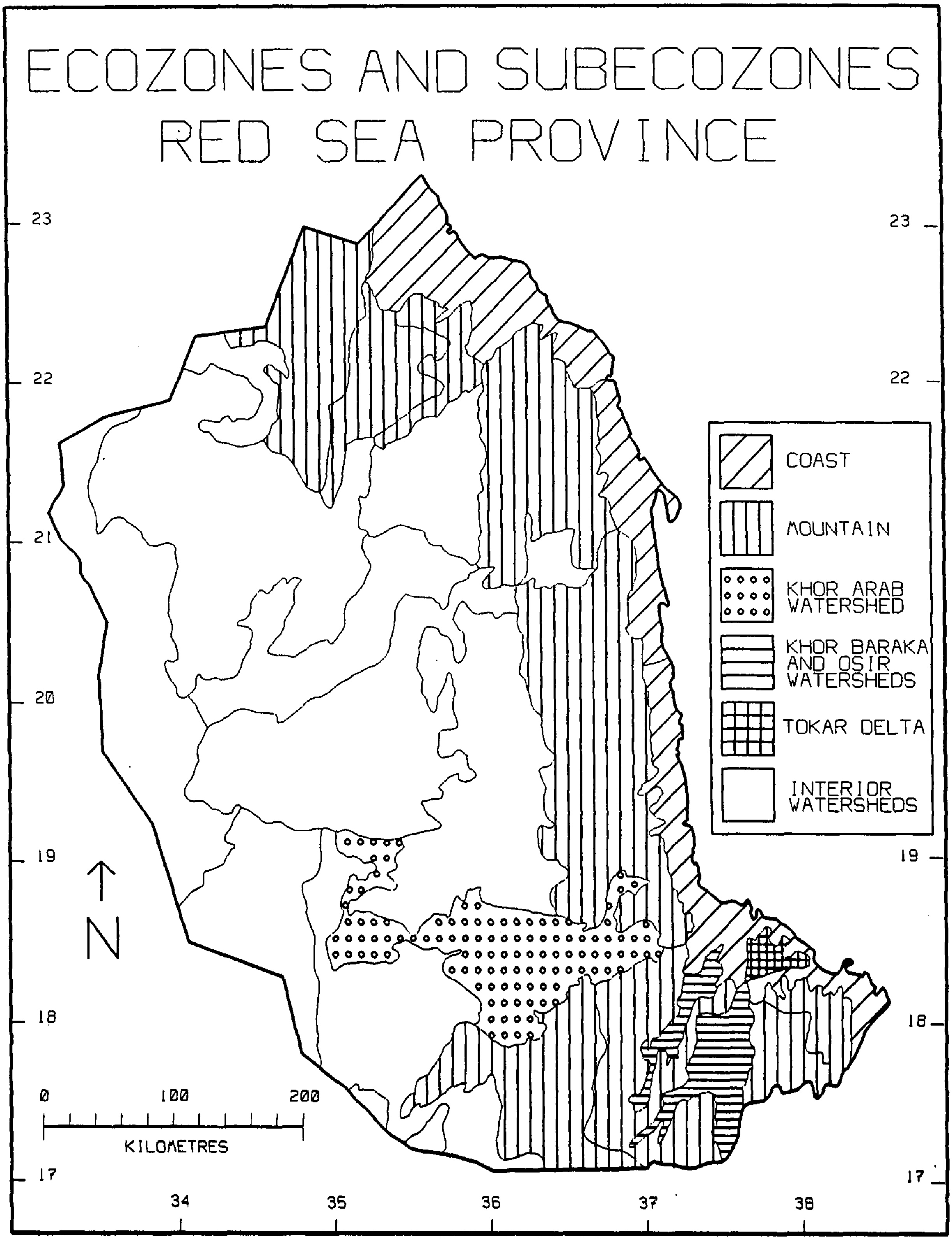
1. Coastal strip units.

2. Contiguous mountain units.

3. Watershed units.

The map on the next page presents the ecozones and subecozones of Watson.

Map 2.1. Ecozones and subecozones used by Watson (1976).



The six variables used to classify each of the subecozones (hereafter called "zones") for the present study are as follows:

1. Rainfall quantity and distribution.

2. Abundance and condition of useful vegetation.

3. The cash crop harvest.

4. The food crop harvest.

5. Livestock numbers, condition and recovery from drought.

6. The availability and use by zone residents of economic opportunities in or outside their zone[3].

The first two of these variables were used to measure drought impacts and the four remaining variables to measure food (and economic) insecurity. The scores for each variable were scaled from 0 to 3: None, Poor, Medium, and Good. The responses for each group of variables were summed (1 and 2 equals "Drought Impacts", 3-6 equals "Food Insecurity") and were plotted with Food Insecurity on the Y axis and Drought Impacts on the X axis.

The data were grouped into four classes according to the deviation of each zone from the mean for each year. Group 1 is equivalent to low drought impacts and food insecurity. Groups 2 and 3 are equivalent to moderate drought impacts and food insecurity; group 2 being moderately above and group 3 being moderately below the mean. Group four is equivalent to high drought impacts and food insecurity. These classes break down in standard deviations from the mean as follows (see Maps 2.2 and 2.3 also).

1. Greater than 1 standard deviation above the mean.

2. Zero to 1 standard deviation above the mean.

3. Less than 0 to 1 standard deviation below the mean.

4. Greater than 1 standard deviation below the mean.

Although it is useful to use means and standard deviations in interpreting the within years scores, it is more informative to use raw scores to compare the change from one year to another. This method gives results for each zone uninfluenced by the scores

[3] These opportunities include, for example, fuelwood production, artisanal production, other goods production, employment in agriculture and in urban areas.

of the other zones for that year. What is of interest in this case is the performance of the zone from time 1 to time 2 not the relation of the zone to the other zones at time n. A technique for the standardisation of unlike spatial units was employed to accomplish the comparison of each zone with itself over the two time periods. A grid composed of cells sized one-half the area of the smallest zone on the maps of Drought Impacts and Food Insecurity was superimposed over each map. For all areas that had a value for both years a difference was calculated and placed in the common grid cell. These cells were then grouped and mapped. The range of classes used in the grouping and mapping are as detailed below. The values reflect the number of positive or negative points change for the cell from 1987 to 1988.

1. >= 5 points change.
2. 2 - 4 points change.
3. 1 to -1 points change.
4. -2 to -4 points change.
5. <= -5 points change.

Results

Average scores and standard deviations for 1987 and 1988 are presented in the table below. The scores for each assessment zone for 1987 and 1988 are presented in the two tables that follow Table 2.2.

Table 2.2. Average scores and standard deviations on two variables for Red Sea Province, 1987 and 1988.

	Drought Impacts		Food Insecurity		Total	
	1987	1988	1987	1988	1987	1988
Mean	3.25	5.10	6.10	6.89	9.35	12.00
SD	0.76	1.05	1.72	2.03	2.06	2.72

Table 2.3. Drought impacts and food insecurity scores, Red Sea Province, 1987.

	Zone	DROUGHT IMPACTS Rain	Veg	Sub Total	FOOD INSECURITY Cash Crop	Food Crop	Stock Cond	Econ Acts	Sub Total	TOTAL	Deviation from Mean
1a	Port Sudan-Tokar Coast	2	1	3	2	2	2	2	8	11	1.65
1b	S. Tokar Coast	1	2	3	1	3	2	2	8	11	1.65
2	S. Tokar Central	2	1	3	1	1	2	0	4	7	-2.35
3	S. Tokar Mountain	2	2	4	1	1	2	0	4	8	-1.35
4	Khor baraka-langeb	2	2	4	3	3	2	2	10	14	4.65
6	Derudeb Khor langeb	1	1	2	0	0	2	2	4	6	-3.35
7a	RPS-Halaib Central Mountain	1	2	3	1	1	3	1	6	9	-0.35
7b	Sinkat/Erkowit Mountain	1	1	2	1	1	2	2	6	8	-1.35
8a	Tahamyam East	2	1	3	1	1	2	2	6	9	-0.35
8b	Haya,Tahamyam	1	1	2	1	1	2	2	6	8	-1.35
8c	Haya,Khor 'Arab Basin	2	2	4	1	2	2	1	6	10	0.65
12	Haya North	2	2	4	1	2	2	1	6	10	0.65
16	Halaib Central Mountain	2	2	4	1	2	3	1	7	11	1.65
17	Halaib Coast South	2	1	3	1	1	3	2	7	10	0.65
18	Halaib Mountain Central	2	2	4	1	2	3	1	7	11	1.65
19	Halaib Mountain North	1	1	2	1	2	2	1	6	8	-1.35
20	Halaib Coast North	2	2	4	1	2	3	2	8	12	2.65
24	RPS-Halaib Central Mountain	2	2	4	1	2	2	1	6	10	0.65
25a	Derudeb Central	2	1	3	0	0	2	0	2	5	-4.35
25b	Derudeb West	2	2	4	1	2	2	0	5	9	-0.35

Map 2.2. Drought impacts and food insecurity, Red Sea Province, 1987.

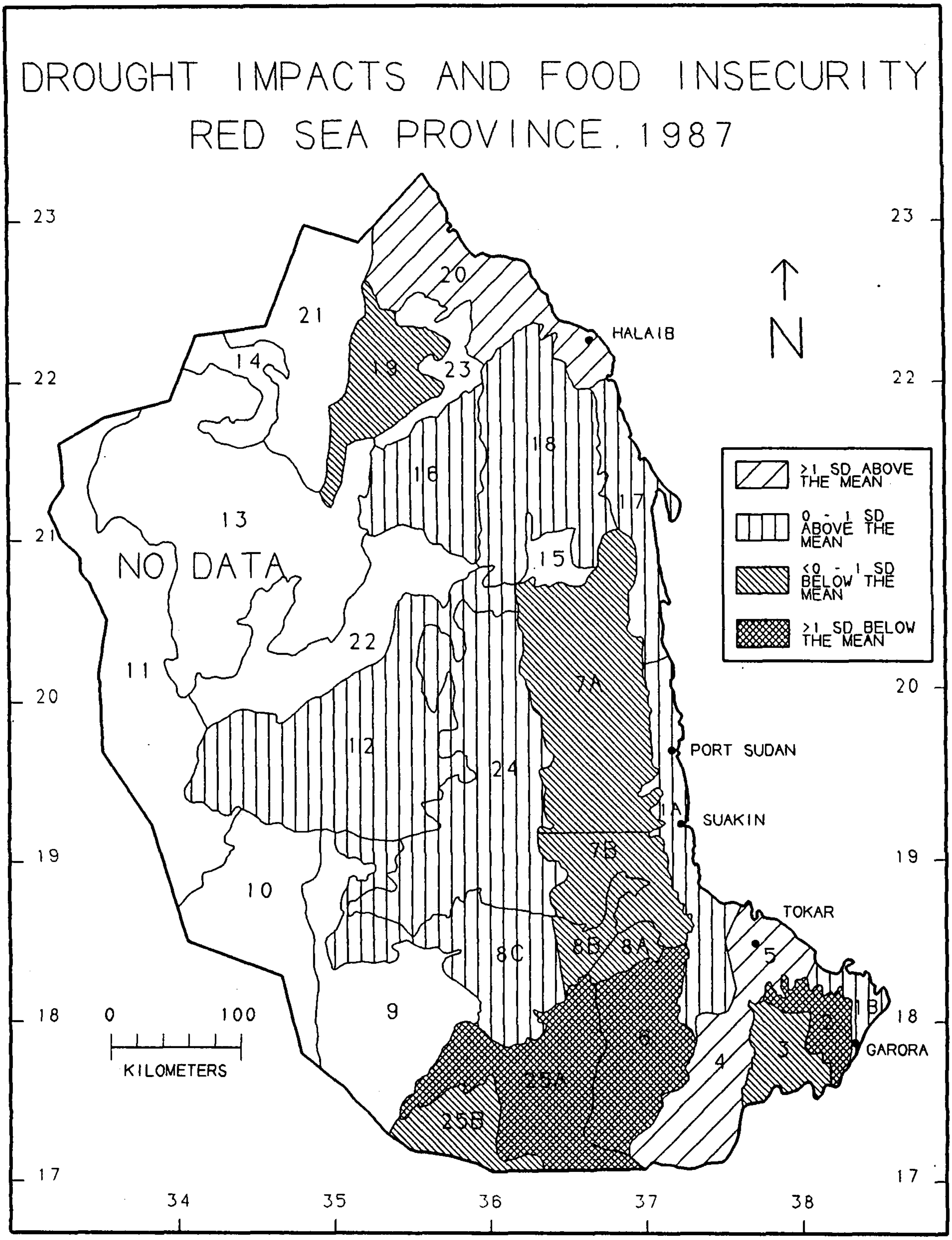
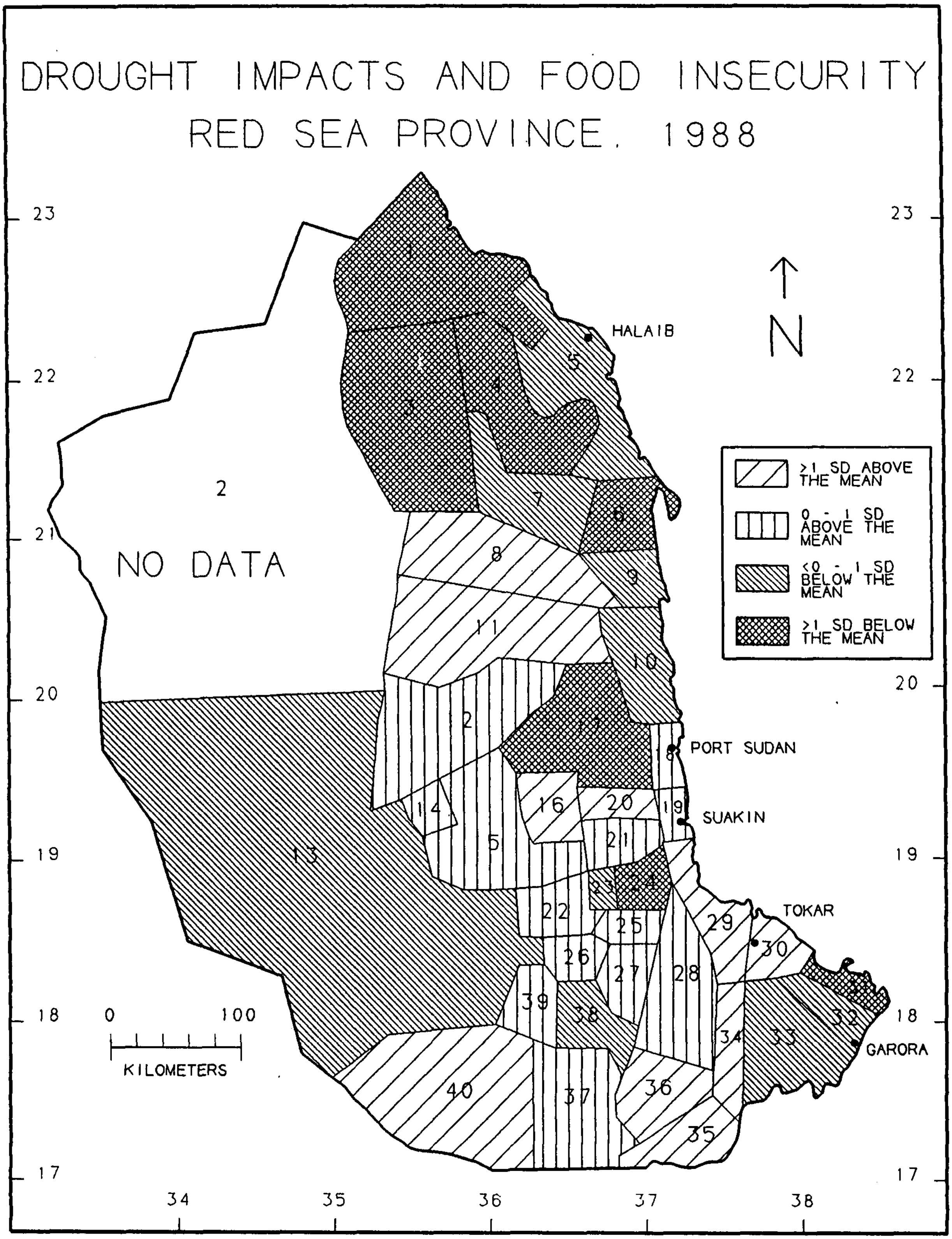


Table 2.4. Drought impacts and food insecurity scores, Red Sea Province, 1988.

	DROUGHT IMPACTS			FOOD INSECURITY						
Zone	Rain	Veg	Sub Total	Cash Crop	Food Crop	Stock Cond	Econ Acts	Sub Total	TOTAL	Deviation from Mean
1 Sarara A	1	3	4	0	0	3	0	3	7	-5
2 Halaib west	no data									
3 Khor 'alaaqi	2	3	5	0	0	2	2	4	9	-3
4 Sarara B	3	2	5	0	0	2	2	4	9	-3
5 Halaib town	1	3	4	0	0	3	3	6	10	-2
6 Muhammed qul A	1	1	2	0	0	2	3	5	7	-5
7 Gebeit al-ma'adiin	1	3	4	0	0	3	3	6	10	-2
8 Khor oko	3	3	6	0	3	3	3	9	15	3
9 Muhammed qul B	2	3	5	0	0	3	3	6	11	-1
10 Khor arba'at A	2	3	5	0	0	2	3	5	10	-2
11 Khor tumaala/Oko	3	3	6	3	3	3	3	12	18	6
12 Khor 'amuur	3	3	6	0	3	3	2	8	14	2
13 North haya	3	2	5	1	1	2	1	5	10	-2
14 Khor agwampt	3	3	6	0	2	2	2	6	12	0
15 Khor 'udrus B	3	3	6	0	1	2	3	6	12	0
16 Khor 'udrus A	3	3	6	0	3	3	3	9	15	3
17 Khor arba'at B	2	1	3	0	0	2	3	5	8	-4
18 Port Sudan	2	2	4	1	1	3	3	8	12	0
19 Suakin	3	3	6	0	0	3	3	6	12	0
20 Khor akwaat/sallum	3	3	6	0	3	3	3	9	15	3
21 Gebeit/'aqaba	3	3	6	0	2	3	3	8	14	2
22 Ayshaf A	3	3	6	0	2	2	2	6	12	0
23 Ayshaf B	3	1	4	0	1	3	3	7	11	-1
24 Erkowit/hadirbab B	3	1	4	0	1	2	1	4	8	-4
25 Hadirbab A	3	3	6	0	3	3	2	8	14	2
26 Khor asot	3	2	5	1	2	2	3	8	13	1
27 Wahribab	3	3	6	0	2	3	3	8	14	2
28 Khor osir	3	3	6	0	0	3	3	6	12	0
29 Suakin/Tokar road area	2	3	5	2	3	2	3	10	15	3
31 Coastal S. Tokar	1	2	3	1	1	2	2	6	9	-3
32 Central S. Tokar	2	2	4	0	2	2	3	7	11	-1
33 Mountain S. Tokar	2	3	5	0	0	2	3	5	10	-2
34 Khor baraka	3	3	6	3	3	2	3	11	17	5
35 Hamashkoreb	Grouped with zone 34									
36 Khor langeb	3	3	6	2	2	3	3	10	16	4
37 Derudeb east	3	3	6	0	2	2	3	7	13	1
38 Khor langeb	3	2	5	0	2	2	2	6	11	-1
39 East haya	3	3	6	1	1	3	2	7	13	1
40 Derudeb west	3	3	6	2	3	2	2	9	15	3

Map 2.3. Drought impacts and food insecurity, Red Sea Province, 1988.

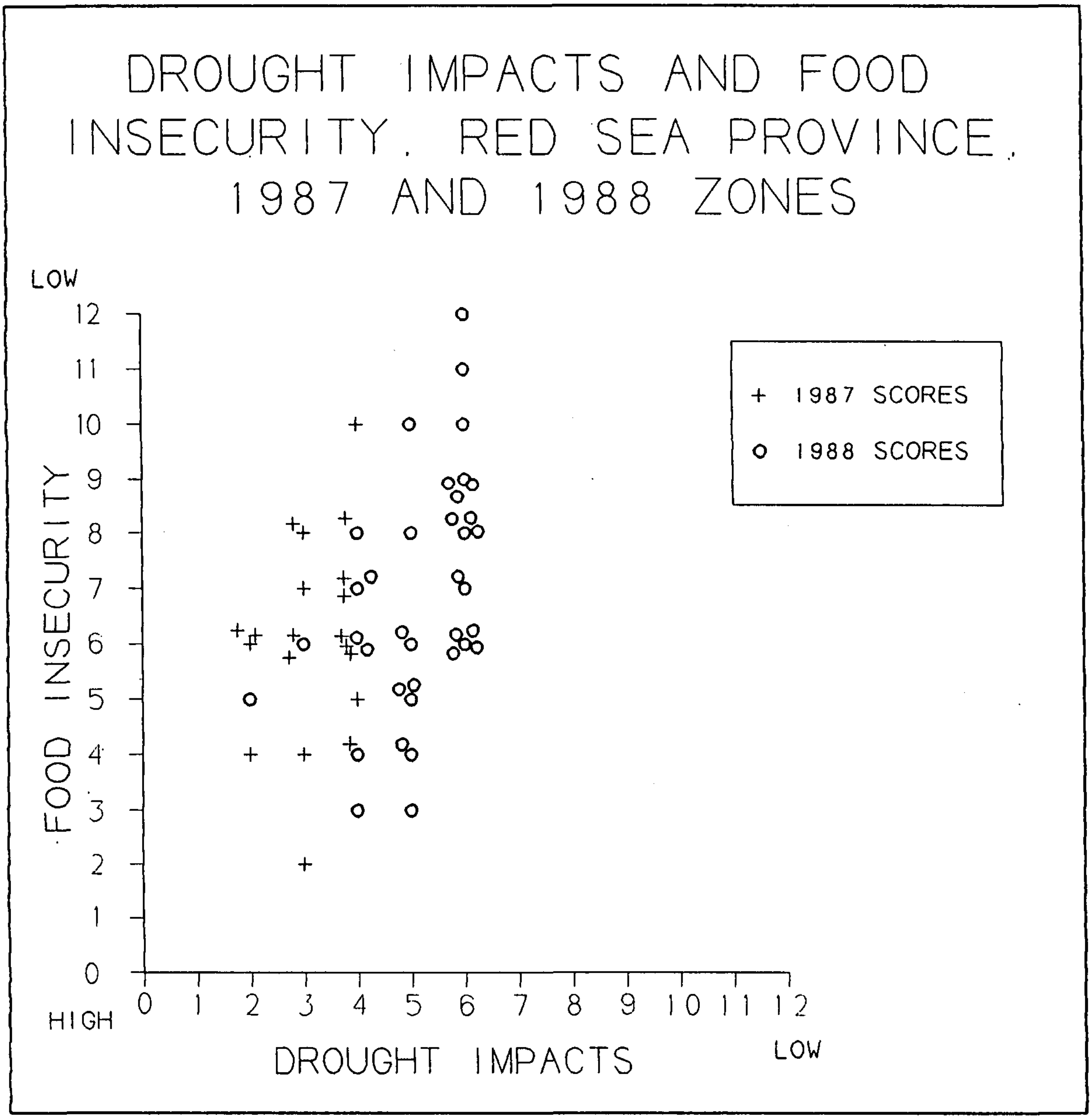


Two areas experienced low drought impacts and food insecurity in 1987 in Red Sea Province: the Khor Baraka watershed (Zone 4) and the coastal strip from Halaib Town to Egypt (Zone 20). The rest of the coastal strip (Zones 1A, 1B, and 17), the central highlands in Halaib District (Zones 16, 18), and the west central portions of Red Sea Province (Zones 12, 24, and 8C) experienced moderately low drought impacts and food insecurity in 1987. Those areas that experienced moderately high drought impacts and food insecurity in 1987 were west of Halaib (Zone 19), the central and southern Red Sea Hills (Zones 7A, 7B, 8A, 8B, and 3), and the Braytek basin in the southwest (Zone 25B). Those areas with the worst scores were two: southcentral Red Sea Province (Zones 25A and 6) and the foothills of the South Tokar mountains (Zone 2) (see Map 2.2).

In 1988 there was a dramatic reversal of position; in general those zones that scored highest in 1987 scored lowest in 1988. Lowest drought impacts and food insecurity was found in the south of the province in Zones
29, 30, 34, 35, 36 and 40), in the centre in the 'Udrus and Akwaat valleys, and in the north centred on Khors Oko and Tumaala in Zones 8 and 11. Moderately low positive scores were registered along the Port Sudan to Suakin coast (Zones 18, 19), in the Khor 'Amuur (Zone 12), Agwamt and western 'Udrus watersheds (Zones 15, 14), the Tahamyam-Haya area (Zones 22, 25, 26, 27, 39) into Khor Osir (Zone 28) and south into eastern Derudeb (Zone 37). Zones scoring moderately low below the mean (negative scores) were scattered around the province. This group is composed of Zones 5, 7, 9 and 10 along the north coast, Zones 13 and 28 in the western and southern interior, and Zones 32 and 33 in the South Tokar mountains. The Zones scoring highest in Drought Impacts and Food Insecurity were, for the most part, located in the north of the province. These Zones are 1, 2, 4 and 8. The three other areas scoring the lowest were scattered around the province with no apparent pattern. These zones are 17, 24, and 31.

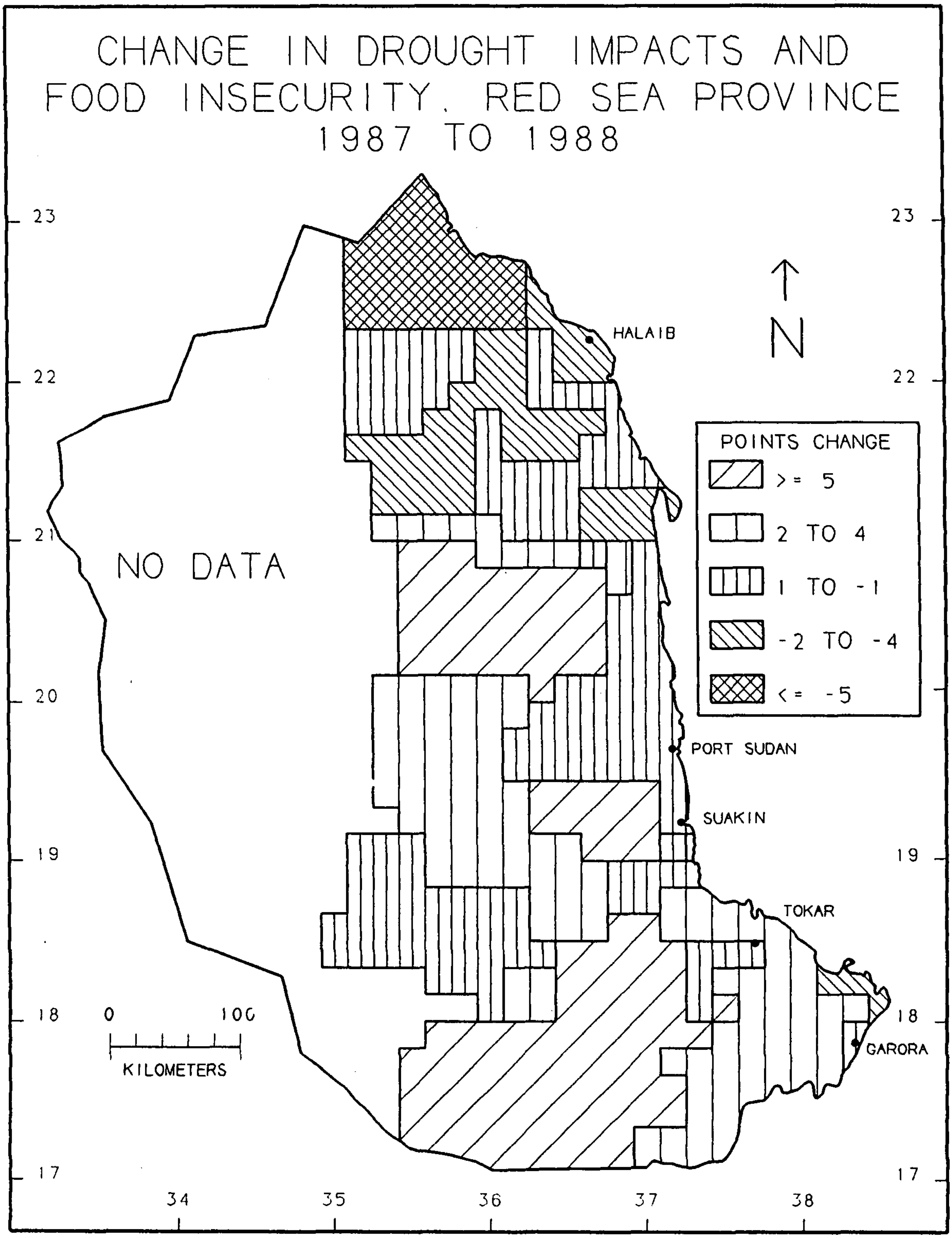
The figure below presents a view of the differences between the two years. Variables measuring rainfall or a rainfall related product such as pasture, vegetation, agriculture, or agricultural employment all scored higher in 1988. The scores for 1988 were on average 1.85 points higher than 1987 for the Drought Impacts variable and 0.79 points higher for the Food Insecurity variable and 2.65 points higher on both variables. The difference in percent is 57, 13 and 28 percent respectively.

Figure 2.1. Drought impacts and food insecurity, Red Sea Province, 1987 and 1988 zone scores.



Map 2.4 below presents change from 1987 to 1988 in the Drought Impacts and Food Insecurity scores. The scores are not marked in standard deviations as in Maps 2.2 and 2.3 but in points change.

Map 2.4. Change in Drought Impacts and Food Insecurity, Red Sea Province, 1987 to 1988.



Conclusion

Considerable change in drought impacts and food insecurity has occurred from 1987 to 1988 in Red Sea Province as measured by the method described in the present paper. This change was due to the excellent rains of 1988 which fell generally over southern and central Red Sea Province. The rains were so good that pasture was abundantly available in and outside of khors and areas were cultivated that had never been cultivated before. There were areas where rainfall was good but vegetation and other variables scored low.

Our method appears to be a useful technique for the rapid assessment of large areas, however, there may have been some problem with measuring the influence of intervening variables, for example, we were not able to assess the economic significance of camel and sheep smuggling in the northern areas of the province. Had we been able to do so the scores for some of these areas might have been higher. Specific issues relating to the method and results will be addressed in the Discussion and Limitations of the Study sections below.

Discussion

Although the method for the rapid assessment of large areas used in the present study appears useful, there are some problems in the interpretation of Maps 2.2 and 2.3 that need to be addressed. The maps themselves are not directly comparable because each zone's value in the map is influenced by the scores of the other zones. While this is a useful method to understand the relationship between the zones in one year it is less useful when comparing zones between years. For example, a change from best to worst for a zone between the two time periods does not necessarily mean any great change in the drought impacts or food insecurity in that zone. The change may be related, instead, to change within other zones that alter the position of the mean value and the position of all other values to the mean. This is what happened between 1987 and 1988 and it reflects the extreme annual variability of the environment of the southern and central portions of Red Sea Province. From 1987 to 1988 the southern part of the province, with the exception of the perennially well-off Khor Baraka basin and the lagging South Tokar District, leapt from last place to first place, principally because of the unprecedented rainfall. This caused the position of the northern zones, ordinarily receiving an unpredictable scattering of from 25 to 50 mm of rainfall annually, to apparently decline. These northern areas are in fact relatively immune from drought because they exist is a state of perpetual aridity.

In order to address this problem (and also to standardise the units of comparison) Map 2.4 was made. Map 2.4 presents a direct comparison of the raw scores for each zone on the map that had observations for both years. Indeed, the greatest changes took place where there was the greatest potential for environmental variability - in the southern and central parts of the province. The relatively low change in one area that received much rainfall, Zone 13 (1988), in the southwest of the province, may reflect the infestation of locusts in that area and also to its east toward Suakin. The extreme difference from 1987 to 1988 at the northern tip of the province was exactly -5. Poor rain in 1988 was the reason why area was classed so low in 1988 but as it is a borderline case perhaps it would best be classed with the next group up, the -2 to -4 class. Relative lack of change in the northern areas as mentioned above reflects the perennial state of affairs in this area. The northern exception is the Khor Oko area which scored above the mean in 1987 and well above the mean in 1988. The good rains of 1988 were responsible for this as well as the nationally and internationally connected social support network of Shariif Aderob of the Mosque at Tumaala. The same observation holds for the Mosque of Shaykh Sulaymaan at Hamashkoreb in the extreme south of the province. The two religious settlements provided assistance to destitute people during and after the drought. The population of children in the rural khalwas, religious training centres associated with the mosques, rose dramatically during the drought as did the founding of khalwas.

Zone 24, the Erkowit area, registered a 4 point decline from 1987 to 1988. Although rainfall was good, vegetation, cash crops, food crops and employment opportunities were not. There is evidence to indicate that there have been significant changes in vegetation in the Erkowit area (Vetaas 1989). These changes may have had impacts on livestock production and recovery. It is known from reports that planting in the Erkowit area had to be done several times because of excessive flooding and crop damage. This may have been responsible for the food crop problems.

The only area that had a relatively high decline in points from 1987 to 1988 in the south of the province was the coastal strip from 'Agig almost to Garora. The poor rain along this portion of the coast plus the high numbers of refugees from Eritrea living in poor conditions resulted in a low score.

Based on our study what can we say about the economic recovery from drought? Quite simply we may state that at present those areas that scored poorly in 1988 did so for reasons different from those relating simply to drought or the general economic climate. In South Tokar, for example, the principal reason for poor scores was war in Eritrea and the influx of refugees. It should be mentioned that the majority of these refugees are indistinguishable from the people living in South Tokar District. The only difference is that, unlike their Sudanese cousins, they have no land or cultivation rights in Red Sea Province. They used to seasonally migrate with the rains from Eritrea to Red Sea Province in search of grazing and employment. When the Sudanese-Eritrean border was closed and mined by the Ethiopian government many of these people were trapped on the Sudan side and lost their livestock in the dry season. When the border was reopened after the Eritreans took the border areas in the mid-1980s it was too late for these people; they were already destitute.

The environment of northern Red Sea Province is an example of low potential for change. The rainfall is scattered and low. The economy in northern Red Sea Province, however, is one of the strongest regional economies in the Sudan. This economy has two linked components: a pastoral economy centred on camel and sheep raising for sale to Saudia Arabia and Egypt and a settled economy which is involved in the smuggling of other goods. The variables used in the present study may not have measured the strength of the northern economy as well as expected.

Lack of recovery in certain areas of Red Sea Province today is less related to environmental or economic factors than to political instability and the specific social conditions of individuals and should be addressed in a more appropriate manner than that done presently by international donors. A specific programme to address the needs of people marginalised by the Eritrean conflict who live outside the camps in South Tokar should be undertaken. Efforts should be undertaken to target vulnerable groups: divorced or widowed women with dependent children and limited family support, pregnant and lactating women and children of weaning age.

Limitations of the Study and Comments on the Research Method

Problems we encountered during the course of the work are listed below.

1. The units of analysis used in the study in 1987 were too big and did not reflect human land use. Smaller units, perhaps clusters of villages, would have been more appropriate. The costs of data collection are a consideration, however. For 1988, several of the zones were still inordinately large. With more information (see below) they could be trimmed into coherent subunits.

2. The concept of the uniform spatial unit was difficult for some of the field workers to grasp. They invariably attempted to classify subareas of the subecozones rather than synthesise and generalise over the entire area. Perhaps this problem would be alleviated by the use of smaller, easier to handle, spatial units.

An Alternative Method

Although expanding the complexity of the work goes counter to our intention to explore alternative, low-technology methods of areal assessment, this type of research would benefit from the high technology approach. The use of the Normalised Difference Vegetation Index (NDVI) maps rather than subjective assessments of rainfall and vegetation quality would have gone far to reduce error in classification. The NDVI is prepared on a monthly basis for the governments of most drought-prone African countries by the United States Geological Survey, National Mapping Division at the EROS Data Center in the United States. It is funded by the Africa Bureau of the United States Agency for International Development (USAID). NDVI images are produced from the United States National Oceanographic and Atmospheric Administration's Advanced Very High Resolution Radiometer (AVHRR) satellite data. The scale of the imagery is 1:2500000 and the resolution is 1 km^2. Reflectance values of vegetation are on a greenness scale from -1.0 to 1.0, the lower limit being equivalent to bare rock and the upper to green fields of wheat.

The study would have benefited from the use of more variables, for example, rainfall in millimetres, cropped and harvested areas, human and livestock populations, number of migrant workers, wage rates and destinations, security, number of refugees, malnutrition rates, and locust damage to crops. These types of data together would go well in a principal components or factor analysis. Principal components and factor analysis are used to bring together variables and different types of data and create new variables that express the relationships between the original variables. These new variables can be mapped in meaningful ways. There are two interrelated reasons to use principal components or factor analysis in a study such as the present one[4]:

1. To identify groups of intercorrelated variables.

2. To create new variables through combination of old variables.

Intercorrelated variables are independent variables that measure the same thing in different ways. In combining the variables we define the "thing" we are measuring. Sometimes this is called "fishing around in the data." One variable, for example, human population, may not explain the distribution of livestock in Red Sea Province at a given time during the year. The aggregation of more than one variable will do so. For example, what is the relationship between the variables, rainfall, tribal affiliation, human population, livestock populations and the Braytek basin? It is a good guess that these variables may explain it. The factor analysis combines such variables and creates factors instead. Out of 25 variables, for example, the factors produced by factor analysis would be about 4. Each factor expresses a characteristic or a concept. For example, a factor composed of the variables, human population, livestock population, rainfall, and location possesses the characteristics of rainfall, rural, areas of good pasture production, people, and location. It may be called "areas of good grazing and human and livestock concentration". In Red Sea Province, where this variable is found to be high one can expect all that the variable measures to exist there. Where it is low, the opposite is expected. Other groups of variables may be so grouped. This reduces many of the headaches of determining significant variables and also creates important variables from variable that alone would not be significant.

The use of a Geographic Information System would also be a great help for similar studies that use more variables. A Geographic Information System (GIS) is a computer programme that stores, analyzes and makes maps of data such as those collected for the present study. A GIS has the power to manipulate masses of data, do much of the statistical work done by expensive statistics programmes (which, these days, may include the creation of factors from groups of variable), and automate the process from data to maps (see Clarke (1986) and Lillesand and Kiefer (1987) for further information). The investment necessary for the high technology approach would be more appropriate for large and long term programmes with generous budgets and secure financing. A programme such as this is more appropriately conducted on the national or international level rather than at the provincial level. A system such as or similar to that described in the present paper would go a long way in providing useful data for drought impacts and food insecurity assessments on the regional or national level. The most important consideration in setting up such a system is to keep the unit of analysis, the

[4] See Johnston (1980) and Rummel (1967) for further information.

cell or zone, as small as possible. If the unit of analysis is too big it becomes insensitive or masks the differences within the unit. Ideally, differences within a unit should be minimised. Good criteria in constructing a unit would be uniform economic activities, land use, land cover, ethnic, cultural or familial uniformity, and urbanisation or linkage to urban areas. Although the District Councils in the Sudan may be of an appropriate size and homogeneity for zoning in a meaningful way, there may be traditional systems of areal zoning that are more useful, for example, lineage or ethnic areas. In the case of the Sudan, it may be more convenient to use the District Councils because they are a unit of data collection on a variety of topics. For example, data are collected at the District Council headquarters on cultivated and harvested areas within the District Councils, rainfall and market prices for cereals and livestock. It is here that data for the Islamic social security system (from the zakaat) are collected. It should be noted that the District Council can be broken down into any number of units because of the way the data are collected. For example, data on cultivated and harvested areas are collected by khor. If a particular khor fits better into some other spatial grouping than the District Council, then it can be regrouped. Also available are data on rainfall (Meterological Department in Khartoum) and wadi flooding (National Water Corporation in Khartoum). Rainfall data are available on a daily, monthly, or annual basis. Available flood data, collected from permanent gauging stations around the country, concern the number of floods, the duration of each flood, the maximum discharge in cubic metres and the total flow per flood in cubic metres. In Red Sea Province there are seven such gauging stations. The agricultural schemes throughout the Sudan collect their own data on rainfall and flooding as well. NDVI maps of vegetation on a monthly basis are available, as mentioned above, but in deeply incised areas of the Red Sea Hills their usefulness is limited because the large unit of analysis (1 km^2) mixes the reflectance values for the khors with the mountains. Landsat Thematic Mapper data would be more appropriate but are more expensive and take longer to process than the NDVI data.

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