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AGROPASTORALISM AND DESERTIFICATION IN CEEL DHEER DISTRICT: PRELIMINARY INVESTIGATION AND TRIAL RESULTS.

by
Richard M.Holt

CRDP TECHNICAL REPORT SERIES NO3, 1985.

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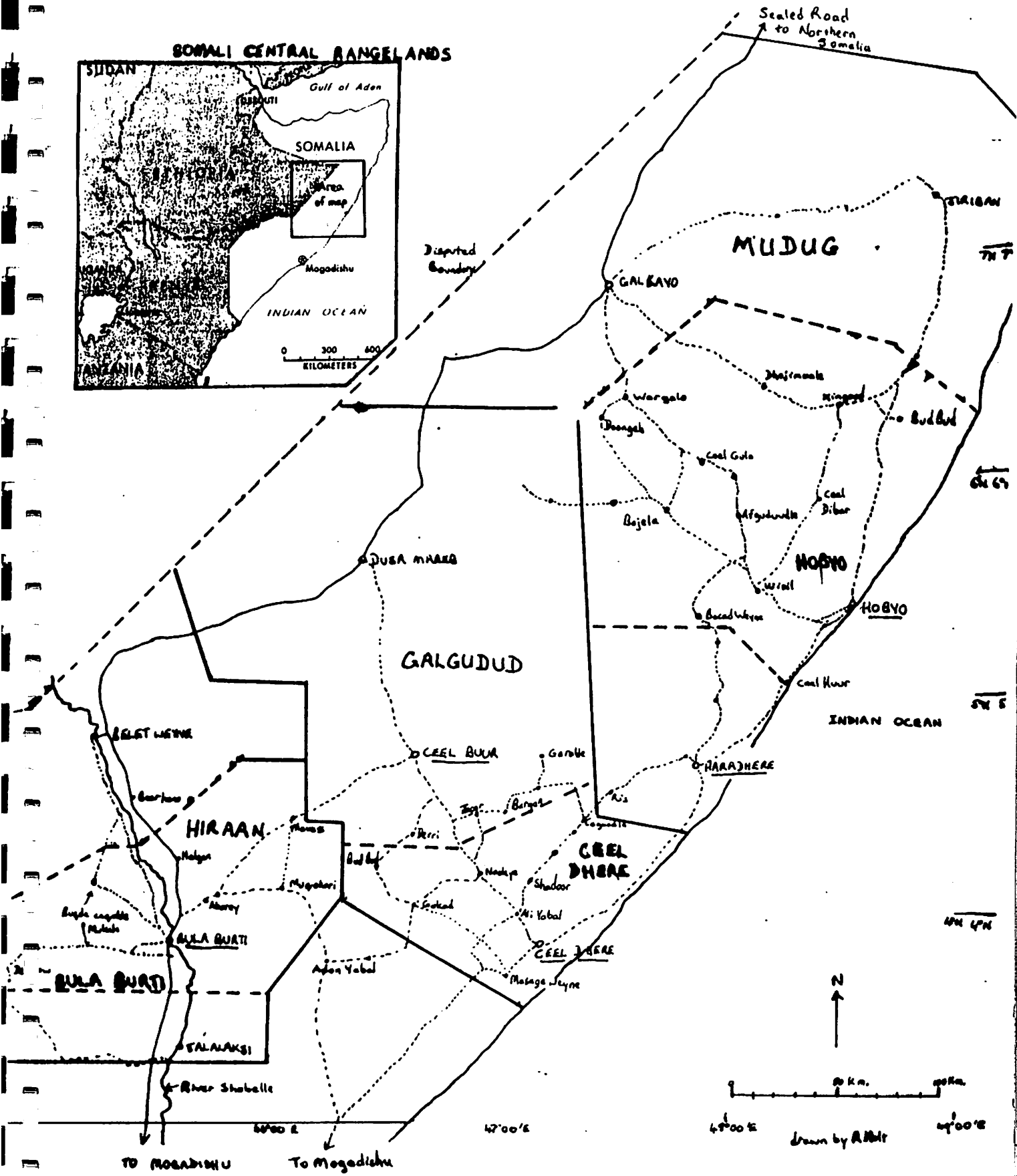
MAP1 : LOCATION CENTRAL RANGELANDS DEVELOPMENT PROJECT.



1.0 INTRODUCTION

1.1 Location

The study was made in Ceel Dheer district, which is the most southern district in Galgadud region, central Somalia. As shown in map 1, its eastern boundary is the Indian Ocean; to the south it joins Middle Shebelle Region, on the west, Ceel Buur District and to the north, Jalalaksi District. Within Ceel Dheer District, which is about 9,000 sq.km in area, the study was undertaken mainly in the Nooleye degaan (locality), and to a lesser extent, near Ali Yabal, Masagaweyn, Shadoor and Agacaddle. These sites all lie within a large band of agropastoralism that stretches from Mogadishu parallel to the coast 650 km north past Hobyo port, as shown on map 1.

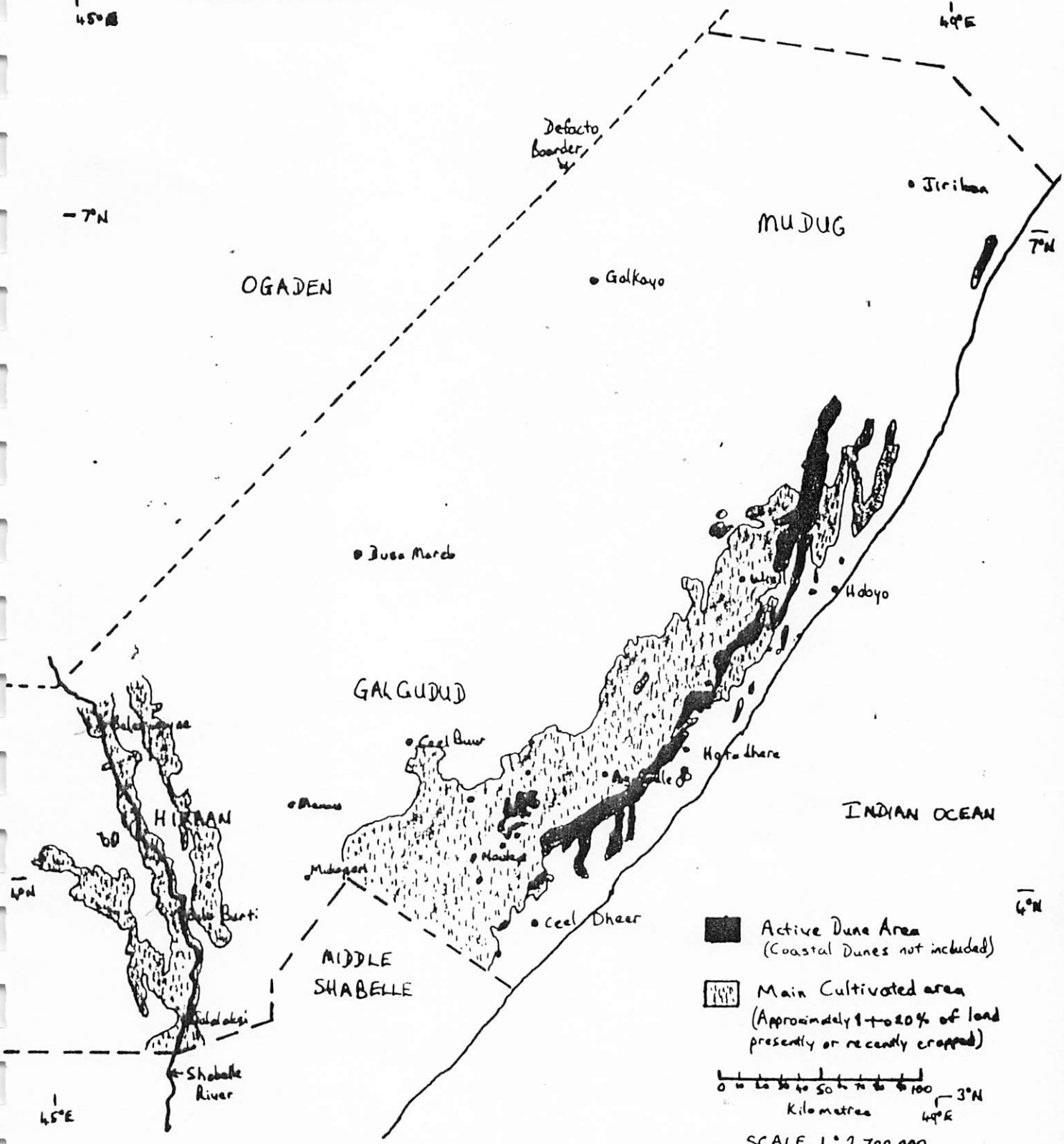
1.2 Topography

The eastern portion of Ceel Dheer District has an extensive coastal plain, about 15 to 20 kilometres wide. This is the only large uncultivated area. On the western side of the plain, also lying parallel to the coast, is a 200-300 metre high ridge about 30 to 40 km wide, that gently slopes down to the inland plateau. The plateauis characteristically about 100 to 150 metres in elevation, and has level or gently undulating topography. Agropastoralism is practised over much of the ridge and adjacent plateau, concentrated close to water points, particularly the new permanent waters, and in areas with good soil. There are few gullies and little opportunity

Holt 1-A

SOMALI CENTRAL REGIONS:

Map 2: Cultivated Area and Active Sand Dune Area.



Richard Holt 1985

Source: RMA survey 1979 plus personal observations.

for cultivators to take advantage of runoff water, except for some sites along the edges of the ridge.

A large active sand dune, about 90 kilometres long lies on the eastern side of the ridge. As with other smaller continental dunes in the area, the edges, particularly the northern advancing edges of the dunes are often cultivated by agropastoralists taking advantage of water stored in the dunes. The location of agropastoralism and active sand dunes is shown on map 2.

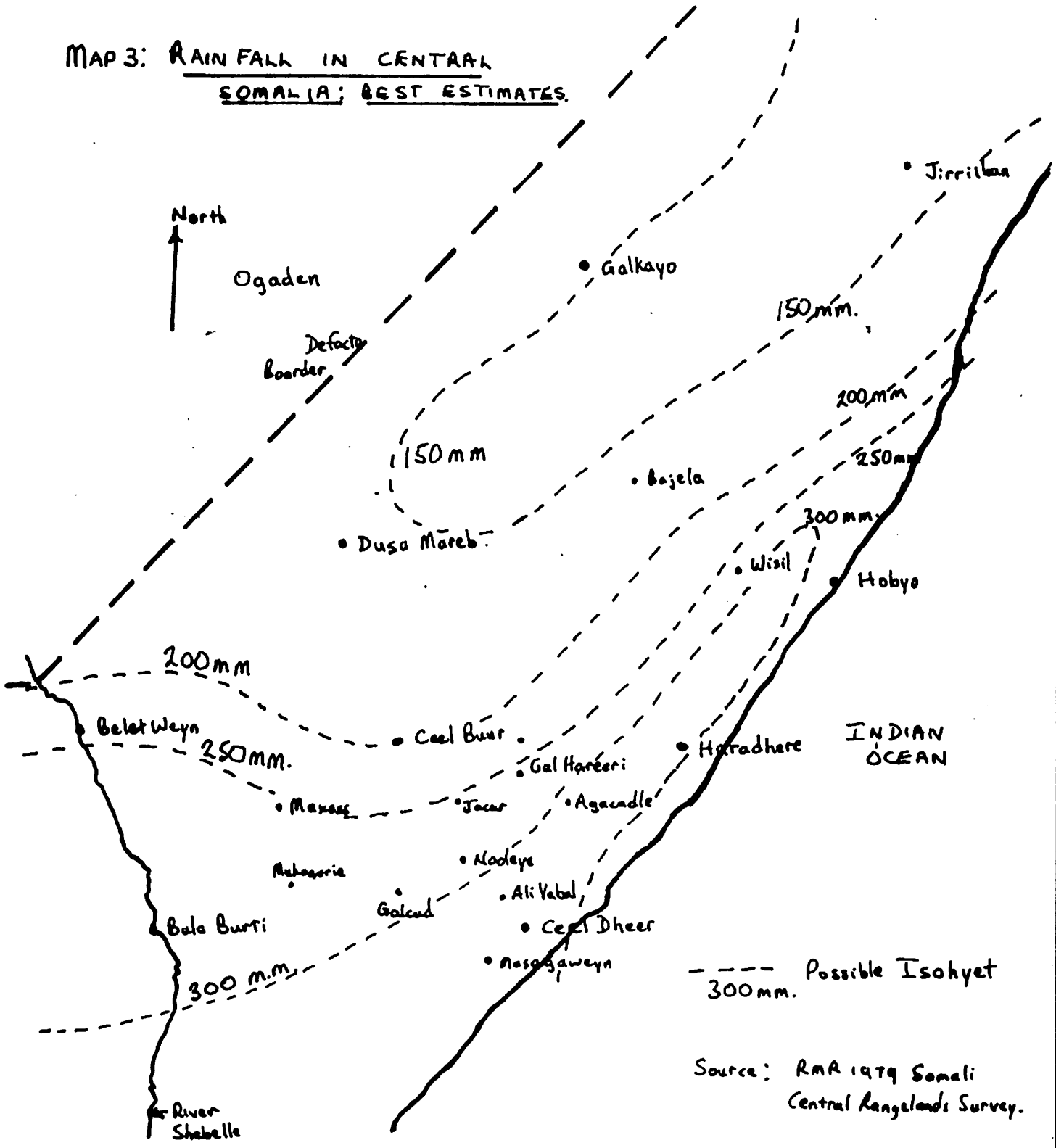
1.3 Climate

As the study area lies 4 degrees North of the equator it has a typically hot climate with comparitively little seasonal change in temperatures. It has a bi modal rainfall pattern with most rainfall falling in the Gu season, April and May, and to a lesser extent, the Dayr season, October and November. These rainy seaons occur in the period between the two dry monsoons, the north east monsoon, the Jilaal season, December to March, and the south west monsoon, the Hagaa season, June to September.

Like most semi arid climates, the rainfall is eratic, varying considerably from seaon to season. Map 3 summarises estimated rainfall in the area, which is probably 250 to 300 mm per annum, although extensive rainfall records are not available from the District. Although rainfall is marginal tor cropping, local agropastoralists in the Nooleye area estimate they are able to grow

HCT-2 A

MAP 3: RAIN FALL IN CENTRAL SOMALIA; BEST ESTIMATES.



Source: RMA 1979 Somali Central Rangelands Survey.

good or very good crops 6 out of every 10 seasons, and they cultivate in both yearly wet seasons. The opportunity to harvest crops twice a year is an important factor that allows the area to have developed a viable agropastoral industry.

No information is available on the humidity, but a estimate based on data from adjacent areas is an average of 60 to 80% in the wet seasons and 50 to 70% in the dry seasons. With such relatively low rainfall and humidity, crop diseases like rusts do not appear to be as serious a problem as they often are.

In some localities agropastoralists say heavy dews occur, stimulating crop production. They sometimes site their farms where dew is known to be heavy.

1.4 Soils and Geology

The central ridge and inland plateau consists mainly of stabilised sand dunes overlying limestone. The sand is generally deep on the central ridge and shallow over the plateau. The sandy soils of the central ridge tend to be more orange in colour and fine textured, whereas inland the sand is generally white and more fertile.

The local agropastoralists classify soils according colour, texture, and fertility (ability to grow crops) as well as other factors, such as water holding capacity. Information collected on this soil classification system during this study is not yet complete, but in

the near future a soils map of the area based on this system will be finished. An understanding of the soil is important in this agropastoral system as the fertility and the susceptibility of the soil to wind erosion appears to greatly effect the period an area can be cultivated before becoming exhausted or blown away, and how long the soil takes to recover its fertility. Some preliminary information on local local Somali terminology and the soil classification system is given in appendix one and two respectively.

The shallow white sandy soil typical of Nooleye and adjacent areas ('ciid) are considered the most fertile in the district. It is soft, and easy to cultivate, but also is rapidly eroded by the wind if the vegetation cover is destroyed, as has happened over the last 20 years at Nooleye and the nearby water bores of Galcad, Bargan, Jacar, Gal Hareer and Garable. The soils on the central ridge are more loamy and not as susceptible to wind erosion.

1.5 Vegetation

The vegetation of the Ceel Dheer district has been studied in general by the RMR 1979 resource survey, and is described in detailed by Dennis Herlocker (1985 Ceel Dheer District Range Analysis Report CRDP). Most of the agropastoral area occurs in the Acacia nilotica - Dichrostachys shrubland range site (Range Site 4, D. Herlocker), which, at least in part, corresponds to the white fertile sandy soil area locally called 'ciid', and also in the Dichrostachys - Dalbergia - Commiphora shrubland range site

(number 5, D. Herlocker) corresponding to most of the western portion of the central ridge, and locally known as 'carra guduud'.

1.6 Land Use

By far the most important land use in Ceel Dheer District is pastoralism and shifting cultivation of crops for food production. In practice, the two types of land use are closely interwoven with most pastoralists in the whole District actually being agropastoralists, practising shifting cultivation and also keeping herds of camels, goats, sheep and cattle. In the Nooleye area, where this study was concentrated, about 75 to 80% of the herd owners are actually agropastoralists. There are also a small proportion of people who are just farmers (not more than 5 to 10% of all farms). They own no livestock but their farms are still usually grazed by livestock of others.

Pastoral and agropastoral land use has historically been almost completely subsistance in nature, but is increasingly becoming commmercialised. Prior to about 1910 their were either no, or only 3 to 4 very small villages in the District, and little trade with virtually no export of livestock. Around 1910 the Italians began to establish a settlement on the coast 18 kilometres from Ceel Dheer, the current district headquarters. Some livestock began to be exported from this undeveloped port, called Mereeg, and perhaps also from Eggo, 20 km to the south, although the numbers were most likely very small. Agropastoralism and pastoralism has been practised in

the District for hundreds of years even though most of the District was far from water points. Prior the early 1960s, the only permanent sources of water inland were shallow hand dug wells at Masagaweyn, Galcad and Ceel Dheer, and perhaps one or two others on the coastal plain. Agropastoralism was still practised far from these water points by carrying essential water supplies using burden camels. Elders relate, for example, how the Bargan area was extensively cultivated more than 200 years ago, due to the fertility of its soil, and how these practises caused sand dunes which are now active in the area, to form. The Bargan area was 60 km from the nearest water points, which were at that time coastal wells.

Until the second world War, the Italians maintained an army garrison and training camp at Mereeg developing it as a small centre of trade. During the war, they retreated inland setting up a base at Ceel Dheer, to distance themselves from the British navy. Ceel Dheer then began to develop as a small village and trading centre.

During the 1950s and 1960s, the price of livestock rapidly rose, and with it, commercialisation of the local pastoral/agropastoral industries. Owners increased the size of their livestock herds and the migration of young people to Mogadishu particularly increased. A marketing system rapidly developed, with traders buying livestock and bringing goods from Mogadishu for sale. The few villages expanded and became more permanent, particularly Ceel Dheer itself, which the newly independant government began to develop as a district centre in the 1960s.

Prior to the second world war, wildlife was said to be plentiful in the area, although, as happens now, some were killed to supplement food supplies. With more guns available since the 1950s, many native animals were killed, and in the case of the predators such as hyeanas, jackals, lions, leopards, also poisoned. The near extinction of predators boosted livestock numbers and allowed a free range system of livestock husbandry to develop.

The pattern of land use was greatly changed in the 1960s by the development of water bores at Ceel Guruf (now abandoned), Nooleye, Galcad, Ceel Dheer and close by in southern Ceel Buur district at Bargan, Jacar, Gal Hareeri and Garable. This is an unusual geographic concentration of water bores, with nothing like it anywhere else in central Somalia, and agropastoralists migrated to these areas in large numbers. Villages immediately developed at each site, while previously densely cultivated/grazed areas, noteably much of the area between the present villages of Ali Yabaal, Cagacadle, Gal Hareeri and Bargan (see locality map 1) were almost completely abandoned.

Immediately prior to the Nooleye water bore being developed in 1969, there were only isolated farms in the locality, with most of the degaan (traditional grazing area) being bushland. Many agropastoralists had moved into the south, south-eastern portion of the degaan when Ceel Guruf water bore temporally operated from approximately 1962 until 1968.

Another very significant development in land use which was stimulated and rapidly expanded from the early 1960s onwards was private enclosure of land for grazing and future cropping. There are many reasons for this development, expanded further on in this report, but it was closely associated with the development of permanent water bores, urbanisation, commercialisation and an apparent increase in the population of livestock, people and farms.

The next phase in land use that can be identified came in the 1970s, the 'berked settlement phase' in which five more villages and their associated, principally agropastoral, communities were developed by first constructing 'berkeds' or cement/stone lined underground tanks/cisterns. Built in 1971 to 1973 to establish the villages of Cagacadde, Haji Iman, Ali Yusuf, Shadoor and Ali Yabal, the berkeds are located such that they collect runoff rainfall during the wet seasons, and are filled by water tanker trucks in the dry seasons. Three other berked sites are currently being developed, but villages have not yet been established.

The most recent (non-CRDP) land use development has been the digging of two more shallow hand dug wells, Ali Afrar and Torfiq north west of Nooleye as shown on map.... by religious groups. These groups immediately established villages as soon as the wells were dug in 1984. The wells attracted large numbers of pastoralists who now spend more time grazing this important wet season grazing area.

There is some charcoal production, and cutting of timber for construction, but this is principally for local use. While no figures are available on the highly variable export of surplus crop production, with increasing commercialisation, selling of crops is becoming more common. This is important particlularly in the case of cow pea, which is difficult to store for long periods. As large storage losses being common, the incentive is great to sell grain and buy needed commodities such as oil, sugar, rice and sorghum later in the dry seasons.

With recent increasing commercialisation, the role of merchants and livestock traders is increasing. They are becoming compartively wealthy and politically influential. Over the last 15 to 20 years, they have been establishing enterprises to accumulate and/or fatten livestock for sale. Many of these 'jebble' or merchants (often also agropastoralists) purchase livestock and hold them until traders (Ganacsato) arrive to export them or sell them in major markets, particularly Mogadishu.

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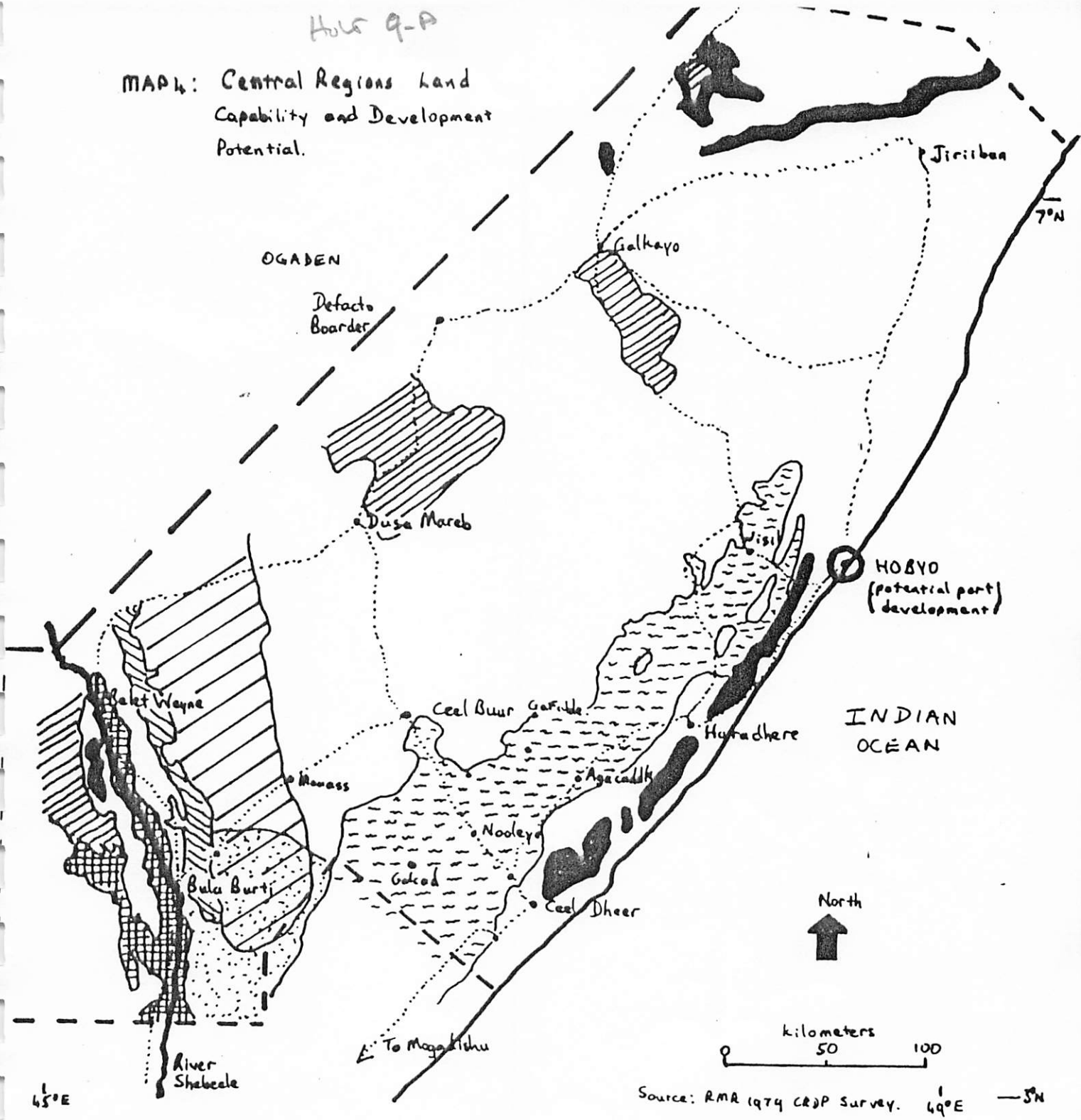
MAP 4: Central Regions Land Capability and Development Potential.



Source: RMA 1974 CRDP Survey.

Areas in which management of runoff water could be used for crop or fodder production.

Current high density rainfed cropping could be improved by new crops, management runoff water, new farming methods. Potential for expansion

Current high densities rainfed cropping could be improved and extended by new crops, strip cropping, soil conservation, farming method trials etc

Area possibly suitable for Yieib bush to be tested

Area suitable for Yieib farming.

Current low density of rainfed cropping could be expanded and improved by proper management runoff water, new crops, experimental work on farming practises etc.

No rainfed cropping — could support some.

Attention deserves to be drawn to potential land uses for the area. The RMR 1979 CRDP Resource Survey has some interesting suggestions, summarised in map 4. The large area of Ceel Dheer District shown here to have a relatively high density of agropastoralism is said to have potential for increased rainfed cropping through development of improved crops, attention to soil conservation problems and experimental work on farming methods. The area shown on map 4 on the eastern slopes of the ridge is said to have potential for managing run off water for crop or fodder production. In regard to agropastoralism, additional suggestions include developing agropastoral forestry systems, particularly through strip cropping and multiple tree use; improving livestock productivity, in part by overcoming constraints such as high mortality of young animals; and refining the development and adaptation to newly establishing markets such as for young well fatterned animals.

1.7 Rural Development Activities

The CRDP was the first, and during the period of this study, (1984/1985) still virtually the only external rural development activity attempted in central Somalia. Other related significant interventions were a modest number of water bores(3), and berkeds(4), and an ongoing small veterinary treatment program provided by the GOS. Regarding infrastructure, roads particularly undeveloped. Roads generally follow cut lines cleared by geological survey teams in the 1950s and 1960s, although some are cleared by local communities as self help programs.

The development activities of the CRDP in the Ceel Dheer district from 1981 to 1985 are summarised in CRDP annual reports.

2.0 Background to Agropastoral Studies

The designers of the CRDP phase 1 (1979 World Bank appraisal reports) did not recognise the importance of agropastoralism in central Somalia, and so made no provision to study the system or to begin implementing any measures that would address the situation. They designed the project without the benefit of resource surveys, and with very little information on the pastoral systems operating in central Somalia.

The first indication that there was substantial cropping activity in the area came from the RMR (1979) CRDP Survey. Although this survey was designed primarilly to make an aerial wet season/dry season count of livestock, some valuable data on cropping was also collected. The report (Watson R, et-al. 1979) noted that;

> "in conclusion then it seems that there is a complex and interlocking use of land in the Central Rangelands in which both livestock and crop growing are important"

A rough estimate was made that cropping could be providing a third of the overall food requirements of the central rangelands human population. However the CRDP was designed as a range project with

no provision for a broad systems investigation or the resources to address cropping in the area.

Hemming (1972) is quoted by Watson (1979) as having suggested cropping was a major cause of dune formation in the central rangelands, but Watson argued against this hypothesis, although he recommended the CRDP should consider some control of cropping activity on the very fine sands. (Watson 1979).

Most technical staff arrived during 1982, and by 1983 the CRDP had begun to concentrate its activities on 3 eastern districts, Hobyo, Ceel Dheer and Bula Burti, where cropping is more common. Initial results of surveys by the extension component and the District Ecologist, Dennis Herlocker, suggested agropastoralism played a prominant role in the area. Although only a small proportion of the land was cultivated, the extension surveys indicated a majority of livestock owners were also farmers, and the ecologist was finding that most of the rangeland vegetation had been altered by past cultivation and clearing practises. The official CRDP plan was still to institute a defered resting/reserving system through this area, but it was becoming clear it would be difficult to make any effective range interventions without increasing the project's understanding of local agropastoralism. As the author had some training and experience in this field, he began to make initial enquiries about the central rangelands agropastoral system in 1982 while undertaking other duties. These enquiries were encouraged by local controversies over the agropastoral system. Local government

officials, particularly in Haradheere Districts spoke out strongly against the perceived detrimental effects of the increase in agropastoralism, and the NRA and CRDP were locally supporting efforts to burn and clear enclosure fences. In 1982, the author published and widely distributed an extension leaflet in Somali and English promoting in part a very simple narrow strip cropping system to reduce erosion.

Major submissions were made to project management in 1983 and again in 1984 by the author to recruit additional staff for investigations, in part, into the agropastoral system, but these were not approved. Thus the author, assisted at times by various counterparts and local extension officers, instigated a modest pilot study of the system, visiting several fenced enclosures and asking many questions. This led to the investigation methods and techiques outlined in section 4. Most of the case studies were undertaken in late 1984 and early 1985, in the long Jilaal dry seaon. With these studies, the causes and extent of agropastoralism and desertification began to be clarified, so therefore the author and extension staff designed and initiated some simple applied trials with 2 local agropastoralists, one near Nooleye, and the other south east between Ali Yabaal and Ceel Dheer, in the Gu (April/May) wet season of 1985. This work is described in section 6.

3.0 Objectives and Goals

The objective of this study was to investigate the agropastoral system in Ceel Dheer District with emphasis given to determining how the CRDP could help improve the management of the rangelands.

The manpower, time and resources available for this initial study were very small, so the goals listed below were modest:

- make intensive case studies in eight (9 actually completed) agropastoral units in the Nooleye/Ali Yabal areas of Ceel Dheer district.

- investigate, using the case study technique, the agropastoral production system with emphasis on how it effects rangeland and what could be done to improve the system.

- investigate the history of agropastoralism in the district, by interviewing knowledgeable local pastoralists.

- begin testing the suitablity under local conditions of applied methods and techniques to improve the system.

- give local extension staff and extension counterparts training in agropastoralism and antidesertification methods.

It is anticipated that the goals of the study will be expanded in the near future as this study continues to meet its objectives.

4.0 Method and Materials

Initial enquiries into the agropastoral system were conducted in 1982, 1983 and early 1984 by the author when on field trips in the

area undertaking other duties as head of the CRDP extension component. These were general, unsystematic, inquiries but they helped develop an initial understanding of the system which enabled a pilot survey questionaire to be designed in 1984.

During 6 days in the area in mid 1984, the author visited six agropastoral units in the Masagaweyn, Ali Yabal and Nooleye areas of Ceel Dheer district. The agropastoralists were chosen by speaking to the respective village leaders (village commitee members mainly) about our objectives and goals, and asking them to select an agropastoralist who could be willing to answer many questions and have us inspect his farm. While a questionaire was used to ensure systematic comparitive results would be collected, many additional questions were asked to widen knowledge about the system.

The results of this study confirmed that the technique worked with some modifications, and the information gained was used to design the questionaire used in this study.

The pilot study indicated the agropastoralists often could not estimate the size of their enclosures accurately, so it was decided this would be measured during the on-farm inspection. Cross questioning about farm yields combined with farm inspections suggested the agropastoralists would give reasonably accurate crop yield data for the past 2 years, but beyond that it was probably variable. Initially, it was anticipated the author would have to directly monitor harvests to get good crop yield data, however this did not prove necessary as;

- the agropastoralists know the weight of their crop yields, as they often sell grain in standard bags, and it is bought (and taxed) on a weight basis.

- the crop yields are critical to the survival of the family, so the yields, at least for the last 2 years, appear to be easily remembered.

At the time of this study, it was not possible to directly check crop yields, but this is planned in the near future to confirm data is accurate.

The nine case studies reported in this study were undertaken in late 1984 and early 1985 by the author accompanied by various extension staff, who included Hersi Gurhan Housh, Adan Mohamoud Mohamed, Abdikarim Hassan Osman, Ali Yusuf Ibrahim, Mohamoud Abokar Hussein, and Yusuf Abdi Gelle, with generally 1 to 3 of these officers assisting with each case study. While only one was necessary, one goal of the study was to train staff.

Ideally the case studies should be chosen randomly, or randomly but stratified according to wealth. An attempt was thus made to choose them randomly and but at the same time to insure that some were wealthy, others average and others lower than average, where wealth was assessed by the local people, and appeared to be based on the number of livestock owned, number of farms, wives, size of family,

remitances etc. In practice some were chosen randomly, on the basis of casual meetings with agropastoralists. Others were chosen by consulting village committee members and asking them to recommend typical agropastoralists. Little difference was found between the selections, except that 2 of the latter were prominent, comparatively wealthy agropastoralists. It is felt that the sample is slightly biased towards the more established, wealthier agropastoralists. However, the bias appears to be small. However, due to the considerable variation between agropastoralists in size and number of enclosures, yields etc, a larger sample will be required to obtain statistically valid results for some parameters.

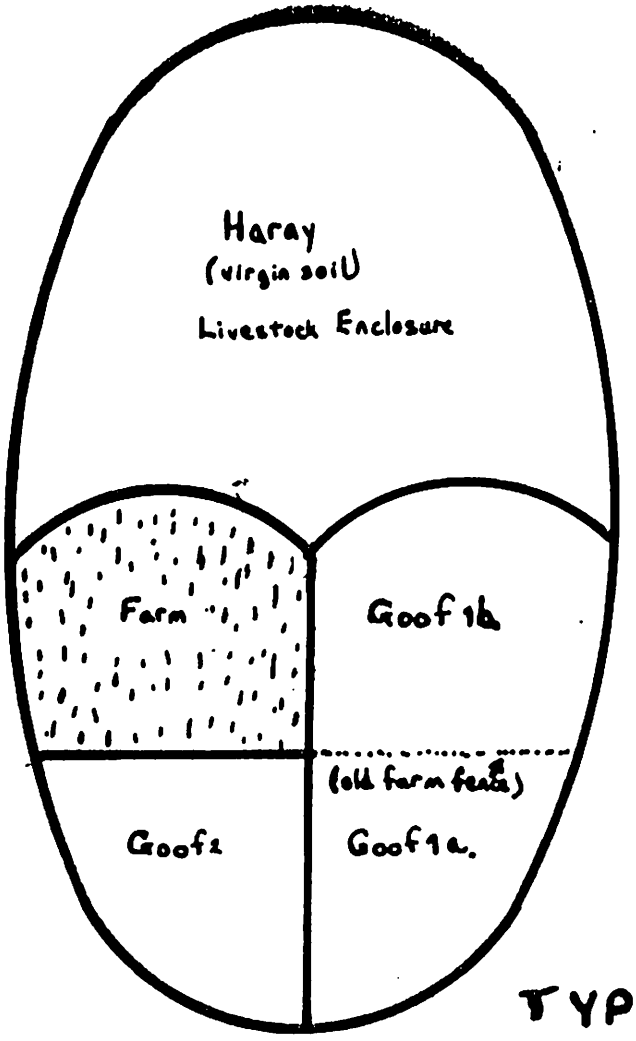
Information about the history of agropastoralism in the area was gathered by discussing the subject with people recommended by community leaders as knowledgeable and reliable sources of such information.

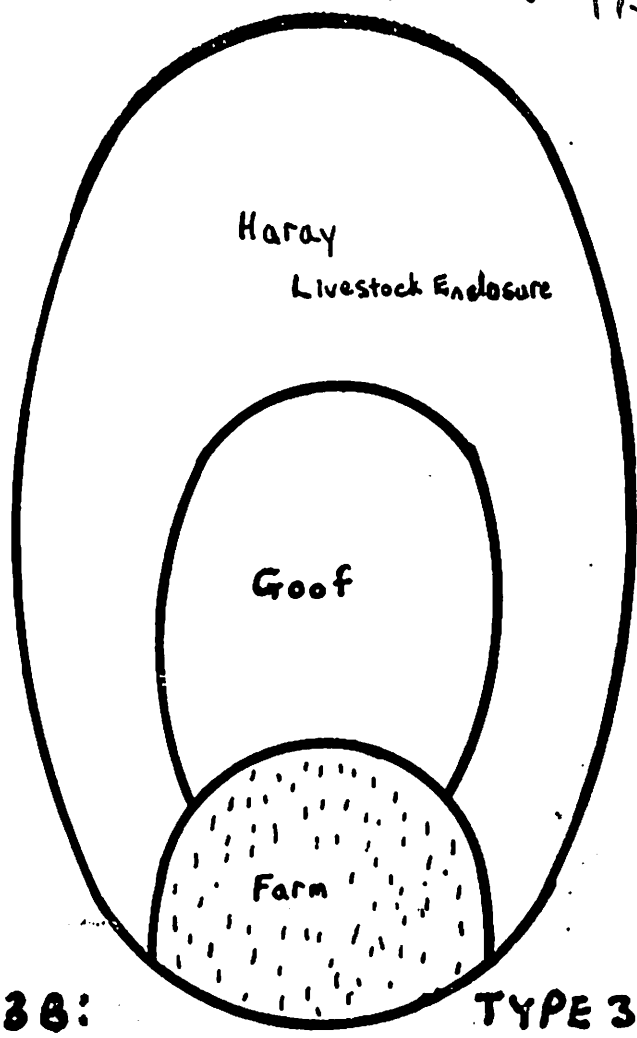
5.1 Description of General Agropastoral System

Cultivation in the semi-arid areas of Somalia is often called shifting cultivation, but it is probably more appropriately described an agropastoral system. With only a few exceptions it is an integrated complex of livestock husbandry and cropping; often in the process of transition into a more sedentary mixed farming system.

There is no single typical type of agropastoral system in central Somalia. Rather it varies depending on the local climate, soil,

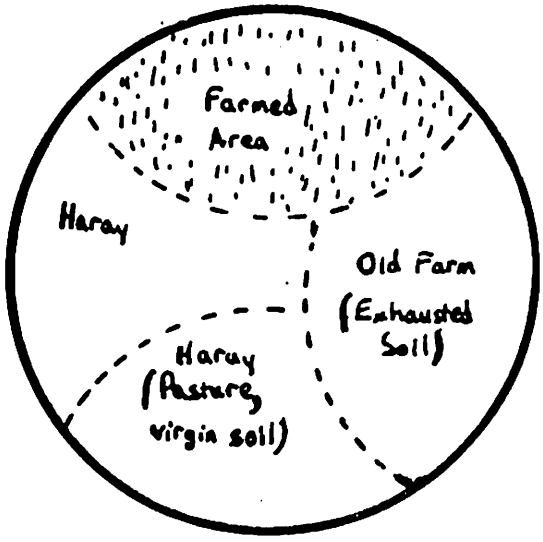
FIGURE 7: SCHEMATIC DIAGRAM OF AGROPASTORAL SYSTEMS.



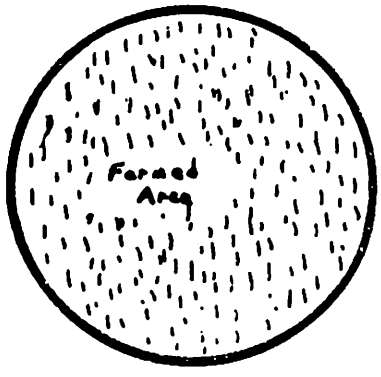


TYPE 3B: AGROPASTORAL COMPLEX

TYPE 3A:



TYPE 2: AGROPASTORAL ROTATION



TYPE 1: SHIFTING CULTIVATION

distance from a village/permanent water, and socioeconomic factors including the of the household wealth, and number of wives.

A schematic diagram of 3 types of agropastoral systems identified to date in Ceel Dheer district is shown in figure 1. As aerial photography was not available for this study, it is not yet possible to establish quantitatively the relative proportion of each system, ~~However,~~ However, some tentative conclusions can be made. In practice the beginning of the agropastoral cycle can be traced to when a family or group of people enclose an area of communal rangeland using thorn bush branches cut from the surrounding bush to build a fence. This serves to keep out livestock; and, to some extent pests and predators, and establishes a claim of ownership to the land. There is considerable variation in the size, shape and orientation of these enclosures, but generally they are roughly round, oval or square in shape, and 1 to 40 ha. in size with most probably being 2 to 6 ha. The male household head who 'owns' the enclosure (or, in some cases, usually involving divorce or death of the husband, the female household head) in at least 90% of cases also owns livestock, normally sheep, goats, cattle and a few camels. Some of these are grazed on the enclosures for a few months a year.

The only areas in Central Somalia observed where agropastoralists do not always fence cultivated areas are in the Shebelle River valley in Hiran region where thorn bush is sometimes not available to provide fencing material, and along the edges of large active sand

dunes in Ceel Dheer, Haradheere and Hobyo District for similar reasons. These 'sand dune cultivators' still fence an area if they can get bush, mainly to keep out livestock. They practice the type 1 and 2 agropastoral systems illustrated on figure 1. The sand dune cultivators appear particularly ecologically destructive, as they line the northern edge of the dunes, clearing all bushes in front of the dunes (which naturally tend to move north), and clearing any vegetation remaining on top of the edge of the dunes to cultivate and build enclosures. They are thus effectively removing all or most of the vegetation which would normally slow the movement of the dunes, and tend to stabilise them.

The most common agropastoral system in Ceel Dhere District appears to be type 3, the agropastoral complex (or APC) illustrated in figure 1. It has also been observed to occur in all other agropastoral areas in central Somalia. Generally, it consists of an outer perimeter fence with a varying number of similar internal fences. If the APC has just recently been fenced, it may have only one internal enclosure, which is used mainly as a farm for cropping. After this farm has been cropped for a number of years and yields have declined, it is rested and another internal enclosure is cleared and fenced and farmed. The old enclosure is then called a goof and is usually kept fenced as a pasture area.

This is a dynamic, variable process. When sandy soil types, such as those around Nooleye, are cultivated much of the top soil is blown away, some of it accumulating on the northern and southern farm

fences, blown there by the two strong dry season monsoon winds which blow in opposite directions. The sand tends to bury the fences so the agropastoralists sometimes move them down wind, then again cultivate the accumulated sand deposites. Thus, the size and shape of the farm enclosure and the goof is not always static. To make use of this moving sand, the farmer thus often establishes a new farm enclosure north, or less commonly, south, southeast of the newly abandoned farm (goof). Thus, in the type 3 schematic diagram, the first farmed enclosure would have been in the south easterly corner, then it was moved north until this too was exhausted. Rather than maintain a fence seperating these two goofs it was abandoned, forming one enclosure. This is not always done, but is not uncommon. In some cases the agropastoralist would keep moving north, until he runs out of available arable land, but there is a lot of variation, and in the illustration the next enclosure cleared was in the south east side of the enclosure. Typically in this system, the agropastoralist has a portion of potentially arable land within the enclosure, called here a 'haray'. In old APCs the haray may be small or non-existant, with most of the enclosure being one big goof, or many goofs. Close to villages harays may be also small, and poor families with little labour may also only fence small areas. Sometimes agropastoralists do not even fence a haray, particularly if they are far from a village and adjacent communal land is freely available.

As discussed more fully elsewhere in this report, there has been trend over the last 20 years towards establishing the more sedentary

type 3 APC system rather than the type 2 agropastoral rotation system, and the type 1 shifting cultivation system. The APC system is not yet sedentary, but has the potential to become so. Usually once the whole APC has been cultivated, the agropastoralist moves to another area, but often, increasingly, he tries to secure more adjacent arable land. With large old APCs it should be possible for the agropastoralists to cultivate old rejuvenated goofs within the APC, but this is not common at present as arable virgin land is still available elsewhere, and very few APC systems are approaching the age where goofs would have had time to rejuvenate.

In the type 2 Agropastoral Rotation system, typically one large area is enclosed with no internal fences. The total area appears to be usually smaller than the APCs. A section of the enclosure, usually about a third to a fifth of the whole is cultivated for a few years until crop yields are too poor, then another section farmed, until all the field has been farmed and the area is abandoned, or kept as a goof, and another area, often adjacent, is enclosed and the process repeated. As with all 3 types of agropastoral systems, it is a dynamic, flexible process. If the season is very good, double the area may be quickly brought into production by a second late sowing on uncultivated portions. It is not uncommon for the system to include an adjacent goof and or haray, so there is a natural gradation towards APCs.

The type 1 Shifting Cultivation agropastoral system is now apparently most common far from permanent watering points, and is

probably the most common system historically. An area, usually smaller than in the cases of type 2 or 3, is enclosed, cleared and most of it cultivated until it is exhausted, then it is completely abandoned, and the agropastoralist moves to another location to repeat the process. Typically there is plenty of adjacent communal rangeland available for grazing or future cultivation, so there is little pressure to enclose goofs or harays.

Under all 3 types of agropastoral systems certain classes of livestock use the enlosed areas for specific periods, but the importance of the enclosures as a source of feed for livestock, and as a means of managing the livestock increases from type 1 to type 2 to type 3.

5.2 Land Ownership and Tenure System

In central Somalia, traditionally access to pasture and browse was freely available to all Somalis, however, if a family or religious group expended effort to fence and cultivate an area, it was considered it then belonged them. The ownership of this land was normally passed from father to son. The transisition from the traditional resource tenure system to the current situation has been recently described very well by Allan Hoben (1985), and the following brief description draws heavily from this work.

The first central state law regulating Somali land ownership was law No. 820, of 8th June 1911, which stipulated all land was owned by the colonial government, which could then give from 250 -2,000 ha. to private parties, who in turn could use, rent or sell it. Kaplan (1977) reports that legislation in the late 1960's gave district commissioner outhority to grant 99 years leases to "Qualified" applicants kaplan (1977) suggested this legislation may have encouraged the rapid privatisation of rangelands in north western Somalia. The enclosure movement is now spreading to more desirable locations in central and southern Somalia.

Law No. 40, dated 4/10/73 made provisions for co-operatives, during a period when cooperatives were actively promoted as an organisational structure for many groups including pastoralists and farmers. The current land tenure legislation includes;

--law no 73 Oct. 1975, Interpretation of law 73, 16/8/76, law 1.2 which gives the state ownership of all land, and the Ministry of Agriculture the responsibility to administer the land.

--LAW 2.5 Vest in the Ministry of agriculture the authority to issue leases to cooperatives, state farms, private agencies, local governments and private farms.

Law 2.6 Individual persons or families can only register one pies of land. These leases are for 50 years

Law 2.7 Leases for cooperatives, state farms, independant agencies and local governments are for an indefinite period.

Law 2.8 Private leases are limited to 30 ha. of irrigated or 60 ha. of rainfed land (Banana farms up to 100 ha.). The size of the leases of cooperatives, state farms, and private and public companies is at the discretion of the Ministry of Agriculture.

Interpretation 2.13 Private lease holders have the right to cultivate or keep livestock on their land, receive extension services, get credit from banks equivalent to the value of the land, and transfer profits to foreign banks (subject to permission from the State Bank).

Interpretation 2.15 The lease holder must cultivate and develop the land within 2 years and pay taxes or the state will confiscate the land.

Interpretation 2.14, 2.15 The lease holder may not sell, rent, or subdivide the land, or break any condition of the lease, on penalty of loosing it. The lease may be inherited by close kinsmen, provided that they notify the registry and cultivate the land.

Interpretation 4.12 List the schedual of taxes lease holders must pay.

Interpretation 73, section 4. To obtain a lease, an individual, whether the person has farmed the area previously, traditionally owned it or not, must file an application to the District Agricultural Co-ordinator (DAC). The DAC must then inspect the land with police, measure it, determine the ownership of adjacent land and establish from local community leaders if anyone else claims the land. Notice of the proposed lease are then surpose to be posted in the local village, police station and DAC office for a 30 day period during which objections may be lodged. The local police, District Commission, Regional Agricultural Co-ordinator, and the Director of Lands all are required to check their is not objection to the lease and concur with it before it is forwarded for approval to the Agricultural Minister himself.

In practise though Hoben (1985) reports;

There is, however, no land map and no way of knowing how much of the arable or cultivated land in a district has been leased.

Nor has it been able to enforce the requirement that new land be brought into cultivation within two years or to prevent a vigorous and speculative land market from developing despite the prohibition of sale.

Given the complexity of the registration systems, lack of maps and storage of trained local staff and transport, it is not suprising that Hoben (1985) estimated;

"Not more than 10% of land under cultivation has been registered". Ceel Dheer District agropastoralist informers estimated a quarter to a third of the farms were registered in their area. Ownership to land is claimed by fencing an area (almost always with branches of thorn bushes), although most enclusures are apparently not registered and thus officially private ownership of these enclosures is not recognised. In central Somalia, leases are issued by the local government on behalf of the Agriculture Department. Lease holders pay an annual fee of 25 So.Shs to the local government, and usually keep the lease until they wish to shift to cultivate an enclosure in another locality, when they return the lease to the local government and apply for a new one. Agropastoralists are encouraged to register their enclosure, as anyone without a lease can legally apply to lease their land. As seen in table 1, farms are obtained in a variety of fashions. Four of the 9 agropastoralists studied said they first fenced their APC then later obtained a licence for at least one enclosure to gain official ownership rights. Two of the 9 bought (unofficially) the licence and the farm from another agropastoralist, and the remaining

4 inherited the land from their father (part of one from his mother) with their father sometimes arranging for the licence to be changed to be in the sons name.

It is rare for agropastoralists in this area to own just one enclosure. Almost all fence and consider they own adjacent abandoned farms (goofs), grazing land, and potential cropping land. If land is available, they keep expanding this area to meet the needs of the expanding extended family. Usually new licences are not applied for, the land is just fenced. Thus, when the soil on the original farm is exhausted, the agropastoralist does not often have to shift his farm to a different location, as he already has suitable land adjacent to his farm enclosed. In most of the case studies piece of land is farmed an average of 8 years, then another cultivated. However, two of the agropastoralists, had owned their APCs for over 20 years (Table 1).

Three of the 9 agropastoralist studied owned two APCs within a few kilometers of each other. (Table 1) This apparently is not uncommon. In these 3 case studies each of the agropastoralists had 2 wives, thus they had enough labour available to maintain the 2 APCs. One of these 3 agropastoralists actually owned a third small APC too, which he primarily used to grow seseme.

These agropastoralists are thus not just simple exploitative shifting cultivators who cultivate some land till it is exhausted then move onto repeat the process. Rather they are in the process of evolving a more sedentary mixed farming system.

Differences of opinion over ownership of land are quite common. It is sometimes difficult to determine if land is still fenced or not, or which plot of land has a cultivation licence, and the traditional ownership system is in a period of having to adapt to the modern system.

In theory the modern land tenure system should provide an opportunity to implement some simple desireable land use planning, and this should be further investigated. The National Range Agency could request the Agricultural Ministry and the local government not to grant agricultural licences in high erosion potential zones. An example would be to forbid the granting of licenses within 1 kilometer of any active sand dune or 2 kilometers of any water bore. As many farms are unlicensed, this would not be completely effective, but could help, particularly if accompanied by disciplinary action for farmers/pastoralists fencing an area within these zones without a license, and by an appropriate intensive non formal eduction program.

Land tenure is a contencious issue in much of central Somalia at the time of writing this report. This has been particularly caused by an explosive increase in fencing of rangeland mainly for grazing, and not for cultivation. In agropastoral areas such as around Nooleye, these are typically part of an APC, whereas in pastoral areas of Ceel Buur and Dusa Mareb districts, for example, cultivation is not part of the system.

Table 1

Cultivation and Fallow Periods, Complex Enclosure and Ownership

Case Study No.	1	2	3	4	5	6	7	8	9	Average
Years Cult. Farm	2	3	3	1	5	1.5	3	1	4	2.6
Years plan to keep Cultivating Farm	5-8	4	3	7	4	5	10	5	5	5.5
Total Years est. can Cult. this farm	7-10	7	6	8	9	6.5	13	6	9	8
Fallow period needed to restore fertility	20-25	20-25	40-5-	30-40	20	20-30	20	20	20-30	greater than 26yrs.
Years owned Complex	13	25	3	2	21	2	3	15	8	10.2
Years complex fenced	13	50plus	40	15	21	2	3	15	8	18.6
How aquired Agro-pastoral Complex										

Note

1. Study number 7, Ali Yabal areas, different soils than Nooleye area.
2. The estimated fallow period required quoted by agropastoralists is often the minimum they feel is needed.
3. The term 'farm' is used to denote a fenced area of land currently at least partially cultivated. 'Complex' or 'Agropastoral Complex' is the term for all adjacent areas fenced and owned by one owner. Often it includes one or two farms plus goofs and livestock enclosures.

5.3 Extent and Size of Agropastoral Enclosure

5.3.1 Rational for Enclosures

5.3.1.1 Harays

In the Nooleye area it appears that fenced enclosures usually occur in groups, each group under the ownership of one person, (or occasionally other members of his family). One or more of these enclosures is cultivated ('beer'), the rest are used for grazing. Those grazed enclosures which have been recently cultivated are usually called 'goofs'. Most agropastoralists apparently have at least one other enclosure which is potential areable land, usually virgin ('gilgap') land. This is often called 'haray' (an enclosure) but the terminology does not seem well defined, as it is also often called an 'oordan' (the name is from the Somali term for a fence) or sometimes a goof. In this report the term 'haray' will be used. As shown in table 2, agropastoralists in Nooleye area often own a haray.

In other areas of Somalia it is common to find large fenced enclosures used only for private livestock grazing although the owners often claim for legal reasons they will cultivate it. This study suggests this practise is not common in the Nooleye area, probably partly because it is considered good land to cultivate. Rather the agropastoralists enclose an area adjacent to their farm for private grazing, and intend to reserve least part of it for cultivation.

Discussions with over a dozen Nooleye agropastoralists, the case study data on the size of harays in table 2 and on the use of APCs by livestock, (table HJ) together with other observations strongly suggest that the major reason for the Nooleye agropastoralists privatising land by fencing adjacent arable land is to aquire an area of pasture which can be used exclusively by their livestock and secondly to secure potential farming land. The haray is normally used as a dry (often late dry) season grazing reserve by the agropastoralist, so, in effect, it is a private seasonal reserving system. Other supplementary reasons for enclosing hirays include the knowledge they are aquiring an asset, which can, and often is sold. Like all real estate the location is important. The distance of the haray to a village is probably the most important factor, but its potential crop producing ability and pasture condition are also important. Social factors are also important; large families, and more than one wife are very desirable objectives. Also the traditional Somali strong social support system based on families and their relatives remains strong. For all these reasons agropastoralist like to have a nearby enclosed area of arable land into which their family and relatives can expand.

Other perhaps less common reasons exist. Livestock traders and merchants or agropastoralists who specialise in fattening livestock for sale typically aquire, often by buying, large harays usually close to a town. Suitable areas within some harays are used for fodder harvesting. Grass and herbs are collected by hand and taken

to the nearby village to feed milking or sick livestock often being sold as hay in the market. Sometimes the owner also collects it for his sick, young or milking livestock. This practise does not yet appear as widespead, as it is near major Somali settlements, and is a new development, in central Somalia/ It reflects the rapid urbanisation process that has been underway in Somalia for at least the last 30 years.

The harays and goofs are used by a few agropastoralists to provide a direct or indirect source of income by subrenting out grazing rights. One agropastoralist stated for example, that he received So.Shs. 2,000/- for adgisting 50 sheep owned by another person on his goofs for 6 weeks.

Probably more common are barter exchange transactions. A person allows his haray to be grazed in return for assistance to fence and clear some land, for example. The predominate use for the haray though, remains to provide accessible feed for the owners own livestock.

The extensive enclosing of harays in the Nooleye area as in other eastern central Somalia areas studied, and, apparently, in northern Somalia (Yusuf Abdi Gelle personal information), is a new phenomonen. Prior to 1969, when the Nooleye bore was developed according to many local elders, there were only a few isolated farms in the Nooleye area.

5.3.1.2 Goofs

Goof enclosures (old farms) present a different situation. They were previously fenced when the enclosure was farmed, and the labour envolved in maintaining an old foof fence is less than building a new one for an harya. However, for at least a year after being cultivated they have little pasture. In fact many agropastoralist say they intensionally do not graze (or only graze lightly) a goof for at least a season or 2 seasons after the last cultivation, to give the pasture a chance to re-establish. Thus they are of little immediate use for grazing. Some agropastoralist reseed the goof with desireable species to quicken its rehabilitation. Others intentionally leave a few selected desireable plants on their farms to naturally reseed the goofs.

As goofs are old farms, which are often, close to villages, there are few live thorn bushes and trees remaining near by to cut to maintain the encircling brush fences. Consequently, goofs are not always maintained as livestock enclosures once the cropping cycle is completed. Very close to Nooleye, as shown in figure 2, foofs are usually abandoned, and soon become badly eroded, as the decaying fences allow unrestricted access to livestock. They are not worth maintaining although the land is potentially valuable, because available bush for the fences is 1 to 2 kilometers away, and the cost of fencing is very high. This grades into the next concentric zone around Nooleye.

Figure 2 : Schematic diagram of Nodeye Area Agropastoralism.

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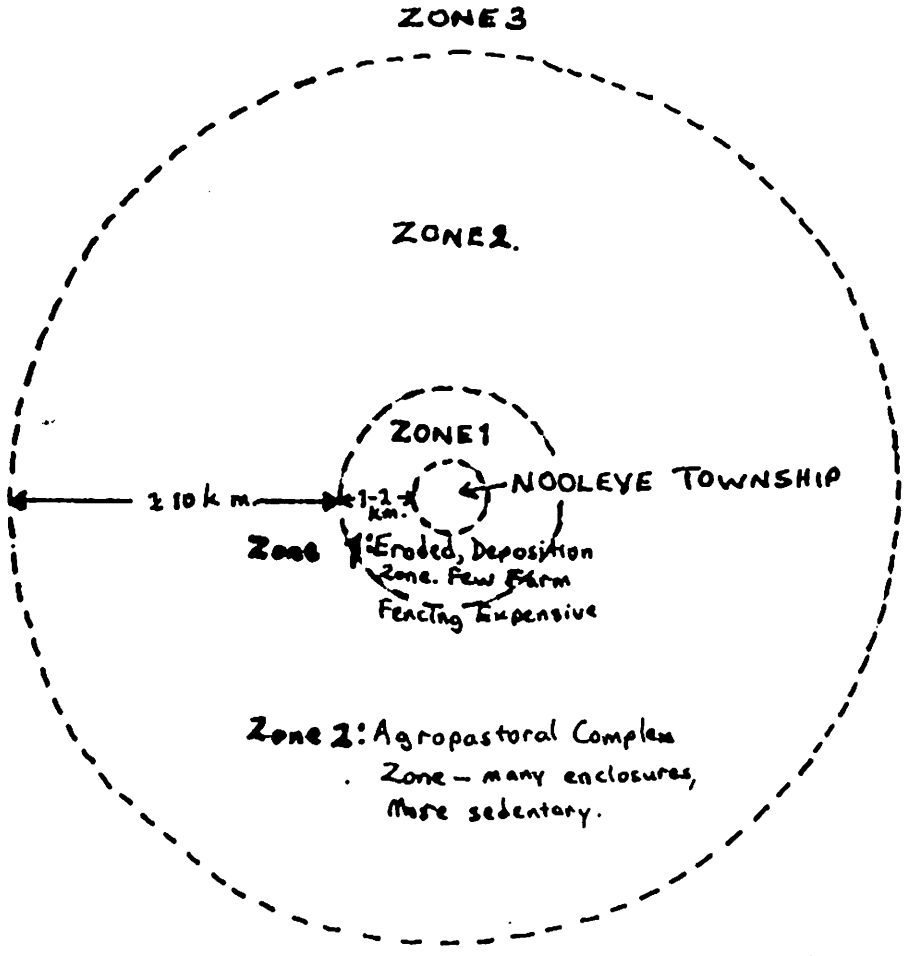

Zone 2: Agropastoral Complex Zone – many enclosures, More sedentary.

Zone 3: Transitional Agropastoral/Rangeland Zone. Isolated APC's, Shifting cultivation,

Shown in figure 2, where there is often just sufficient brush for fences, and APCs are well established, and often quite dense. Here goofs are usually maintained and good land is considered valuable. The actual shape and size of goofs, like the farmed enclosures, is quite dynamic. For example part of a goof fence may be shifted or not maintained, so 2 goofs become one. However, internal goof fences are still often maintained, for the same reasons a western farmer divides his farm or ranch up into padocks; to give greater control over livestock, so the stocking rate of different pastures can be controlled, and livestock can be kept seperate. Thus, goofs are principally enclosed for livestock use.

The agropastoral system is currently in a state of flux. The recent development of nearby permanent water bores and subsequently, villages to provide services, and the development of harays is encouraging some agropastoralists to become more sedentary. Many shift from their APC only to find more arable land. With harays, they are able to keep their APC for much longer. In fact some have already become sedentary mixed farmers as by the time they have exhausted all their haray, they will have goofs available which were cultivated 30 to 50 years before and will have ecovered their fertility. Thus some agropastoralists see their goofs as a future cropping area. As arable virgin land becomes rare, a situation we are close to now, this attitude should develop further. Extension workers should take advantage of this situation to get the agropastoralists to take better care of their goofs, reseed them and

fence them well. This will reduce desertification, and increase the productivity of the system.

In the third concentric agropastoral zone, which begins about 10 kilometers from Nooleye, the APCs are not as dense or as well established. This conclusion is tentative. Aerial photograps will be needed to confirm it. The limited studies to date also suggest the agropastoralists in this zone are not as sedentary, virgin land is more freely available and the APCs are not settled so long. Thus in these areas goofs are often abandoned about 4 to 7 years after cultivation has been completed, when the bush in the goofs becomes too thick. Up until they are abandoned, they are used primarily for grazing of the owners livestock. Other goofs in this zone are maintained for grazing as in zone 2, but this does not appear common.

There is also more opportunitic cropping in zone 3. Fences of an APC may not be maintained well for 2 or more years if the seasons are very bad. The livestock are then grazed elsewhere. If the season is good, the owner returns to sow crops, and the APC is again fenced. This agropastoral practice appears to be common in central Somalia in areas far from permanent water, so it could be said that zone 3 encompasses much of the degaan border areas, such as between Nooleye and Bargan and Jacar water bores (and degaans).

5.3.1.3 Beer (Farms)

he rationale for fencing enclosures for cultivation, is, as could be expected, principally to produce crops for human food consumption.

All agropastoralists questioned were emphatic about this, saying that, while the side benefits of their livestock were important, by far the main purpose of the farms was to produce crops for direct consumption by the extended family. The importance of the farms as a source of food is indicated from the case studies. Estimated yields are substantial, as shown in tables CP2 and CP3. The situation of each agropastoralist varies, but estimates were often given that the yield from one very good season was enough to feed the family for 6 months to 2 years.

The use of the farm enclosures by livestock is detailed in section 5.8. In addition the sorghum stalks are usually stored, and sometimes sold, for supplementary livestock feed. Two fifths of the area of the farmed enclosures studied (table 2) were uncultivated pasture used for livestock. In good seasons this is often cleared and cropped, so is a useful source of livestock feed. Crop residues and the common regrowth of crops with late rains are considered very important sources of feed for livestock and their contribution should be evaluated.

5.3.2 Extent of Enclosures

The only quantitative information available on the extent of cropping and enclosures, in central Somalia is the results of aerial resource surveys conducted for the Central Rangelands Development Project prior to its implementation, in 1979. (RMR Somali Central Rangelands Survey 1979).

The results of this survey presented for ecological unit 71, which encompasses most of the Nooleye degaan, as well as adjacent areas, is shown below in table 2.

Table 2: Extent of Cropping in the Nooleye Area (Ecological Unit 71)

Percentage of land cropped in previous growing season. Aerial survey April 1979	17.95%
Percentage of land fallow, prepared and planted in previous growing season. Aerial survey July/August 1979	7.0%
Percentage of fallow and abandoned crop land by strata. Aerial survey April 1979.	12.75%
Percentage of abandoned crop land. Aerial Survey July/August 1979	9.77%

Source of data: RMR Surveys, Central Rangelands Somalia 1979, Ecological Unit 71.

As stated by the surveyers, (Vol. 1, CRDP survey, 1979) these aerial surveys were designed as a livestock census, not to estimate cropping densities, so sampling errors were large and difficulty was obtained in differentiating cropped fields from fallow, prepared and abandoned enclosures. Thus in the April late Jilaal dry season census of 1979 the surveyers state there was probably an over representation of fallow and cropped fields, which explains the large difference between the wet and dry season survey results. In the late Gu rainy season, (July/Aug. 1979) the surveyers felt they were able to differentiate cropped, fallow and abandoned enclosures quite well, so these figures may give an indication of the situation in that season.

The author of this report feels that there is probably more than 7% of the Nooleye degaan cropped or prepared for crops currently. This though is a guess estimate and suitable well ground truethed aerial surveys would be needed to clarify, the situation. It is likely that the cropped area has increased since the RMR survey, as many local people say this is the case. The figure of 7% does refer to all of ecological unit 71, which covers an area much larger than just Nooleye degaan, so it is possible densities were higher in the Nooleye area in 1979, but not reported. Included in the figure of 7% cropped or prepared land was fallow land. It is not stated what this category includes, but it is probably also prepared land, land recently dug over with a hoe, and weeded, as the agropastoralists in this area do not weed an area then intentionally not sow it to a

crop, which is the definition of fallowing. In poor seasons though, (which this was not) prepared land is sometimes not sown. No definition of 'fallow' land is given, and fallow differentiated from crop, so the survey yielded no definative information of currented cropped area.

The percentage of abandoned crop land in July/Aug. 1979 of 9.77% presumeably includes goofs and harays, although the report makes no mention of livestock enclosures or harays, so the situation is not clear. Again the author estimates that the area of goofs and harays in the Nooleye area would now be higher than 9.77%.

A casual observer would guess that less than 40% of the Nooleye area is currently enclosed. The eastern edge of Nooleye degaan is thick bushland, well known for its wet season biting insect called 'ribi'. Only about 30 years ago, just before water bores were developed nearby, which attracted the agropastoralists away, this area was densely cultivated. The 2 metre high sand dunes formed along the old fence lines of the cultivated fields are still easily recognised. The vegetation was of course changed greatly by this agropastoral sequence, so this site provides a good example of how the impact of agropastoralism, and its importance to the range resource goes far beyond the present extent or boundaries of enclosures.

According to the Ceel Dheer District Ecologist (Dennis Herlocker personal communication 1984), probably only 5% of the bushland or

potential bushland of Ceel Dheer District (and this is most of the district) is not being cultivated, or has not been cultivated in the past, and that these agropastoral activities have had a considerable impact on the vegetation now growing in these areas.

This study fully supports his conlcusion from details of the history of agropastoralism in this area (refer CRDP Technical Report 5, Richard Holt 1986 - in preperation, History of Agropastoralism in Ceel Dheer District.) Agropastoralism has been practised in the area for hundreds of years. Almost all potentially arable land that is now shrubland is at some stage in a long term agropastoral cycle of clearance, cropping and subsequent recovery, as shown bellow.

Cycle		Land Use
Native virgin woodland	-	grazing
Cleared	-	cultivated, grazed
Regenerating woodland	-	grazed.
Cleared	-	cultivated, grazed
Regenerating woodland	-	grazed
(sometime active sand dune)		
etc.		

These conclusions are further supported by a comment in the 1979 RMR aerial survey results, (Vol.1 part 1) that although the aerial census results had not recorded it, occasionally they saw from the air patterns in tree growth indicating cropping at least 30 years ago.

5.3.3 Size of Agropastoral Enclosures

The only information available on the size of agropastoral enclosures in central Somalia is the results of the 9 Agropastoral Case studies undertaken by the author, and presented in table 3. This prelimenary information will be supplemented by additional stratified samples in 1985. Pilot studies indicated it was impossible to get accurate figures on the size of enclosures from interviews with agropastoralists, so they were physically measured and inspected. The shapes were often irregular, so it is estimated an error of 10-15% in the sizes shown in table 3 could be possible. Ground surveys do have some advantage over aerial surveys in this case, as the exact history of the enclosure can be determined, but the preferable technique, not possible at the time, would be to use both ground and aerial surveys to assist each other.

The variability in the number, size and type of enclosures each agropastoralist has would appear to be considerable, although there is a general pattern. Most of the 9 agropastoralists each have at least 1 cultivated enclosure (beer), a very variable number of old farms (goofs), but usually at least 1, and 1 livestock enclosure (haray). Some tentative conclusions from this small sample number is possible. Generally, most extended families with only one wife cultivate about 0.7 to 1.5 ha., but they may easily double this in good seasons by weeding and sowing a reserve area within most farm enclosures often left uncultivated. This fexibility is probably a

very important strategy. Agropastoralists with two wives, may cultivate roughly double this area. The Nooleye area has a soft, friable white sandy soil, which is easily weeded and cultivated, and this is one reason, mentioned by informers, for the popularity of this area for cultivating, and for the reasonably large size of their cultivated areas, considering the only implements they use is a short hoe and a small, light axe.

The size and number of goofs varies greatly. A person or family which has been cultivating an APC for a long time, may have many goofs, or at least a large area of goofs. Occasionally, as with case study 8, goofs are large (up to 24 ha.) as many goofs have been amalgated by shifting or allowing their fences to degenerate. Also observed in two case studies was the situation where a goof was large because only a small section of it was cultivated each year (a fourth or fifth) until it was abandoned. Usually though goofs are the same size as the cultivated enclosures. The situation sometimes does become complicated as some agropastoralists who experience a lot of erosion on their farm, keep shifting the fence so they can keep cultivating the sand that has occumulated on the fence. Hence the location, size and use of enclosures can be quite dynamic.

All the agropastoralists studied have harays or access to adjacent arable land. Informants and observations suggest that, as the density of farms and goofs increases, and, thus, the area of communal grazing land decreases, the pressure, and the resulting movement to enclose harays increases. An additional factor is probably the increase in the number of livestock, or grazing

pressure. The latter, in combination with the increase in watering points and human population, are said to be the reasons behind the explosion of livestock enclosures in northern Somalia.

The size of harays varies greatly, as demonstrated by the case studies figures in table 3. Some wealthy agropastoralists may have a very large haray close to Nooleye, whereas the "normal" agropastoralist only has a small one close to the village where good land is scarce. This grades though to the situation in zone 3, far from the village, where the density of APCs is less, more arable land is available, and agropastoralists often do not enclose any land, enclose some principally for grazing, or opportunistically enclose quite large areas. In zone 3, many harays are large, with more rudimentary fences, only maintained in good seasons, when the agropastoralist returns to cultivate an adjacent enclosure. These harays can be 10-20 ha or more in size.

Table 3: Size of Case Study Agropastoral Complexes

Case Study No.	1	2	3	4	5	6	7	8	9	Average
No. cultivated enclosures	1*	1*	1	1	2	1	2	2	1*	1.3
Area Cultivated (ha) (Total)	2	0.7	1	1.4	2.3	0.8	3	1.7	1	1.5
Area in Cult.Encl. uncultivated(total)	2	0.07	1.0	-	0.7	1.4	1.2	1.0	1	0.9
No. Goofs	1	3	*	3	3	3	-	8	1	2.4
Average Size (ha) Goofs	6	0.8	*	1.5	1.1	4	-	3	5.3	2.4
Total Size Goofs	6	2.4	*	4.5	3.3	12	-	24	5.3	6.4
No. Haray	1	1	1	1	1	-**	-**	1	1	1.0
Average size Haray	12	6	3	0.4	3	-**	-**	7	.9	4.6
Total size Haray	12	6	3	0.4	3	-**	-**	7	.9	4.6
Total Area Complex	22	9.2	5	6.3	9.3	14.2	4.2	33.7	8.2	13.4

Note: * These Agropastoralist have 1 or 2 farms in other localities (within a few kilometres) but these were not studied as we were not invited to them at the time.

** These Agropastoralists have plenty of adjacent unfenced virgin land.

5.4 Farm Site Selection

Criteria/Indicators of Land Suitable for Cultivation as used by Nooleye Agropastoralists

The following list of indicators are based mainly on discussions with agropastorists in the Nooleye area, particularly during the case studies undertaken, but is generally supported by similar investigations in the Masagaweyn, Ali Yabal and Agacaddle areas, and many on-site observations. The indicators used by agropastoralists and the priority they are given varies from person to person, but those listed are the most commonly encountered.

It is probably no coincidence that the adundance of certain leguminous trees and pasture species is recognised as a critical indicator.

Criteria/Indicators

5.4.1 Trees

The species of trees growing in an area is probably the most important indicator. Closely allied to this is the age (state of maturity) of the trees, and their density, size and vigour. In the Nooleye and Ali Yabaal/Shadoor areas Maray (Acacia nilotica) is the most important indicator of good soil. It must be mature, at full height and thus estimated to be at least 25 years old. It is said

to live at least 90 years before beginning to die. Other large Acacias are also good indicators, particularly Surman (Acacia horida) and Qunseh. (Acacia reficiens). They are said to be more short lived than A. nilotica, beginning to die after about 25 years, so their senescence is a positive indicator. The more dense and large these Acacias the better is the prospect for cultivation.

The presence of mature Dichrostachys species (often D. cinerea-'Dhigtar') is considered positive. It appears to reach maturity after about 10 to 20 years.

Sometimes the absence or low density of certain species is an indicator. Among these species, 'Cadhur', Solanum jubae is the most prominent. It often dominates old farms for 1 to 10 years after the farms are abandoned, and it is not until about 20 to 25 years after cultivation, when the fertility of the soil is apparently restored, that only few bushes are found.

5.4.2 Pasture

A well established, dense, vigorous pasture cover of desireable species is often considered a good indicator. The species which are most often mentioned as good indicators, if common and vigorous are the grasses Garrow (Cenchrus ciliaris) and legumes, Qurdhoban (usually Indigofera ruspolii), Qurdhubaan, Qurdhoban (Crotalaria dumosa), Gilib (Crotalaria spp), and Gubulgorey (probably a Rhyncosia sp)

5.4.3 Soil

5.4.3.1: Quantity of humus present is often given top priority. Origin of humus on the surface is well recognised. Descrip- tions were given how dead plant material, particularly leaves, degrades into humus.

5.4.3.2: Availability of fine dusty silt/clay particles. A soil sample is often ground between hand, if a proportion is dusty, with a fine particle size, and thus it easily blows away in the wind this is considered an indicator of fertility.

5.4.3.3: Classification of soil types according to colour, proportion of grain size, content of silty, clay, humus and sand particles, water holding capacity and known ability to produce crops widely used. Refer to annex 2 for some preliminary information on this.

5.4.3.4: Occassionally conduct a texture test by sinking a hole about 30cm. deep then refilling it with the same soil. Ability to overfill hole is a good indicator.

5.4.3.5: Depth of surface soil horizon. At least 20 cm of surface horizon is normally thought necessary.

5.4.4 Location

The distance to a water source, and the reliability, quantity, and quality, type of water source is often given high priority. (berkeds-expensive water, little, unreliable; shallow wells-labour intensive often poor quantity and quality, and may be not permanent; water bore - cheap, abundant water, may be unreliable and poor quality)

This in addition to some of the other location factors are reflected in the market price of enclosed (fenced) land, and the proportion of land fenced. Proximity to a village to be thus close to the services (school etc.) and market/supplies is often mentioned, particularly by those agropastoral families also involved in commerce.

Many families try to settle close to relatives. With the strong social family support system in Somalia this factor has considerable importance, particularly in the selection of degaans or localities to settle.

5.4.5 Other

5.4.5.1: Virgin (Gilgap), land which people feel has never been cultivated before. This land is highly sought after by agropastoralists. Many agropastoralists say they never choose a site to farm if they think it has been previously cultivated.

5.4.5.2: Run-on area. Available water to grow crops is increased by chosing a site to farm onto which additional water runs. This is a factor considered very important in the areas very marginal for cultivation such as in the gypsum areas of Ceel Buur or in Galkayo and Jiiriban districts.

5.4.5.3: Period since previously cultivated. Based on previous experience, there is a widely held concept by agropastoralist that each soil type requires a certain period of rest to rejuvinate and recover its fertility. Immediately around Nooleye, people feel the fallow cycle should be 25 to 35 years.

5.4.5.4: Rainfall and dew are often considered. Within a degaan, the average rainfall may not vary much, but often the amount of dew does. Some agropastoralists in the Nooleye area seek out depressions etc. where the dew is heavy as they consider this increases crop productivity.

5.4.5.5: Availability of a large area of land, (i.e. 5-10 ha). Enough land is enclosed so the cultivation can be shifted nearby after the soil on one farm becomes exhausted. Owners usually do not state that they want to enclose a large area for exclusive use by their livestock, or occasionaly for harvesting fodder or renting out to other livestock, but observations and investigations indicate this is often considered.

5.4.5.6: Often agropastoralists investigate the crop yield history of areas nearby when selecting a farm area. With some people this is given great consideration.

5.5 Cropping Practises

5.5.1 Crop Rotations

A form of crop rotation is common. Rarely do agropastoralists grow sorghum twice in the same soil in subsequent seasons. They almost always rotate cowpeas, or occasionally seseme after growing sorghum. This is done because:

- they widely recognize that sorghum quickly exhausts the soil, certainly at a faster rate than cowpeas or seseme.

- they recognize that sorghum crop diseases and pests, such as stem borer, increase if it is grown in subsequent years in the same soil.

- it is traditional, they say that it was always done this way by their ancestors.

It would appear that a major reason for this rotation developing is that sorghum yields are very poor in the main Gu season (due probably to rust and other diseases and pests) and that it is normally only possible to grow it in the Dayr season. Thus, the

natural rotation of sorghum in the Dayr season followed by cowpea often intersown with watermelon in the Gu season has evolved. Occasionally a little seseme is also grown in the Gu season, but the rainfall is apparently almost always too low for corn.

Occasionaly, the Nooleye farmers plant no or only a little sorghum in the Dayr season, instead planting just cowpeas often with watermelons in both seasons on the same soil. This is apparently more common in poor seasons. Farmers say they loose a lot of sorghum grain from the bird pest (quelas), and this discourages them from planting more.

5.5.2 Crop/Pasture Rotation

No proper short term crop/pasture rotation is practiced. Some farmers leave part of the farm uncultivated for a few years, allowing pasture to re-establish and the soil to improve before sowing again. This is done if an area on a farm has poor crop yields. They also cultivate all possible land in good years, often allowing part of it to revert to pasture in poor seasons. However, these are not strictly rotations.

All agropastoralists in the Nooleye area practise shifting cultivation which is a form of long term rotation. After the soil has been exhausted, and/or blown away during the cultivation period, it is then allowed to revert to pasture wood land, occasionally assisted by some agropastoral reseeding of selected species. This fallow period in the rotation apparently must be at least 25 years in the Nooleye area to restore the soils. In other nearby soil types the fallow period is different. For example, preliminary investigations in the more loamy red soils west of Masagaweyn, where the local people say cultivation has been practised for at least 200

years, suggest the soils can only be cultivated for 5-7 years, and then require 40 to 50 years of fallow.

5.6 Crop Production

The belief that cultivation in the marginal rain fed cropping areas of Ceel Dheer, Ceel Buur, Haradhere and Hobyo Districts should be stopped because it produces little food and is assumed to be causing considerable environmental damage is a commonly held by government officials, particularly many local government and National Range Agency staff. It is thus highly desirable to find out actually what food the cropping produces, how important it is for the survival of the inhabitant, as well as to quantify the damage to the environment so that an objective assessment can be made to guide future policy.

The yield of crops in the Nooleye area varies greatly from season to season and year to year, a common situation in low rainfall areas where the rainfall is low. It is thus difficult to get good crop yield data, as long term studies are needed. A number of techniques were thus adopted to get the best data possible in the limited time available.

Firstly agropastoralists were asked to estimate the probability of cropping success based on their past experience.

The results are presented in table 4. In any 10 years they estimated they would have 6 normal, good or excellent Gu seasons and

a further 6 normal, good or excellent Dayr seasons. Although these results are only from 5 agropastoralists, their estimates were fairly consistant, and agree with estimates of other agropastoralists interviewed. While the estimates are probably too high, this study indicated that these agropastoralists have developed techniques of survival to grow successful crops with very low rainfall events. Also, although the total annual rainfall is low, probably about 250-300 mm., it almost all falls in two distinct seasons over a peiod of about 2 months in both wet seasons. This is ideal for growing a short season crop such as cow peas.

The cropping success rate of the Dayr season is not as high as the more reliable Gu. The agropastoralists estimated That 2 out of 10 Dayr seasons yielded excellent crops, and 4 normal crops.

Table 4: Estimated Seasonal Cropping Success: Per 10 years.

Seasonal Cropping	Gu Season		Dayr Seaon	
Evaluation/10 years	Estimate	Average	Estimates	Average
Excellent to Good	4,4,3,3,2	3	2,2,2,3,2	2
Normal	2,2,4,3,5	3	2,5,3,3,5	4
Poor to Failure	4,4,3,4,3	4	6,3,5,4,3	4
Total		10		10

The same 5 agropastoralists were then asked to estimate what crop yields they get in normal and excellent Dayr and Gu seasons. The results shown in table 5, demonstate that the agropastoralists say they get very good yields from their farms. There is typically considerable differences in crop yields between agropastoralists, even when they are close to each other and receive similar rainfall. Observations suggest that a lot of this difference is due to differences in farming techniques as well as different farm sizes. There is potential for further increasing the yields by the extension of appropriate techniques such as better weed control following field trials.

Table 5 Estimated Seasonal Crop Yields.

Crop	Gu Season		Dayr Season	
Estimates	Normal Season	Excellent Season	Normal Season	Excellent Season
Estimates Cow Peas (kintals)	10-15,6 20-25 25,5	20-25,18 35-40 30-35,10	7,10,10,10, 8,8	15-20,20 15,20,10-15
Average Estimate	14	24	9	17
Estimates Sorghum (Kintals)	-	-	6-7,10,20 6,6	8,20,40 40,12
Average Estimate	-	-	10	24

Extrapolating the estimated seasonal cropping success data in table 4 with the estimated seasonal crop yields in table 5, we can calculate that these agropastoralist estimate they obtain the following yields in an average year.

Table 6: Estimated Crop Yields in An Average Year

Crop	Gu season (kg)	Dayr Seaon (kg)	Annual (kg)
Cow Peas	1,140	700	1,840
Sorghum	- (none)	880	880

Crop Yields in the order of magnitude of those in table 6 would provide a very signifcant proportion of the diet of the agopastoral families. Average yield estimates from 4 other agropastoralists and other observations sugggest the estimates in table 6 may be higher than the average area production by 20 to 50%, but even if this is the case, cropping is clearly providing a lot of food for the local people. In good seasons, the author has observed large quantities of cowpea being exported from the Nooleye area to all over the country.

During the case studies, the agropastoralists were asked to list the actual yields of the farms we had measured and inspected. These results are shown in table 7. It was found that their recollection of yields beyound 3 to 4 seasons was poor, so only these were recorded.

Table 7: Case Study Crop Yields

Season	Crop	Case Study Number, Yield Kintals									
		1	2	3	4	5	6	7	8	9	Average
1983 Gu	Cow Pea	7		6						5.5	6.2
	Watermelon	100		-						'000	
	Seseme	-		-						1	
1983 Dayr	Sorghum	20	-	8	-	1.5	-	4	-	-	3.7
	Cow Pea	5	-	2	-	10	-	5	-	-	2.4
	Watermelon	'000	-	'000	-	-	-	-	-	-	
	Seseme	-	-	-	-	2					
1984 Gu	Cow Pea	-	-	-	-	1	.5	4	-	-	.6
	Watermelon	-	-	-	-	-	-	7500	-	-	
	Seseme	-	-	-	-	-	-	-	-	-	
1984 Dayr	Sorghum	-	-	-	-	-	2.5	5	-	-	.8
	Cow Pea	-	.15	-	-	-	1.5	5.5	-	-	.8
	Watermelon	-	-	-	-	-	few	2100	-	-	
1985 Gu	Cow Pea										
	Watermelon										
	Seseme										

Note: All agropastoralists classified the 1983 Dayr as poor to fair, the 1983 Dayr, 1984 Gur and Dayr as disasters with a very little rainfall. They said they had excellent Seasons in 1982 receiving the sort of yields shown in table 5, which shows estimated yields.

5.7 Major Ecological Post Cultivation Successional Stages

At the time of the case studies, the District Ecologist, Dennis Herlocker was beginning to suspect the effects of the shifting cultivation practices on the range vegetation were much more widespread than expected, given the relatively small area the APCs now occupy.

The ecologist suspected that much of the extensive bushland in the District had previously been cultivated, or cleared, and was actually at various stages in a long term ecological succession. Consequently, during the case studies, the agropastoralists were questioned about their understanding of the successional sequence.

Most agropastoralists have a ready understanding of the major ecological succession following the abandoning of a cultivated field. As shown in table 8, they recognise and can describe changes in both the vegetation and soils. Clearly there are many other changes than these, and they have since been investigated in some detail by the District Ecologist.

The agropastoralists commonly use their knowledge of these successional stages to help select future sites for cultivation. They notice that, for the first few years after cultivation has been abandoned, the soil has little surface horizon as, typically, most of it has blown away, leaving a coarse grained hard pan on the surface. Over a period of 20 to 25 years, the surface layer is

re-established and the quantity of fine sand and silt increases. Paralleling this process, in the first few years, a cover of grasses and herbs begin to establish. Solanum jubae particularly becomes dominant after about 2 years, and up to about 8 to 10 years. If all the surface layer was not lost during the cultivation phase, which is often the case, young tree seedlings begin to establish, and by 5 to 10 years, often become quite dense. As these trees mature, pioneer species like Dactyloctenium sp. increase in abundance, being replaced by other grasses such as Cenchrus ciliaris and Leptopthrium senegalense, and herbs, particular Indigofera and Crotalaria species. The large Acacia trees are consided key indicators of the next successional stage. By 25 to 30 years Acacia horida and others including A. reficiens are said to begin to die, where as A. nilotica continues to live for 90 or more years. Observations suggest it is in fact probably longer than 25-30 years before these particular large Acacia species begin to die, but A. nilotica is known to be comparatively late maturing and long lived.

Table 8: Major Ecological Post Cultivation Successional Stages, Nooleye Area, Years after cultivation of farm finished.

	1 to 3 years	10 years	20 years	25 to 30 years
Vegetation	Grasses and to lesser extent herbs dominate-often bare areas Gurbi(Dactyloctenium sp) often common, also (garow (Cenchus ciliaris) Rarmay (Leptothrium senegalense), Doy (Eragostis sp). Herbs include immature woody specimens of qurdubaan (usually Indigofera ruspolii) other Indigofera species (eg. Harjin), and Crotalaria species (Gilib etc). Cadhur (Solanum jubae) is a principle indicator, often it is the dominant shrub. Small seedlings (10-30cm) of many tree species present, including Acacia horida, A. nilotia, A. reficiens Commiphoras spp. Dichrostachys spp.	Young trees dominate area Solumum jubae (mature), Acacia horida A.nilotica, A. reficiens very common. Dichrostachys near full height. Woody herbs nature	Acacia horida full height. Climbers beginning to establish Solanum jubae present, but fewer plants	Acacia nilotica full height. A. horrida A. reficiens and many other trees dying and in some stage of reseeding. Climbers also mature and beginning to die Little Solanum jubae. Often good pasture cover of mature Indigoferas and Crotalaria spp, and grassess particularly Cenchrus ciliaris and Leptothrium senegalense
Soil	Sandy, little humus or fine particles, infertile, grows plants poorly	Humus layer on surface beginning to form	Humus layer thickening. Soil becoming softer, little dusty surface horizon developing.	Good top humus layer, becoming fertile, dusty, many fine particles,more silty.

5.8 LIVESTOCK AND THE AGROPASTORAL SYSTEM

5.8.1 Livestock Species and Classes Using Agropastoral Complexes

Pastoralists and Agropastoralists in Ceel Dheer district generally own all four major species of livestock; camels, goats, sheep and cattle. While this is typical of Somali pastoralists, the relative proportion and number of the species varies greatly depending particularly on local vegetation. A sample of livestock numbers in the Nooleye area is shown in table 9 below:

Table 9. Livestock Number in Nooleye Degaan

Species	Camels	Goats	Sheep	Cattle
Total	4,228	26,323	10,490	3,225
(of 330 owners)				
Average	13	80	32	10
Range	1-100	3-400	2-200	2-160
Var.				

Note: 1. Figures from 330 livestock woners Nooleye area 1984. Livestock owner described as the extended family unit which includes all wives.

2. Figures obtained by interviewing owners. Sometimes checked by counting livestock when opportunity arrises.

3. The census of livestock owners in the Nooleye area is not yet complete. There are probably over 1000 owners in the areas, so these figures should be considered a sample.

Seventy five percent of the livestock owners in this sample were agropastoralists, practising both cultivation as well as livestock production. In a CRDP extension survey sample survey of 16 Nooleye livestock owners, a comparable 81% were agropastoralists. As seen from this table, the agropastoralist generally have reasonable sized herds, relying greatly on livestock for their subsistance. The agropastoralists confirm this, saying their herds provide most of the money they need, and allow them to survive crop failure and droughts, whereas their farms provide most of the food. The livestock provide milk and meat, with milk, in particular, being a significant part of their diet. Livestock husbandry and crop production are complementary as livestock provide much milk in the wet seasons, and then in the dry seasons, after harvest, crops provide grain and young animals are ready to slaughter.

A comparison with CRDP Extension surveys in other areas of central Somalia indicate areas (degaans) with a high proportion of agropastoralism generally have a lower number of livestock per livestock owner (or extended household), but the numbers and the role of the livestock involved in agropastoralism is clearly still great.

In this agropastoral system, livestock husbandry is closely interwoven with the shifting cultivation system. Table 10 below records the use of livestock of nine APCs in the Nooleye area.

These figures were obtained out of necessity from interviewing the livestock owner. It is usually not easy for the livestock owners to accurately estimate the livestock use of their APC as it varies so much from day to day and season

Table 10 Case Studies: Number of Livestock and Period they Spent in Agropastoral Complex

Case Study	Camels		Sheep and Goats		Cattle	
Number	No.	Weeks/yr.	No.	Weeks/Yr.	No.	Weeks/yr.
1.	-	-	70	24	4	24
2.	-	-	8	12-16	6	16
3.	-	-	50-60	12	3	12
4.						
5.	-	-	55	16-24	5	16-24
6.	-	-	60	14	-	-
7.	-	-	30	16	-	-
8.	4	8-12	50	8-12	-	-
9.	-	-	20	12	10-15	12

Note: Case study 6 owns no livestock, but allows relatives to graze the APC.

to season. Spot checking by counting livestock during the case studies did support the figures given however. Dynamic on-site studies would be needed to confirm these estimates. This could be most easily and accurately done by aerial photographs.

The figures in table 10 demonstrate that the APCs are heavily utilised by livestock, particularly sheep and goats, and, to a lesser extent, cattle. The stocking rate far exceeds the carrying capacity of the surrounding range unit, but a large proportion of the livestock grazing APCs are young animals, which eat less. The importance of the APCs to livestock production and subsistance is far greater than these figures suggest as;

-Often all young sheep, goats and cattle are kept in the APCs almost exclusively until they are 4-6 months old. Small kids (goats) and lambs are often even allowed to graze in the farm while the crop is growing. This practice probably increases the survivability and growth of the young animals, as in the APCs they are protected by fences from predators, or from staying, and the quality of the feed in the APCs often is far better than surrounding areas.

-Sometimes all milking animals are kept in the APCs, usually for 1 1/2 to 3 months during each of the 2 dry seasons. They are normally placed on the farms immediately after harvest to eat crop residues. The rest of the APC, the goofs and harays, are reserved

for grazing in the dry season when the pasture in local accessible rangelands has been heavily grazed. This is probably an important survival strategy as the supply of good quality food to milking animals has a critical effect on the production of milk, a very important component of the local Somali diet.

- It is common for agropastoralists to keep their sick animals in APCs. This would be expected to increase their chance of survival and recovery as here they can be better protected, fed, treated and cared for.

- Sorghum stalks are usually collected, following the harvest of grain, and stored to provide the livestock with supplementary feed during the often difficult, long Jilaal dry season, during November to April. Occasionally, particularly close to villages, fodder is sold from the APCs. Cow peas are an excellent fodder crop. The nutritious leaves are grazed immediately after the grain is harvested. Often the stems reshoot if late rains are received. This is quite common and provides excellent feed. Sorghum also reshoots with the late rains, but this can be dangerous as the small shoots are apparently poisonous. This disease, locally called 'gurdo' is prevented by pulling up the sorghum or keeping livestock out of the farm. All species of livestock are affected.

It would appear that the use of APCs by livestock varies considerably between APC's. Closer to villages, (and thus to major

water points such as the Nooleye water bore) the density of APCs is usually higher, and, thus, there is less communal rangeland available to graze livestock. thus there appears to be heavier grazing of APCs in these areas, as well as adjacent rangelands. Conversely, where the density of APCs is low, observations suggest that the cover and condition of the pasture in the APCs is good. Also adjacent agrpastoralists differ greatly in the degree to which they graze their APCs. Some feels that overgrazing of their APC does not cause erosion or desertification, whereas other agropastoralists appear to have a good understanding of the erosion process, and graze their APCs conservatively. Other socio economic, and cultural factors are also involved, such as the availability of family labour to herd the livestock elsewhere, herd size, and the relative contribution of the herd to the household economy.

5.8.2 Livestock Herding Pattern and Management

An adequate understanding of the agropastoral livestock production system is essential before a reasonable attempt can be made to stop desertification, significantly reduce the likehood of famines, improve the quality of life of the agropastoralist and the substainable productivity of their system.

5.8.2.1 Seasonal Herding Movements

5.8.2.1.1: Wet Seasons

The Nooleye degaan is one of the few areas in central Somalia subject to a reasonably well defined transhumance migration of livestock herds. The cause of the regular transhumance are biting insects. The major insects, locally called "ribi" appear a few days after the first rains in both the Gu and Dayr seasons in the bushy areas only. It is a very aggressive, persistant biting insect giving humans and their livestock a nasty bite. Personal observations confirm that the annoying behaviour of these insects is enough reason to migrate elsewhere! The ribi only remain for about a month, although if further good rains occur, this period is extended.

Thus, a few days after the first rains, often after crops have been planted, most livestock are moved. The principal movements from the more bushy areas in the east and south of Nooleye degaan, towards the west and north into the adjacent degaans of Galcad, Bud Bud, Derri and to a lesser extent Jacar, Bargan and Ceel Buur, as shown on map 5. The most important factor determining the destination of these migrating herds is the relative quality and abundance of pasture and fodder for the livestock. This is roughly equivalent to

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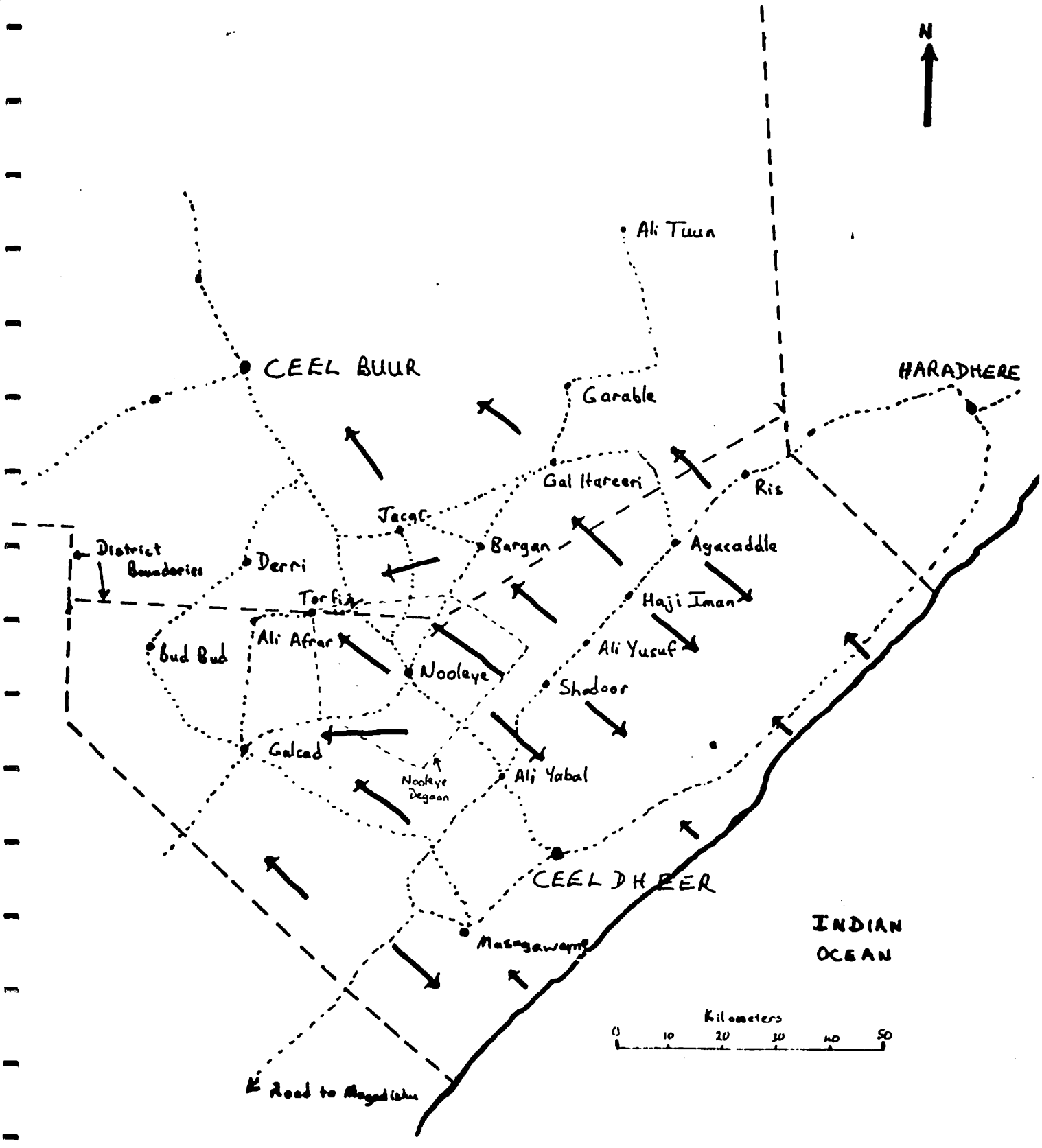
MAP 5: BIANNUAL WET SEASON LIVESTOCK MIGRATIONS—
APRIL AND OCTOBER EACH YEAR
CEEL DHEER DISTRICT



grazing where the rainfall has been heaviest. Thus, one year, a herder may move his livestock west towards Galcad, the next year, if rains are better there, north-west towards Derri.

Although the Somali pastoralists are legally free to graze anywhere over the extensive Somali rangelands, which are communally owned, in practice long migrations are rare. Thus if the rain has been particular poor in the Nooleye and adjacent degaans, the herders may move a hundred kilometers to degaans such as Ceel Buur, Daac and Wabxo, to graze areas where they have heard the rainfall has been good. However, movements of many hundreds of kilometers are rare, even in bad droughts.

Prior to making wet season migrations, agropastoralists normally split up their herds and families. If a man has two or more wives, one wife and her children may go with the migrating herd, the other(s) remain to tend the farm and the remaining livestock. Otherwise, the migrating livestock are sent with an older unmarried son or relation in charge, assisted by younger children. Some milking animals, the sick animals and the very young animals are usually left behind to graze on or near the APC. Pastoralists without farms usually do not devide up the in herds in this way, rather the whole household and herd migrates. However, if the pastoralist has more than one wife, the herds are normally separated. These subherds often graze close each other, but are otherwise kept separate, and are herded each night into separate yards (heros) next to separate nomadic portable huts (aquls).

In some parts of Somalia, the seperate herding of most of the camels is a common management practise, but it is rare in the Nooleye area. Under this "Geel Xer" system most of the dry camels are sent, often over long distances with young men and boys tending them, to seek good feed. As seen in table 9, Nooleye livestock owners have relatively few camels compared to other Somali pastoralists an average of 12 compared to 50 to 70, so this management strategy would yield little return on the labour input involved.

In the wet season then, although many livestock migrate out of the degaan, many still remain, grazing nearby the APCs, or less commonly, on them, in areas within the degaan which have had most of the thick bush, and thus ribi flies, removed by the cultivators. The proportion remaining behind, not taking part in the transhumance, appears to vary seasonally, depending on relative difference in seasonal conditions between Nooleye degaans, and other accessable degaans. In the 1984 Gu season, the CRDP extension surveyers estimated that from a half to three quarters of the livestock had migrated, although many of these were on the edge of the degaan using the newly constructed Torfiq well shown on map 5.

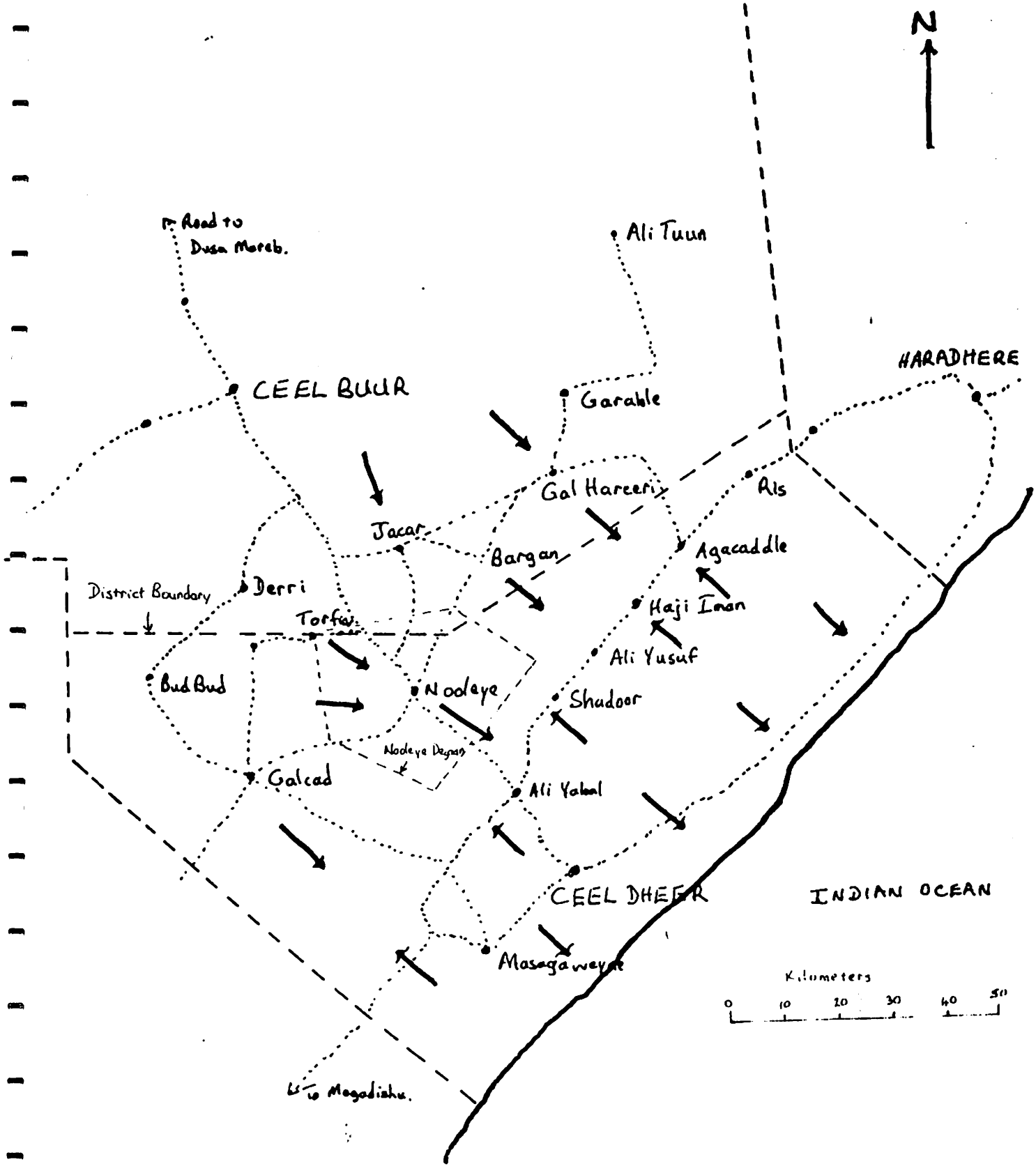
In most of central Somalia, the major wet season livestock herding strategy is to graze livestock on fresh in good condition pasture far from important dry season watering points while still remaining within the "home" degaan. The livestock need less water, and their

needs are met from rain water pools (balli or war - natural water basins) or temporary shallow wells ('laars', very temporary or 'ceel'-well). This management strategy, which in effect is a seasonal resting system, is also used in the Nooleye area, but the transhumance caused by the ribi insect appears more important.

An important factor which would need to be taken into account if any pasture resting/reserving system is to be implemented in the Nooleye area is the influx of livestock from other degaans into this area. Most of this migration takes place in the 2 wet seasons. Rarely are livestock from other degaans brought into the Nooleye degaan during the dry seasons, the main exception being when the Bargan, or to a lesser extent, Gal Hareri water bores stop functioning. During the wet seasons, in descending order of quantitative importance, livestock from the following degaans often migrate into the Nooleye area; Bargan, Gal Hareeri, Derri, Ceel Dheer and Ceel Buur. These are migrations to follow good rainfall events. Typically, rain does not fall evenly over the area. Particularly in the Dayr (Oct. Nov.) season, geographically isolated showers and storms are common. Being good nomadic pastoralists, the local herders thus move their livestock to where rain has fallen recently.

An accurate quantitative estimate of these migrations is very difficult using ground survey techniques. Aerial surveys repeated over a number of seasons would be the best available technique. During the present study, pastoralists interviewed estimated that about 50 to 150 herds (qoys) move into the Nooleye degaan for at

MAP 6: BIANNUAL EARLY DRY SEASON LIVESTOCK TRANSHUMANCE — JUNE AND DECEMBER EACH YEAR.
CEEL DHEER DISTRICT



least part of the Gu and Dayr season nearly every year from each of Bargan, Gal Hareeri and Derri degaans. These subjective estimates are probably too high, but do imply that any large scale range interventions, such as introduced pasture resting systems, would have to establish a dialogue with the pastoralists from these adjacent degaans, if they were to gain acceptance. The pastoral needs of these people would also have to be considered when developing range management plans for the area.

5.8.2.1.2 Dry Season (June-Early Oct., Dec.-April)

After the ribi insects disappear, usually about a month after the first rains of each wet season, some livestock begin the return leg of their bi annual transhumance. Many return to the thick bush areas after 2 months, so the family members can help with the harvest of cow peas and watermelon and the herd can eat the crop residues. The principle movements of livestock are shown on map 6. Some herds remain in the wet season grazing areas until well after the onset of the dry seasons, taking advantage of favourable seasonal conditions elsewhere. The proportion again varies from year to year depending particularly on the seasonal conditions in their degaan relative to suitable accessible areas nearby, but unless there is a serious drought in their degaan, all normally return to graze in their home degaan for the last 3 months of each dry season, July - September and January - March.

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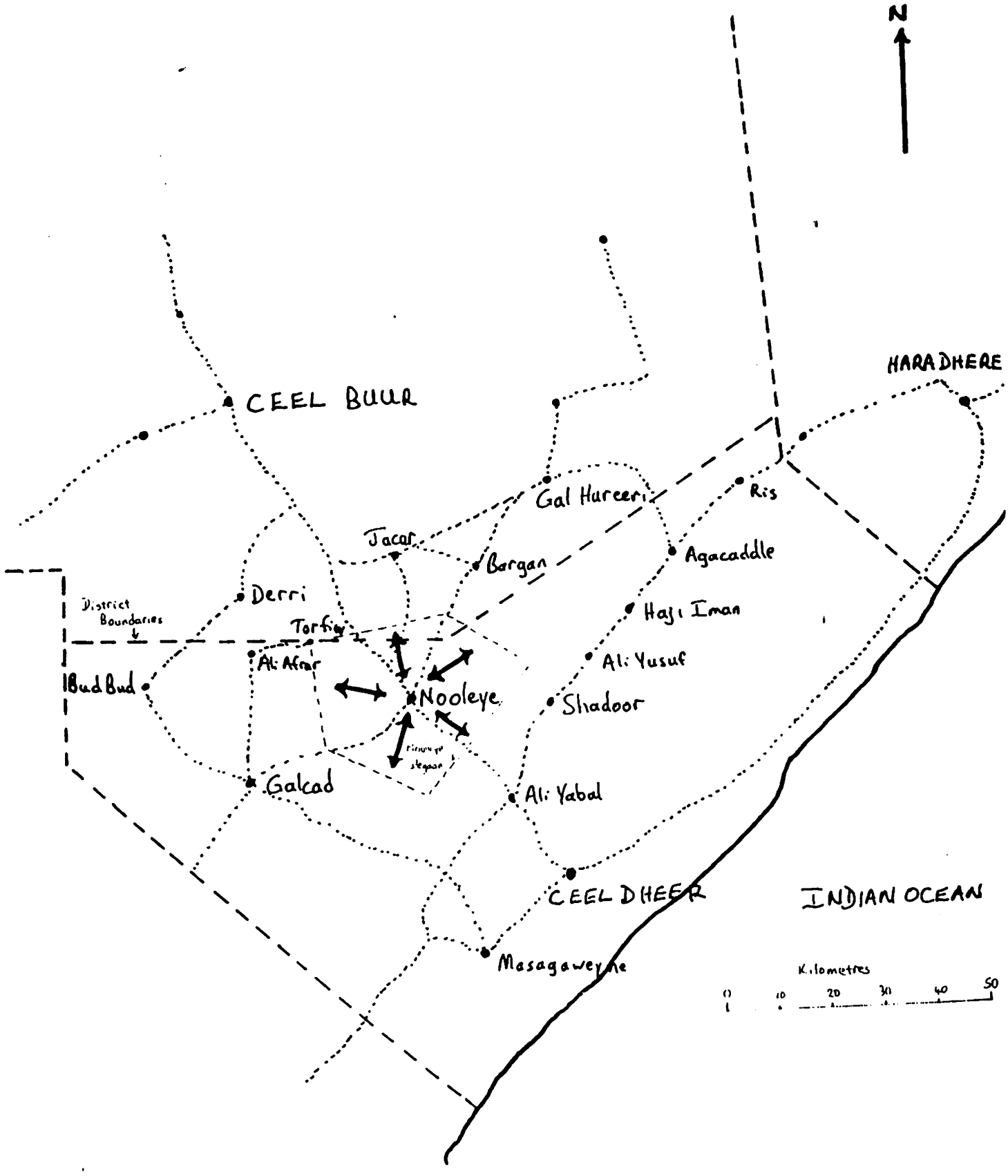
MAP 7: DRY SEASON LIVESTOCK GRAZING PATTERN — JULY TO SEPT/OCT. AND JAN. TO MARCH/MID APRIL



During the dry season, the typical livestock movement pattern shown on map 7 is established. The only watering point available in the degaan is Nooleye water bore, so it becomes the hub of the livestock and the herders life. The herds are grazed within the Nooleye degaan, regularly returning to Nooleye water bore to satisfy their growing requirements for water. Very few livestock enter the degaan from other areas druing this period, unless some unusual event happens, such as Bargan waterbore stopping operation.

During the dry season, it is common for the very young animals, sick animals and a few milk producing animals to be kept on the owners APC, or to be herded nearby by young boys and girls, and sometimes their mother. They are yarded each night in small thorn bush yards next to the owners hut. The rest of the herd is typically herded further away from the water bore, often in bushy areas where the feed is better, and is tended by older boys and girls, young men or often a wife and, occasionally, the father/livestock owner. When suitable pasture is not too far from their APC, the livestock are yarded each night in the yard(s) next to their hut, otherwise separate facilities are temporally established close to the good grazing site.

5.8.2.2. Free Range Grazing

As noted by the author in the Somali Range Bulletin 16 1984, in some areas of central Somalia, certain livestock are allowed to graze freely, untended by a herder. This practice is particularly significant for potential range management interventions as it is too expensive to fence large potential reserves or other sites to be rested. If many livestock graze untended, then it will not be feasible for their owners to control the livestocks day to day movements, and so, without fences, reserves would fail unless an extensive, effecient guard system was established.

In the Nooleye degaan, only cattle, or occasionally camels, are allowed to freely graze. Initially, herders shephard these animals, guiding them to good pasture, then back to Nooleye bore when they need water. Once this pattern is established, the cattle keep on grazing in this manner without supervision. They regularly come into the water bore for a drink (2 to 4 days), and the herder, usually the livestock owner, or his elder sons, who has been expecting them, water them by bucketing water from the water tank, into small personally owned troughs.

Initial investigations indicate that probably no more than a third of the cattle in this area graze this way. This labour saving

management practice is most common in areas with few livestock predators, such as the Ceel Dheer coastal plains. However, The practice is said to be increasing because most predators have been killed, and the theft of livestock greatly reduced, over the last 20 to 30 years.

5.9 Household Composition

The composition of the extended agropastoral households was studied during the case studies. The results presented in table 11 indicate that extended families are very large. The average immediate family size, where the term 'family' is used to describe and a man his wife or wives, and their children, was 13 in this sample of 8 agropastoralists. This compares with the results of a random survey of 20 Nooleye pastoral housholds conducted by the CRDP extension section in 1985, which found an average extended family size of 9. (Table 12) The natural variability of the data is high, as indicated by the high standard deviation figures. The difference

Table 11: Agropastoral Case Study: Household Composition Case Study

Person	Case Study Numbner 1	2	3	4	5	6	7	8	Average
Male household head	1	1	1	1	1	1	1	1	*1*
Wife (Wives)	2	1	2	2	1	died	2	1	1.4
Daughters									
on farm	3	1	4	2	3	3	3	3	2.8
local area	-	1	-	3	-	-	4		
Other	1 Mog.		-	5 Mog.	-	-	1 S.Arabia 5 Mog.		
Sons									
on farm	4	4	5	2	3	3	7	3	2.9
local area	-	3	3		-	-	-		
Other	-		-	2 Mog.	1 Mog.	3 Mog.	1 America 2 Mog.		
Mother	-	1	1	-				1	0.4
Mother-inlaw	-	-		-					-
Other	-	Fathers 2nd wife Wifes Previous Children, 2 sons 1 daughter	3nephews 2nieces	-	2nephews 1niece		3boy launt relatives		2
Total	11	16	21	17	12	11	28	10	16
Total Dependant on farm	10	12	18	7	11	7	16	10	11
Family Size	11	11	15	17	9	11	25	8	13

between the two averages can be accounted for by the large families of two of the wealthy case studies. (Number 3 and 7) There is strong local pressure to have large families to provide a source of labour, future family social support, compensates for traditionally high mortality rates, and as a large family is a social sign of wealth, prestige and influence. The agropastoralist case study number 7, table 11, has a family size of 25, and this is not unusual for wealthy local people.

Although the case study sample is small, it is interesting to note the high proportion of children that are in Mogadishu. Most are apparently working, but some are there to attend school. Agropastoralists frequently complain about an increasing labour drain. The case studies also confirm the common practice of Somali pastoral or agropastoral families supporting other relatives. (Table 11) Generally, the wealthier families support relatives from less well off families.

Table 12: Household Composition and other Sources of Income of LivestockOwners in Nooleye area

Extended Household (rear) Composition

	Range	Average	Standard deviation
Number of Wives	0-3	1.25	0.83
Number of Children (Total in rear or elsewhere)	0-20	6.7	5.44
Number family outside rear	0-9	2.9	2.16
Number relatives living in rear	0-6	1.65	1.60

Sources of Income other than livestock rearing	Percent of Livestock Owners
Cultivation 75%	
Remittances of absent family	15%
Livestock trading	0%
Other 0%	

Sample: Random Sample for 20 Livestock Owners in Nooleye degaan.

5.10 Work Allocation Strategies

Agropastoralists were questioned about which people carried out agropastoral system duties, The questions were supplemented by on-site observations. These results should be treated as preliminary. Further investigations using women extension staff are under to study in more depth the prominant role of women and children in the agropastoral system, are still in progress.

The clearing of bushes and trees from the APC and the associated initial construction of thorn bush fences are heavy jobs requiring a lot of labour. It is normally done in stages with the first priority being given to fencing the outer perimeter of the APC and the internal fence of the farm enclosure. Usually at the same time at least a small section of the farm enclosure is cleared and hoed preperatory to planting. This first stage is often carried out by work groups ('goob') which combine the labour resources of two or more agropastoral families. The assisting people are repaid on a reciprocal basis, or in kind, often by giving fodder, or a share in crops. With the rapid recent commercialisation of the system, it is apparently becoming quite common for the working party to be paid in cash and provided with food during the work period. More wealthy people, such as some merchants, use this system almost exclusively, and are thus able to enclose large areas.

As the clearing and fence construction operation is a heavy job, it is carried out mainly by the fathers and their elder sons, often assisted by the wives, in the dry seasons. It is one of the few operations in which children do not have a major role.

If the farm was not completely cleared in this first stage, it is done little by little during each dry season, when labour is available, by the owner.

The hoeing of the soil to kill weeds is done mainly by the wives who are assisted at times by old children and/or the husband. This is usually done at least twice each wet season. It is a difficult, labour intensive job, and is one of the bottlenecks limiting the size of the area farmed. Observations suggest farms are often not weeded well and the competition by weeds for scarce water and nutrients is probably reducing crop yields. A common local practice for example, is not to weed crops until the cow peas reach the fourth leaf stage. By this stage, weeds are dense and well established.

The sowing of the crop seeds is done just before the first seasonal rains, or as soon as possible after the first reasonable seasonal rains. Further sowings are made if additional good rains are received, indicating that the season will probably be good. The farmers evaluate rainfall using an excellent method, used around the world, of measuring the depth of soil moisture. These additional sowings are a very important strategy to increase total crop production. Sowing is done mainly by the wives. Older available children may also help, if not herding livestock, and, sometimes, particularly with poorer agropastoralists, the fathers also help.

Guarding against birds and other pests is done mainly by which ever children of the family are available. This is particularly important prior to emmergence, and while the crop is ripening.

Harvesting is done principally by the wife assisted by her older daughter. The wife and her children dry the grain, and then it is treshed by the wife, ready for cooking or sale.

The APC fences are usually strengthened and maintained mainly by the husband late in the dry season, but sometimes also in the wet seasons..

The members of the household who herd the livestock are discussed in section 5.7. In summary, herding is done mainly by the children, assisted at time by either of the parents. The milking of cattle, sheep and goats is mainly the provence of the mother and older children. The camels are milked by the older boys who most often herd them.

Although husbands head most households and make most major of the decisions, women and children do much of the work, make many lesser day to day decisions and thus it is essential that extension work must effectively include the whole family.

5.11 Agropastoralism and Desertification

The local historic evidence confirming that agropastoral practices have in the past, and are still causing desertification is detailed in CRDP Technical Report in press, 1986, Richard Holt. The formation of active sand dunes covering hundreds of hectares near Nooleye village over the last 6 years Provides an excellent opportunity to examine how existing agropastoral

practices are causing desertification. This is not an isolated example, similar processes appear to be underway near other water bores that were also developed in the 1960s; Jacar, Bargan, Gal Hareeri, Garable and Galcad. The recent rapid rate of the desertification need special attention by the CRDP.

Direct and indirect agropastoral factors causing desertification are typically interconnected and related to each other. Firstly, any factor which causes agropastoralists to establish farms and APCs close together, is indirectly very important. In the case of Nooleye and nearby villages, the development of water bores in a previously waterless area was without doubt the factor that drew an inward migration of many agropastoralists although other factors, such as the increase in human population, may have contributed. The many square kilometres of active dunes in the Bargan area, caused, directly by agropastoralism, practices, are probably indirectly caused by the areas highly renowned soil fertility which attracted dense settlement of farms. Other significant, yet indirect causes of the desertification are local increases in humans and livestock the population. No good quantitative data is available to confirm this trend, but local knowledgeable people say the number of people, farms, livestock and herd size have all been increasing over the last thirty to fourty years, but particularly during the last 15 years. The large size of local pastoral families and the high estimated human population growth rate, (Dept. of Planning 1984) support these views.

The direct cause of desertification is the removal of the protective plant cover, and, to some extent, also the destruction of an algal and silt film

which often covers the soil surface, thus allowing wind to erode the soil. The most obvious way agropastoralism causes the removal of plant cover and, thus, desertification, is by the clearing of trees, bushes, grasses and herbs to make way for crops. The size and shape of this clearing is critical. As discussed further in the recommendations and conclusions (section 7) the locally typical ~~local~~ round, oval or square type farm is much more prone to erosion than a long narrow farm orientated against the main prevailing winds, as the fence and surrounding vegetation act as a windbreak. Similarly, observations confirm that very small farms, with a diameter of 40 metres or less, are not so prone to erosion, as long as they too are surrounded by a windbreak.

Clearing, however, is only one contributing factor to future desertification. Another important factor is livestock. Almost all farms and APCs are grazed, many of them heavily. The agropastoralists keep their livestock on or near the APCs for long periods during the year. (see section 5.8.1) Frequently, the condition of communal range near APCs is poor due the heavy grazing pressure caused by children herding the animals close to their homes on the APCs. Spectacular examples are often seen of goofs and harays with an excellent pasture cover surrounded by near bare, eroding, heavily grazed communal range. Grazing of the farms and, probably to a lesser extent, new goofs, is also an important factor contributing to desertification, which should not be underestimated. If farms and goofs were only lightly grazed, in many cases sufficient vegetive cover would remain to protect the soil surface from wind erosion. After a crop is harvested, the soil is well protected by crop residues and weeds. However, this residue is

typically almost completely removed by grazing leaving the soil exposed. Agropastoralists highly value crop residues as livestock feed. Cow peas, in particular, are an excellent fodder crop.

Sorghum plants are often completely uprooted and stored for fodder after harvesting. If the stalks were left on the farm they would provide good protection against erosion, but often are removed to provide stored feed, to decrease the build up of crop diseases and pests, and to prevent livestock injesting toxic young shoots.

Old farms and goofs are particularly susceptible to erosion. Observations and of sources of information suggest that erosion from farms for the first 2 years after establishment is not great, but it progressively increases with further cropping as the structure of the sioil is broken down, protective algal silt layer destroyed, and the organic matter content, weed cover and fertility reduced. Some agropastoralists intentionally do not graze, or only lightly graze, goofs for the first year after the cropping cycle is finished, to allow plants to re-establish within the area. This reduces further erosion. However, others abandon the farm after the soil is exhausted, not bothering to maintain the fence. An abandoned farm is highly vunerable to erosion, as it has little cover, and is open to communal grazing. If it is near a watering point, it is immediately, and constantly, heavily grazed, so plants get no chance to re-establish. This appears to be a major process causing desertification near water bores such as Nooleye.

What, then, are the factors causing agropastoralists to abandon farms, rather than to maintain the fence for a livestock enclosure (goof)? The most

important reason close to established villages is the lack of bush in the vicinity to cut to maintain the thorn branch fence. APCs are dense around villages, and these all need thorn bush for fence maintenance. In addition villagers need fire wood and building material. Therefore, within 11 years in Nooleye's case, there is very little bush within 2 kilometres of the bore. It then becomes a very difficult, labour intensive, expensive process to maintain a fence close to the village. Goofs are then often abandoned, which leads to rapid erosion and dune formation. Thus, close to major water points or in areas where APCs are close together, it is the lack of brush to cut to maintain fences which indirectly allows overgrazing of bare cropped areas that causes rapid erosion. According to informants, it is not uncommon for farms to be abandoned close to villages while it can still grow crops due to the increasing shortage of fencing material.

Antidesertification trials, and extension should, therefore, also look at promoting fence hedges of live trees, and resowing goofs with trees to provide fencing material. (as well as firewood, fodder etc.)

There is a natural tendency for areas near major water points in semi-arid areas to be degraded by livestock as they come into the water and return again to the bush. This, the so called pliosphere effect, is amplified in an agropastoral system. Further, the livestock, which are mainly owned by agropastoralists, are restricted by enclosures to a small area nearer Nooleye, so the grazing and trampling effect on these communal areas are magnified and erosion encouraged of sandy soils that are already very susceptable to erosion.

Personal Observations and reports of informants in many other village areas in central Somalia, where agropastoralism is not practised, suggest that villagers cut significant quantities of vegetation near villages for firewood and building. On its own this factor has not been seen to cause severe desertification, although no doubt it does contribute to the degradation of a village area such as Nooleye.

5.12 Rare Indigenous Anti-desertification Practise

5.12.1 Sowing of Native Pasture Plants

A potentially significant discovery during this study was that a very small percentage of agropastoralists in the Nooleye and Ali Yabal area collect the seeds of certain native pasture species. They sow them after the last crop has been harvested from an enclosure with exhausted, eroded soil, a newly formed goof. Four agropastoralists who practise this technique have been identified, 2 of them were included in the case studies.

The pasture plants so far identified include those listed in table 13. Seed is normally sown in the late Jilaal dry season by scattering on the soil surface. Sometimes a branch is pulled over the soil surface to cover the seeds.

Table 13: Indigenous pasture species Locally sown

Local Somali Name	Latin Name
Garow (Probably most important)	Cenchrus Ciliaris
Gubulgorey	Rhyncosia spp.
Qurdubaan	Indigofera spp, including I. ruspolii
Gilib	Crotalia spp., including C. dumosa
Rarmay	Leptothrium senegalense
Doy	Eragrostis cilianensis
Guebi	Dactyloctenum sp.
Harjin	Indigofera sp.
Naylood	Cynanchum sp.
Geesoriood	Cynanchum sp.

Cenchrus Ciliaris (buffel grass) is a drought resistant perennial tussock grass (bunch grass) native to India and Africa now widely sown by pastoralists in arid or semi arid areas of USA, Africa and Australia to increase livestock productivity. It is often also sown to control erosion such as in a project at Alice Springs in central Australia where it has successfully stopped dust storms which used to often force the closure of a strategic airfield. The species has many varieties exhibiting large differences in growth characteristics and adaption to local conditions. One local agropastoralist said he took advantage of this variability by collecting seed from a variety which kept green shoots longer than other local varieties. The green shoots of buffel grass are much more nutritious than the dry leaves (12 to 15 % protein compared to 4 to 8%) so this technique should benefit his livestock.

The Rhyncosia sp. sown is common in the local area, sometimes it even appears to be an increaser under heavy stocking, even though it is very palatable. It has a deep single taproot allowing some plants to perenniate. It is probably not as useful as some of the other species for erosion control, as during the dry season, it is typically reduced to a single short stalk by grazing. However, it is a legume, appears quite productive and, so may have a future role for quality fodder production soil improvement.

The Indigoferas and Crotalarias are very important pasture species in the local range type. At least 2 species of Indigoferas,

including I. ruspolii, are occasionally sown onto goofs. They are hardy, woody perennial legume species and, are all palatable, although some, like Harjin, more so than others. As they are woody, they provide a valuable wind break effect during the dry season, so may have potential in strip cropping to prevent wind erosion. Their role in improving the soil should also be investigated as they are legumes and locally have a reputation for this ability. Indigofera ruspolii is also used in building and for cleaning utensils, so the dry plants have a market value locally. Overall, these species appear promising and deserve further investigaion.

The grasses, Leptothrium, Eragostis and Dactyloctenum spp. are valuable palatable local pasture species sown to provide fodder and decrease wind erosion.

Naylood and Geesoriood are probably two different Cynanchum species, although positive identification is still underway. They are evergreen, deep rooted, small perennial bushes, often 50-100 cm. high, and are usually heavily browsed. They send out long thin stems, which tend to climb if support is available. When it grows on a farmThe farmers reportedly trim Nayloood so that it doesn't grow more than 1 m high. It is sometimes sown on farms, because it is a useful fodder; if kept trimmed; reportedly does not compete with nearby crops; and the family (usually the children) eat the 4 cm long seed pods when they are fresh.

It is highly likely that additional field work will identify other species domesticated by the local agropastralists.

The reasons given by agropastoralists for sowing these pasture species are, in the usual order given;

— to provide fodder for their livestock. After a farm has been cultivated for about 8 years, and is left to rest, regrowth of natural pasture can be slow. After being weeded for years, the amount of seed left must have been reduced, soil fertility reduced, and, often, much of it blown away. Therefore, sowing seed in the goofs, speeds production good feed for their livestock.

— to protect the soil from wind erosion. Some agropastoralists are very concerned about excessive wind erosion and clearly recognise the importance of establishing a cover of plants to reduce erosion. They apply this rationale particularly to their cultivated enclosure, the farm, more than the goof, as excessive wind erosion, can, very rapidly, (within 2 years) make a productive farm completely unproductive. Labour, effort and, sometimes, money is then required to shift to a new enclosure.

— to improve the soil. Agropastoralists describe how some plants are better than others at speeding soil recovery. They say that one way of improvement is through the degeneration of leaves to form humus. Also due to the windbreak effect, fine particles and sand are deposited once the plants are established.

The author has seen 2 to 3 year old goofs established with a dense productive pasture, often dominated by Cenchrus ciliaris, using these techniques. Given the apparent benefits of this policy it is thus surprising it is not a more widespread practice. It has been practiced locally for quite some time, at least for 50 years in the Ali Yabaal area. This may be because agropastoralism in Nooleye and surrounding areas has only very recently become more sedentary due to permanent water development over the last 25 years and the subsequent increasing pressure of agropastoralists and their livestock on the land. In the past plenty of uncleared land was available near to the farm for the livestock to graze, or to clear for additional farming. Now, with less communal land available, agropastoralists have a good reason to reserve as much land for their private use as possible, and to make it more productive.

If this hypothesis is true, then this is an excellent opportunity for a good extension campaign to demonstrate improved husbandry techniques to agropastoralists. Limited investigations to date support this hypothesis.

Finally, it should be noted that for the same reasons given above, some agropastoralists sow some of the above species on other parts of the farm than just the goof. This is very significant, as the author found it fairly easy to explain how sowing the same species in strips in the opposite direction to the main prevailing winds was very similar to what the agropastoralist was already doing.

However, but instead of the plants growing in isolated clumps or on their own, when planted in this way they formed a windbreak. Often, the plants are apparently sown on a portion of the farm on which the soil is exhausted, but this is not always the case.

5.12.2 Preserving Selected Pasture Species

A practice possibly more common than sowing pasture species is to intentionally save certain plants on the farm from weeding. The author has observed that while weeding, the women in particular, often leave isolated, particularly vigorous, suitable plants of desirable species. Of the above list of pasture species, only Cenchrus ciliaris Naylood and Geesorioo have so far been observed. The primary reason given for this practice with C. ciliaris was to provide an on site readily available seed supply to naturally (or otherwise) reseed the farm. Therefore if the season is a failure, some plants are present to protect the soil, and when the farm is abandoned, it can quickly become productive for livestock. The secondary reason given was to provide fodder, and the third to directly protect and improve the soil. In the case of Naylood and Geesoriood, the first reason given above was not as important as the second and third.

5.12.3 Agroforestry

One of the significant applied forestry technique observed, in terms of its future potential to increase the sustainable production of this agropastoral system, is the collection and sowing of seeds of certain native local tree species on old farms (goofs). Like the pasture species, Seedsare typically scattered on the soil surface in the late Jilaal dry season, just before the long Gu wet season. Unfortunately, as in the case of the pasture species, the technique is not common. However, it may often not be a high priority, because local native trees usually re-establish quickly anyway (Refer to section 5.7 Post Cultivation Major Ecological Successional Stages).

Three agropastoralists using this techniques, when interviewed, said the reasons for this policy were;

— speed the establishment of good fodder trees to provide a source of fodder for their livestock.

— protect the soil from wind erosion.

— speed the improvement of soil fertility.

The main species used were:

Local Somali Name	Latin Name
Muray	Acacia nilotica
Surman	Acacia horrida

Another potentially important local agroforestry technique is the planting and sowing of local bushes to support the thorn branch fences typically used to fence APCs. The practice is neither systematic nor common, but is a locally established technique reportedly used for at least 50 years, and its application is widely accepted. It is another indigenous technique that has potential for rapid expansion given the changing circumstances of the agropastoralist. Where in the past they normally had an abundant supply of adjacent thorn bushes to regularly cut to maintain their fences, now, particularly close to villages, little is available, yet requirements are expanding as each agropastoralist tries to enclose more land.

The impression was received that local agropastoralists are very interested in live fencing, as long as it does not involve a lot of labour, but feel the locally available species are not completely suitable and are interested in any alternatives. Known species used

are given below. A few different Commiphoras species are apparently the most popular fencing plants.

Local Somali Name	Latin Name
Rahanreb,	Commiphoras incisa
Gundid,	Commiphoras spp
Saaee, Dudous	
Gunray	Commiphoras Surreh
Surman	Acacia horrida
Gumar	Acacia nubica

The Commiphoras are planted in the dry season when labour is available. The techniques used by agropastoralists have been very successfully adopted by the CRDP and NRA to make windbreaks and to fix active sand dunes. Some Commiphoras species have the very useful characteristic of establishing very successfully by vegetative propagation during the dry season. A branch is cut, often about a metre long, then is left for at least 3 days for the sap from the cut to harden in the sun. The cut end is then simply buried in the soil deep enough to resist movement by the wind. If it is planted close together in a line so the branches interlock, an immediate, reasonably stock proof, fence is formed, which shoots after the first rain, and forms a long lived barrier. Many Commiphora spp. are thorny, which makes them particularly suitable fencing material. Some species establish very well from cuttings,

with at least a 90% success rate, others establish poorly. At least one species apparently can be successfully planted in the wet season, but this is not common. A study to define the species involved is obviously necessary, and would be relatively simple to achieve, as a world expert on Commiphoras taxonomy, Peter Kutchar is a CRDP ecologist.

The explanation given by agropastoralists as to why live fencing using Commiphoras species is not common is that the technique is labour intensive, and, there often are too few Commiphoras close by. However, the local range vegetation often has plenty of Commiphoras plants and there is little more effort in planting Commiphoras than in placing them in a line to make a dead thorn branch fence. In the long term, the labour requirement would be reduced as arduous fence maintenance would be reduced.

During the rainy season Commiphoras also provide some browse for livestock but the production is probably low, although it varies from species to species. Live fences of Commiphoras spp. around APCs should also act as long term wind breaks to slow and stop wind erosion. They may also provide limited use for firewood.

It is interesting to note that for the last few years local berked owners have been developing the technique of using Commiphoras spp. to make live fences around the berkeds to control access of stock, and thus manage private water points. Future development projects

may be able to adapt the technique to management of dugouts or waterbores.

Over the last few years the same technique has been rapidly adopted to fence house yards or livestock yards in the adjacent Bula Burti district. It is thus possible that the technique may rapidly gain acceptance for use on APCs, particularly if the idea is spread by extension, education and demonstration.

It may be worth investigating the propagation of Commiphoras spp. using locally collected seed rather than cuttings. Local agropastoralists say this technique would be successful, but they don't use it as it is too slow. The bushes take 5-6 years to grow to a reasonable height, and by then, the farm is nearly exhausted. However, if strip cropping, rotation and other techniques prove able to extend the useful life of a farm, seed propagation may have potential. Seed would be sown next to initially constructed bush fences made from the bushes cleared off the farm.

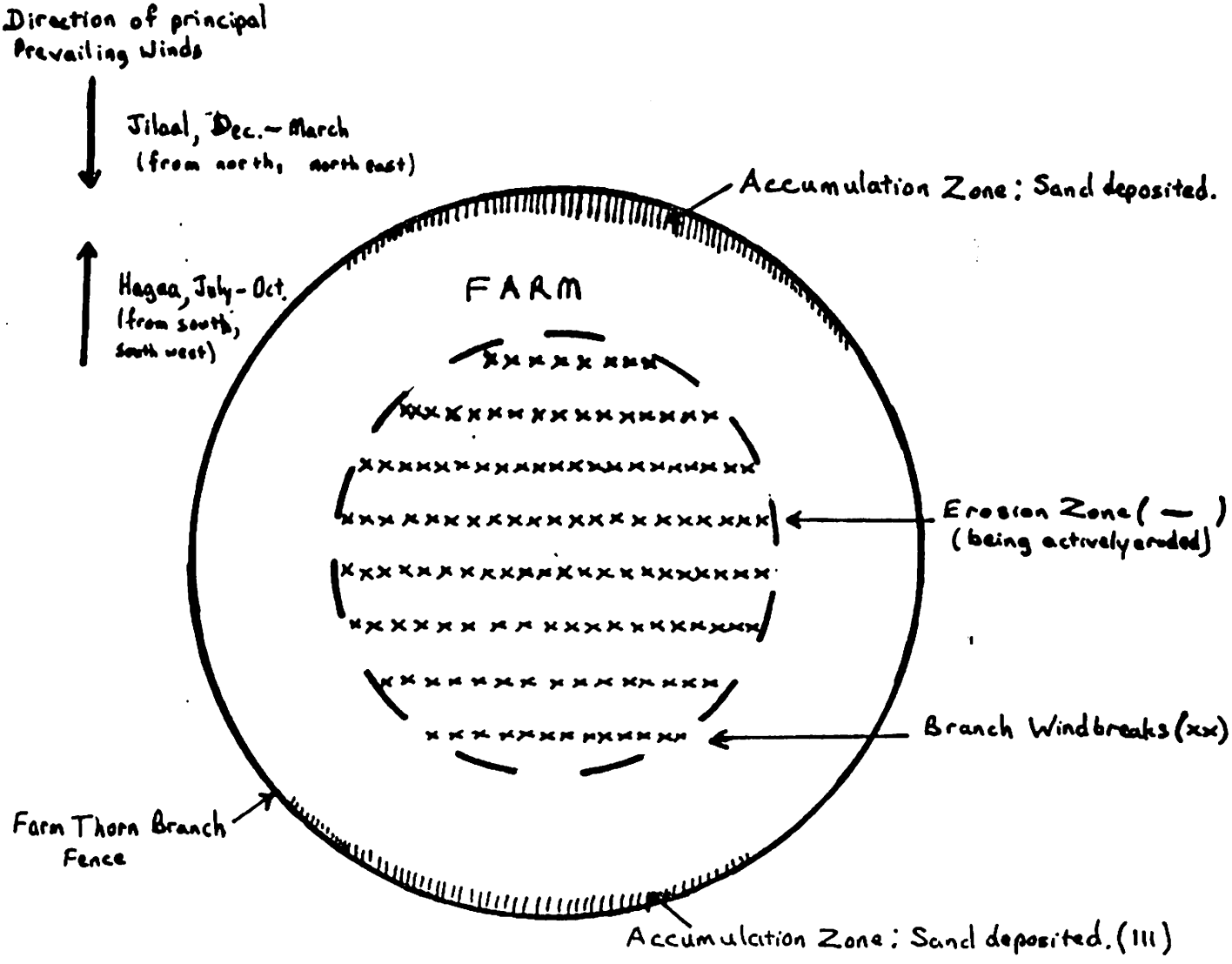
An agroforestry system has been recently spontaneously feveloped about 100 km to the south of Nooleye, which could have considerable potential. Crops are grown around and under young Terminalia (spinosa 'Hara') trees. The lateral branches are regularly cut providing good dry season livestock fodder. The wood is reportly excellent, strong and termite resistant, and the main trunk is straight, so the poles have a ready market as building meterial. In

Mogadishu a good sized pole sells for 500 to 900/-. Further investigation is warrented and trials are needed to determine whether this practice could be spread to some of the central regions agropastoral areas.

A potential indigenous agroforestry system: Young Terminalia Spinosa trees and a crop of cow peas near Masagaweun, Ceel Dheer District.

HOLT-96 A

Figure 3: Schematic Diagram Branch Windbreaks on a Farm



15.12.4 Branch Windbreaks

If the topsoil on a farm is being eroded badly by the wind, some agropastoralists cut nearby tree and bush branches, then place these over the eroding area to form parallel windbreaks about 8 to 10 metres apart as shown below:

Figure 3: Schematic Diagram of Branch Windbreaks on a Farm

This traditional antidesertification technique is very similar to that being by the CRDP and NRA to fix active dunes. Informants stated the technique was commonly used 30 to 50 km north east of Nooleye in the Bargan area where agropastoral practices caused so much wind erosion that large sand dunes were formed, probably from 50 to approximately 400 years ago. (See CRDP Technical Report 1986 in press. R. Holt). The author observed the technique being used on a small scale in the Nooleye, Ali Yabaal and Bargan areas. It is labour intensive and not widely used. It is used mainly over the bare prepared, hoed soil in the dry seasons following one or more successive poor wet seasons.

It is interesting to note the similarities between this system and strip cropping, a point which should be exploited by future extension workers.

5.12.5 Sorghum Stover Windbreaks

Sorghum stalks are usually collected and stored for livestock feed, but sometimes they are left on the field intact and just grazed, or occasionally, a small number of agropastoralists will pull out the stalks and place them in parallel lines 8 to 10 metres apart over cradable soil farming in the opposite direction to the strong wind, just as in the case of branch windbreaks described above. This is usually only practiced if the season has been poor, and the top soil is beginning to erode badly.

Generally, agropastroralists seek to clear all sorghum stover from the farm, as they say this reduces future sorghum diseases and pests such as stem borer.

6.0 Preliminary CRDP Pilot Agropastoral Trial

6.1 Introduction

This report is a summary of work only just intiated. It is included here becuase the goals, design and preliminary results are highly relevent to this study.

Although this work was not in the original CRDP design it was was initiated because;

a) Ecological studies of the CRDP had recently identified agropastoralsm as the major factor in fluencing the range land vegetation.

(b) A study of the history of agropastoralism in Ceel Dheer Distict (CRDP Technical Report 1986, Richard Holt) found that agropastoralism was very dynamic in nature, that it had almost certainly caused the formation of active dunes in the area over the last few hundred years, including those near the villages of Nooleye, Galcad, Jacar, Bargan and Gal Hareeri, during the last 20 years. The authors' observations suggested that thisdesertification process has increased over the last 4 years.

(c) Extension studies suggested that the pastoral/agropastoral systems in Ceel Dheer District were in a process of rapid change which we did not fully understand, but that some of these changes, including increase in the number of water bores, wells, and berked; privatisation of land by enclosures, urbanisation and commercialisation ot the enonomy, had far reaching implications.

(d) The case studies and other investigations had begun to clarify which agropastoral factors and practices were causing desertification.

(e) Following these studies, the author felt there were certain agropastoral methods and techniques that had the potential to fulfill the objectives the following of this work, which could be readily adopted by local agropastoralists namely;

- prevent desertification and range degradation caused by agropastoralism.

- maintain and perhaps even improve the long term sustainable production of the agropastoral and pastoral systems.

6.2 Methods and Materials

6.2.1 Slection of Trial/Demonstration

As part of the agropastoral studies, attempts were made to identify innovative agropastoralists, people who were aware that agropastoral practices were causing desertification, and had a commitment to solve this problem.

Two such people were identified by consultation with village committees, CRDP Range Elders and local staff. This was followed by case type studies of their agropastoral system with emphasis on their committment to desertification control and innovative

approaches. These studies were instigated to identify co-operators, and to study their system. Both chosen agropastoralists were senior, respected people in their respective communities of Nooleye and Ali Yabal/Ceel Dheer.

One APC, owned by Mohamed Duqow was ideally situated, being on the southern edge of Nooleye township, in the erosion zone where in the southern part of which, active sand dunes had been rapidly forming and expanding over the last 5 years. The CRDP had been working for 4 years to stabilise one of these dunes. While the work was successful, it was very expensive and time consuming with a technician, 20 or 50 WFP workers and, often a truck, involved for 4 years. During this time another larger sand dune had formed nearby! Thus, it was a very appriopriate place to begin to develop and demonstrate anti desertification techniques.

The other APC selected, owned by Osman Omar Hersi was located half way between Ali Yabal and Ceel Dheer, next to the road. Being only 10 km from the district headquarters of Ceel Dheer, access was ideal. Situated in a Acacia nilotica shrubland range site, and located between two large active sand dunes, it too was a promising site.

Both agropastoralists said they were willing to try methods we suggested to reduce desertification, and possibly improve long term production. At this stage resources were not available to establish

an independant CRDP agropastoral trial/demonstration farm, so it was decided to undertake some applied trials and demonstrations on these two APCs. It was understood that undertaking trials/demonstrations on producers farms had many advantages, particularly low cost, low imput, test/trial under authentic local conditions, chance to rapidly disseminate successes etc, but it also had disadavantages, particularly the lack of control over agropastoral practices, such as weeding, grazing etc.

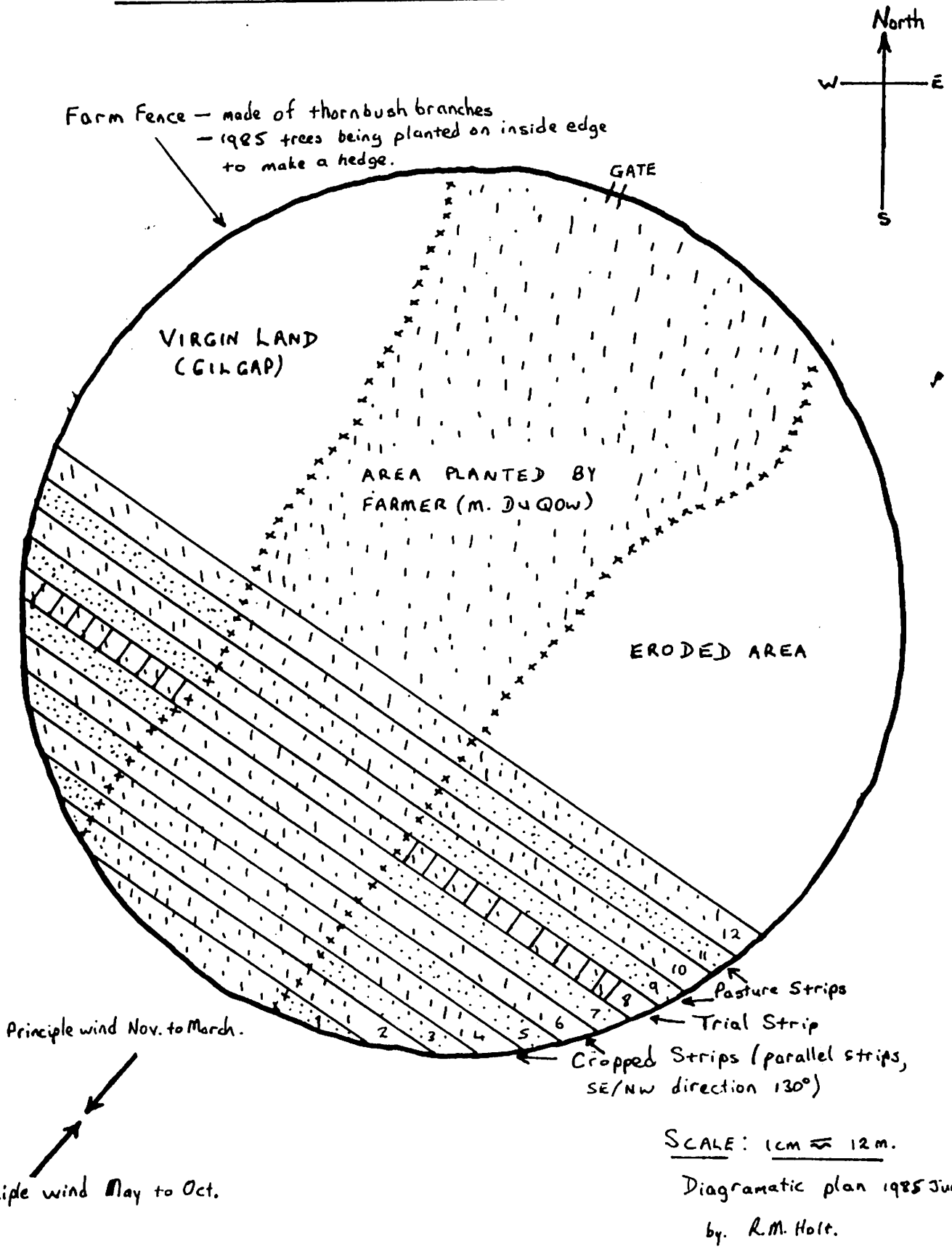
A decision to go ahead with this proposal was made a few months after the case study data was available, in April 1985. As the Gu rains started early, in early April, the trial unfortunately missed planting with the early rains, a practice local agropastoralists must do to make full use of local rainfall. Results, however, were very encouraging. The following interventions were negotiated with the respective agropastoralists and instituted by them with technical help from the extension component in April 1985. An unusual aspect of this work was that extenal (CRDP) inputs were intentionally kept to a minimum, for instance the Agropastoralists were not paid in any way for his effort. The CRDP only provided technical advice assistance and encouragement. This differed greatly from other development work. The extension component was attempting to put the responsibility for development mainly back onto the local people, rather than the Somali Government. As the CRDP paid or supplied food to all others involved in project work, so this required an effective continious dialogue.

Holt 102-A

FIGURE 4:

M. DUQOW'S AGRO PASTORAL DEMONSTRATION FARM

NOOLEYE, CEEL DHEER DISTRICT 1985, GU SEASON



SCALE: 1cm ≈ 12m.

Diagramatic plan 1985 June

by. R.M. Holt.

The advantage of this approach was that;

a) The agropastoralists concerned would only initiate practices which the extension staff could convince them had practical potential. We thus quickly tapped the expertise of local agropastoral experts to evaluate our proposals.

b) The proposals tried had to be completely practical, and adaptable to the local climate, soil type, pests, diseases and agropastoral practises.

c) We gained immediate and continous access to some of the best practical, local agropastoral experts, who had a strong commercial and survival incentive to try and make our interventions work.

d) Results of these trials and demonstrations would be quickly disseminated to local communities as these agropastoralists had considerable local prestise. Local agropastoralist also would closely monitor techniques they freely chose to adopt by choice.

These advantages were already becoming apparent.

6.2.2 Agropastoral Farm Layout

Figure 4 is a diagramatic plan of the farmed enclosure owned by M. Doqow, next to Nooleye township, showing interventions made in

FIGURE 5: MOHAMOUD DUQOW'S AGROPASTORAL DEMONSTRATION

FARM: SOUTHERN EDGE NOOLEYE VILLAGE CEEL DHEER DISTRICT

SOMALIA 1985

DAYR SEASON - OCT.

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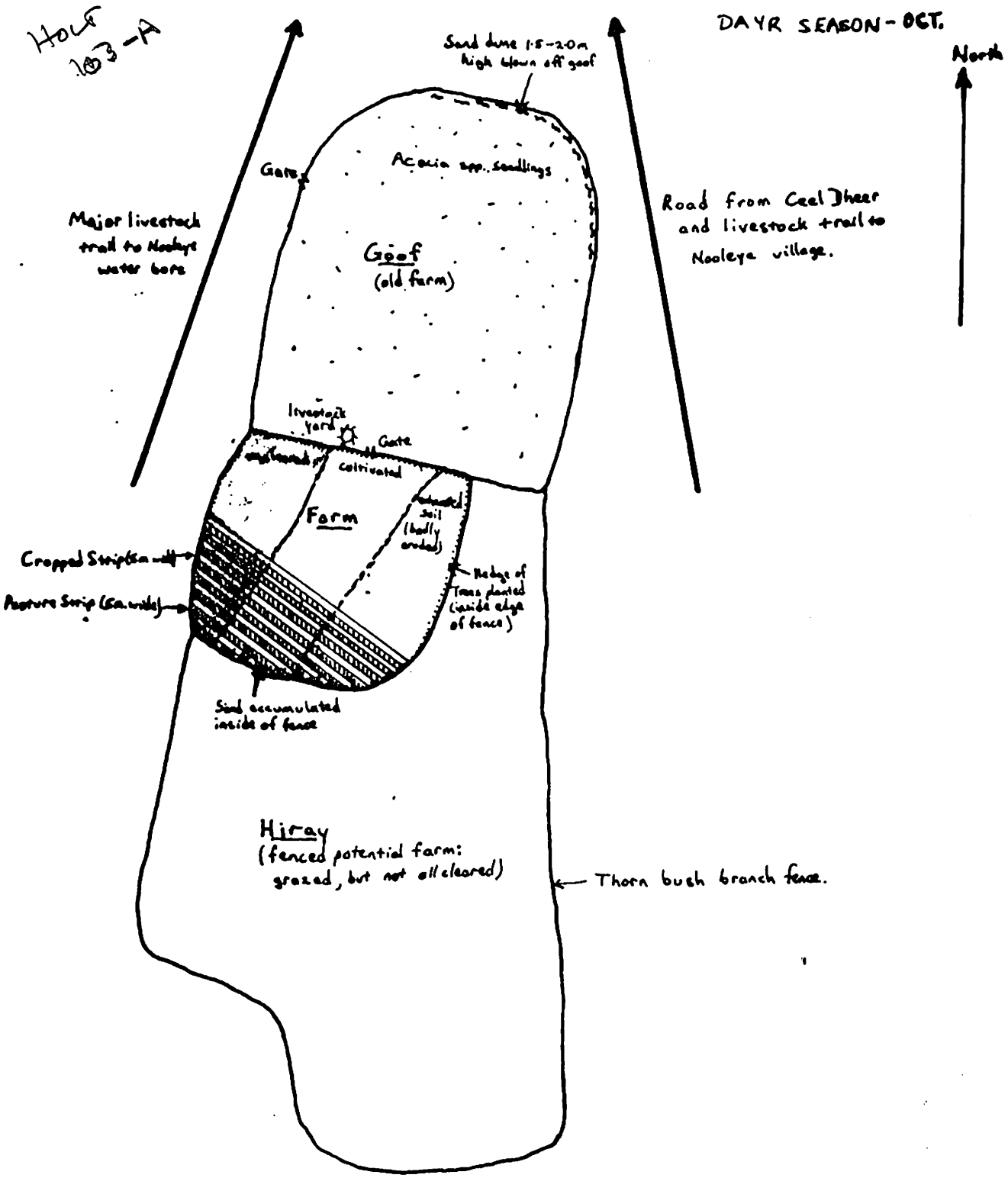


SCALE

0 50 100 150 200

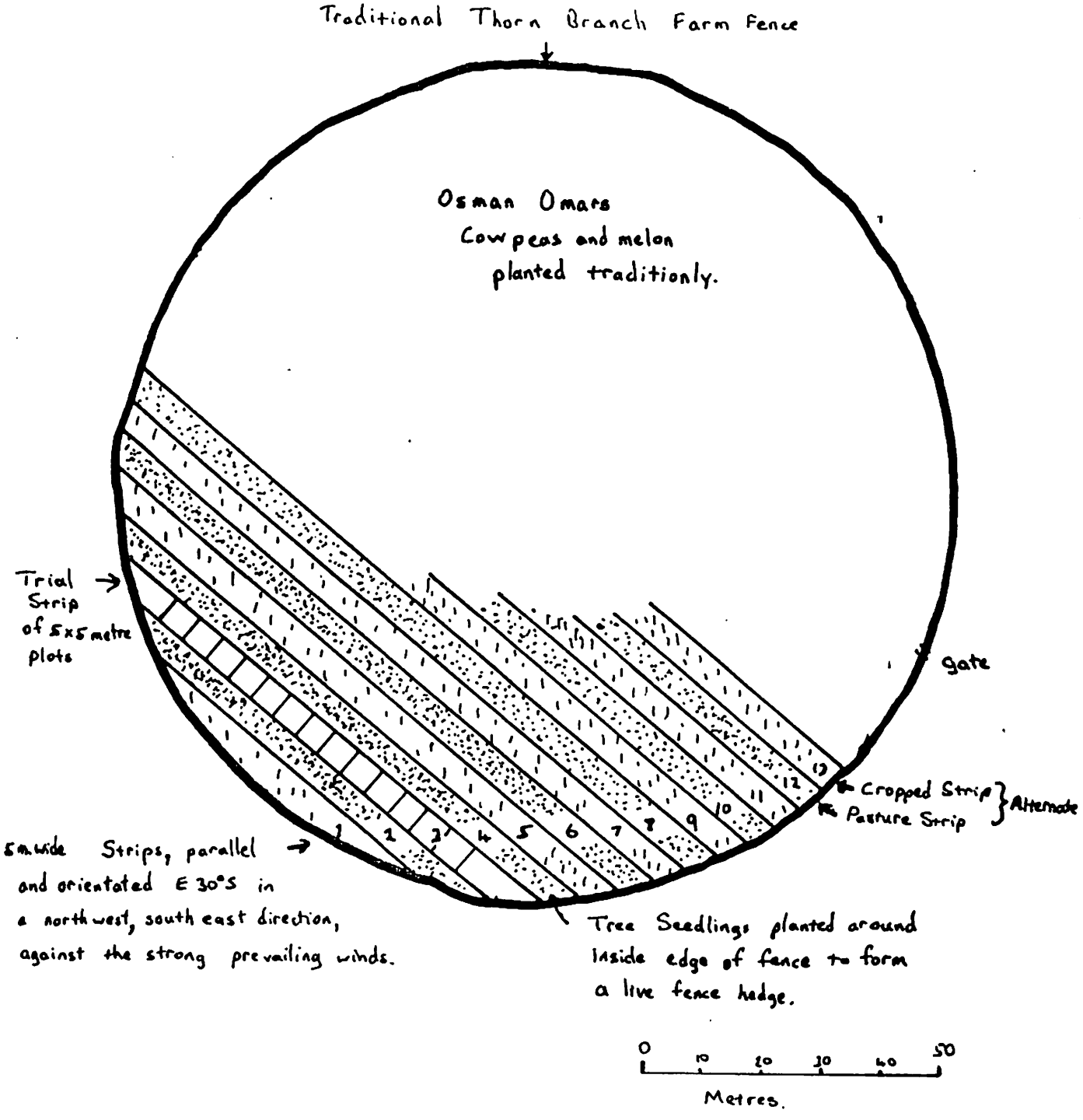
Metres

Sketch - Draft - Not exactly to plan.
by Richard Holt Aug. 1985.

April/May 1985. A diagramatic sketch of his complete APC showing interventions in Oct./Nov. 1985 is given in figure 5. M. Doqow had already, planted a strip of cowpeas and watermelon down the centre of his farm when this trial was intiated in late April 1985. A third of his farm on the eastern, and south eastern side was badly eroded as this had been the first area cropped, and the farmer was progressively clearing and sowing the farm from the south east to the north west side of the farm. (To the best knowledge of the local people) the north west

*Mohamed Duqow with his newly established crop/pasture strips in the background - Nooleye June 1985.

Figure 6: Diagramatic Plan Osman Omar's Agropastoral Demonstration / Trial Farm: Gu 1985, April May.



third of the farm had never been cultivated before. This situation presented an ideal opportunity to directly compare interventions on eroded soil, soil that had been cultivated for 2 years, and virgin soil, and was one reason this farm was chosen for a demonstration.

The farm plan of Oman Omar's farm and interventions made on the second demonstration trial, are shown in figure 6. Osman's family had already planted about two thirds of his farm. He had weeded the remaining south eastern portion in antisipation of this trial. Just prior to

6.2.3 Pasture Crops and Trees Sown and Planted

The pasture and crops sown on each strip on M. Doqow's farm in the 1985 Gu season is shown on table 14.

Table 14: Crops and Pasture Sown M. Doqow's - Farm 1985 Gu'

Strip Num.	Treatment
1.	Pasture: Unimproved, weeded. unpalatable plants only weeded, natural growth left.
2.	Crop : Cowpea from Mogadishu
3.	Pasture: Weeded Natural plus Gayndah, As in strip one, but intersown with Gayndah variety Cenchrus ciliaris
4.	Crop : Safflower oil seed crop
5.	Pasture: Weeded Natural plus local buffel grass: same as one, no buffel seed available yet.
6.	Crop : Seseme

7. Pasture: Weeded Natural plus USA variety buffel: As in strip 3, but USA var. Cenchrus ciliaris sown

8. Trial Strip

9. Pasture: Weeded Natural plus local Pasture legumes: As strip 1, no legume seed available yet.

10. Crop : Local Traditional Cow Pea

11. Pasture: Weeded plus Additional Local Legumes and Grasses: As strip one as seed not yet available.

12. Crop : Left unweeded or cropped in this season.

13. Pasture: Control Natural Pasture

implementing the trial, on-site inspections were made with each agropastoralists, and a specific plan developed for each farm during discussions with the owner. The needs and priorities of the owner were thus incorporated into the plan, with extension officers continually emphasising that the farm and its produce remained his.

Following the development of a mutally accepted plan, which only took one day per farm, extensive discussions had taken place months before, parallel strips were marked out over the portions of each farm included in the trial. A strip width of 5 metres was chosen for these initial trials, as it was felt that a 5 metre wide strip of well established pasture would be needed to act as a wind break for the adjacent 5 m. wide cropped strips. Wider strips could be investigated in the future. Having both cropped and pasture strips of equal width meant that the strips could be easily rotated. As shown in figures 4 and 5, the strips were marked out parallel in a north west, south east direction so that they would be orientated at right angles to the two strong prevailing winds. A compass was used to orientate strips, and local wooden poles to mark their position. One strip on each farm was chosen for small trial plantings, and this trial strip was marked out into 5 m. by 5m. plots again using wooden poles.

Local pasture seed was not available as there was no opportunity to collect it, but it was incorporated into the plan, and sown in the following 1985 Dayr wet season.

The pasture and crops planted on Osman Omar's farm in the 1985 Gu season is shown on table 15.

Table 15. Crops and Pastures sown, O.Osman's Farm, Gu' 1985

Strip No.	Treatment
1.	Crop : Mogadishu type Cow Pea
2.	Pasture: Weeded Natural plus Gayndah buffel.
3.	Trial : Many species.
4.	Pasture: Weeded Natural plus Local Legumes: Legumes not planted until following Dayr Season.
5.	Crop : Safflower
6.	Pasture: Weeded Natural plus USA buffel: Cenchrus ciliaris var. USA intersown.
7.	Crop : Mogadishu type Cow Pea
8.	Pasture: Control Natural, Unweeded
9.	Crop : Seseme
10.	Pasture: Weeded Natural plus Gayndah buffel: Cenchrus ciliaris var. Gayndah intersown.
11.	Crop : Cow Pea, Mogadishu Type
12.	Pasture: Natural Weeded plus USA buffel plus legumes: Intersown with USA buffel. Legumes sown Dayr..
13.	Crop : Safflower

Each farm had adjacent areas of traditional cow peas and melon sown by the farmer, so this served as a direct comparison to the strips.

There had been no opportunity to purchase suitable seed from abroad for this first season, so any potentially suitable seed available locally was used, with most lent by the Agriculture Settlement Project sublayley, Somalia in early 1985. Steps were immediately taken to order small quantitites of some appropriate seed for future use.

Very small quantities of seed of some potential species were available, so these were sown in the trial strips on each farm, shown in figures 4 and 5. Enough seed was available to have 2 replications of 5 by 5 metre plots of each variety sown. The varieties sown are listed in table 16 below:

Table 16: Trial Plot Varieties, Gu' Season, 1985

Species, and Variety sown in each 2 separate 5x5m. plots	
1. Mung Bean, variety Berka	
2. Mung Bean, Rugta (black gram)	Vigna mungo
3. Mung Bean, Celera (Green gram)	Vigna aureus
4. Lab Lab	labLab sp.
5. Safflower (Oilseed)	
6. Cow Pea (Mogadishu)	Vigna unquiculata
7. Cow Pea (local)	" "

Both seeds and seedlings of three tree species, Parkinsonia aculeata, Prosopis hilensis and Prosopis juliflora, with potential roles as rainfed semi arid live fence hedge species, were located at varying sites around Somalia and sown or planted in mid April 1985. The seedlings were successfully transported 450 km from the Belet Weyne CRDP nursery over rough roads to the sites. They were all about 4 to 5 months old, and supplied in plastic bag pots.

6.2.4 Sowing and Planting Methods

At this stage it was felt in appropriate to try any changes in traditional techniques of sowing crops and pastures, although it was recognised that in future, if the project owned and had complete control of a trial, such factors as crop density, sowing depth and sowing time may deserve attention. Thus, the farmer and his family sometimes assisted by a local District Extension Officer, sowed all seeds in the traditional way. Safflower, a new crop, was sown 2 to 3 cms deep with hand hoes at a slightly more dense spacing than local cowpeas. Cenchrus ciliaris is normally broadcast by local farmers just before the first rains. We sowed the seed directly into the ground, as with all other species, using hand hoes, from 0 to 2 days after at least 25mm of rainfall. It was sown in rows about a metre appart and 1.5 to 3 cms. deep. The Mung Beans, Lab Lab and Cow Peas were all sown at a similar spacing, but the former two were sown at only 1 to 2 cm depth.

All legume seeds were presoaked in water for 12 to 24 hours before sowing to stimulate rapid germination and emergence; apparently a common local technique.

Parkinsonia were planted 30 to 40 cm apart, and the two Prosopis species 1.5m apart, in lines just inside the inside edge of the thorn bush farm fences. It was hoped that in this position they would get some protection from grazing, and that the brush fence would shade and have a mulching effect on the soil, improving the critical water relationship of the trees. The tree seeds were sown 2 to 3 cm deep, and the seedlings were generally planted deep in a depression so the butt of the plant was 8 to 14 cm below the soil surface, to both accumulate rain water and get the roots established below the, soon to be dry, surface soil zone.

6.3 Results

Although the trials were established about 3 weeks after the first good rains of the season, and thus well behind local crops, much was learnt from the effort.

Firstly, the problems the local agropastoralists have with the crop pests, bush squirrels, and native rats was emphasised. They ate most of the safflower and some of the cow pea and mung bean seeds, digging them up right up to the time they had fully emerged from the ground. Osman Omar's farm was more effected than the Nooleye farm, as there was an abundance of bush and other suitable habitats very close by. It appears that as APCs become more dense closer to villages, these pests also become less significant, and this may be another factor encouraging the association of APCs.

Safflower was resown following further rains, but again was destroyed by pests. A few plants grew reasonably, but by then the wet season was too short to give this potential oil seed crop a trial. It should be tried again in future, but sown just before the first rain into dry soil so the pests have difficulty locating the seeds. Pregermination treatment of seed and sowing immediately after rain may also be worth investigating.

As the local community purchase and use a lot of cooking oil, it would be very useful to find a suitable oilseed crop they could grow.

Cow pea grew well although close to the fences the pests had eaten some of the sown seed. There was little difference in the vegetative growth of the local traditional cow pea and that purchased in Mogadishu. This was surposed to be a determinate type plant newly introduced to Somalia, which produced good results. Cow pea is probably the most important local crop, and is an important source of fodder. While the local variety seems well adapted and productive, selection trials have been going on in a few countries for many years, and varieties from countries including Nigeria, Tanzania, Kenya and Australia, may have been more productive. Therefore, at least the most promising varieties should be tried in future. Both agropastoralists let their animals into the fields to graze them before crops could be harvested from the cow pea. They did this because the area of the trial cow peas was relatively small, and if they did not graze the area, their livestock would miss grazing the nutritious green feed and crop residues. This illustrates how closely farming is interrelated with livestock production, and how any interventions must suit such a system.

Mung beans, a new legume crop (for this area), showed promise. Rugta and Celery varieties (black and green gram) did not do well, growing slowly and never reaching maturity, but a small yield was obtained from Berka variety, this was particularly encouraging considering the late sowing. It and other potential Mung Beans deserve trying in future. None of the Mung beans displayed any obvious serious diseases or deficiences.

The Lab Lab proved disappointing, as it only grew a few inches high, and had very yellow, nutrient deficient, foliage. The seed was obtained from a bag ordered and labelled as Lab Lab pururea, an important leguminous forage and human grain crop, but it is suspected it was some other species. Lab Lab does require a different variety of rhizobia to nodulate and thus fix nitrogen, so future seed should be innoculated. This innoculant was sought, but was unavailable for this trial.

The preliminary results of the strip cropping trials were encouraging. The two trial agropastoralists theoretically appreciated and were interested in the concept. Many other agropastoralists spoken to also found it logical and some were even excited with the system. Probably the most difficult aspect of the system for them to adopt will be the labour and time required to collect and sow pasture species, when they could be sowing crop. At least this is the impression so far, However, as some farmers already do this, the practice should eventually catch on. The very preliminary results of this trial suggested that just allowing native pasture to re-establish on the pasture strips would quickly provide a good pasture and windbreak strip. However, this could be expected to be highly variable. Regrowth on farms near exhaustion, which have been weeded for years, would probably be slow, but on most farms, observations suggest it would be fast.

The advantages of establishing better pastures will have to go through a trial and demonstration process. The new varities of Cenchrus ciliaris

imported from Australia, var. Gayndah and var. USA (Garrow) also seemed to be promising. The germination of the Gayndah seed sample was poor, though this is no a reflection on the variety, which normally has a similar germination success to other varieties. The germination of C. ciliaris typically decreases rapidly after 2 years, so this may have been old seed.

The USA variety, in particular, established well and remained green after all local species, including local C. ciliaris were dry. This could have been due partly to an effect of the sowing date, but the result was very encouraging. The perennial C. ciliaris varieties Gayndah and USA are normally more large tussock type grasses than the local varieties under similar conditions and are worth further evaluation .

During the strongest yearly winds in July-September, following the Gu' rainy season and crop harvest, the pasture strips already appeared to be providing valuable protection against wind erosion, although this effect should be easier to demonstrate and quantify after the strips are established for 2 good wet seasons. Whether this will be possible though will depend greatly on how heavily the agropastoralists graze the area (and of course on rainfall).

The results to date on planting live fences are inconclusive, as it is too early to draw any conclusions, particularly as the trial had to be planted long after the first rain. The seeds of both Prosopis species did not germinate. They were harvested only 2 months previously, then

given a boiling water treatment just before sowing as recommended by the project Forester. Further investigations into this germination problem will be needed.

In the case of seedlings pregrown in nurseries, Parkinsonia seedlings were promising. Most were alive and growing when inspected in September. Only about 70% of the Prosopis seedlings still lived, with the 2 species giving similar results.

The Parkinsonia seeds germinated and established well, but most died. Time of sowing, and the length and success of the growing season and the microclimate would seem critical here.

The initial conclusions and recommendations from this trial have been integated into those of the rest of this report.

7.0 Conclusions and Recommendations

7.1 Agropastoralism, a system combining pastoralism and agriculture, is a very significant production system in central Somalia on which a large proportion of the local inhabitants depend for their existance. In Ceel Dheer district, where studies were concentrated, over 70% of all pastoralists also enclose areas of land for both crop production and private grazing. In other districts including Haradhere, Ceel Buur, Hobyo, Jalalaksi, Bula Burti and Belet Weyne this practice is also common. The agropastoralists depend for their existance on the

crops they produce from these areas, and the livestock, which they have integrated closely with the cropping, through the use of crop residues, and enclosed pastureland. The agropastoral system now supports hundreds of thousands of people in this area. Therefore, the role of government aid projects should be to:

(a) understand the system

(b) assist it to maintain or even increase sustainable productivity,

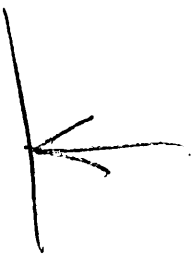
(c) reduce the severity and effects of inevitable future droughts,

(d) urgently extend methods and techniques that ensure current and future agropastoral practices do not cause further desertification.

7.2 Management of the rangelands can not and should not be separated from a consideration of the agropastoral system in these areas as:

- Ecological investigations during this study have found that, although only a small portion of the area is cultivated at any one time, much of it has been cleared and cultivated over the last few hundred years.

- The effect of the combined agropastoral clearing/ cultivation/intensive grazing of rangelands, but particularly vegetation, is greater than rangeland pastoralism.



- The grazing of the rangelands in areas in which agropastoralism is practiced is closely related to farming, as agropastoralists typically graze at least some of their herd for long periods close to their agropastoral enclosures, making use of family labour available close to home.

- Agropastoralists require access to their enclosures for their livestock too, so it would be very difficult to institute a range management plan, such as deffered grazing, in such areas.

- Agropastoralism is probably leading quite rapidly, to the privatisation of rangeland, and this reduction in the area of

communal rangelands will probably have considerable long term ramifications.

- Historic, physical and ecological evidence has shown that agropastoral practices have caused the formation of some of the active sand dunes in the central Somalia rangelands, and there is evidence that this desertification process is progressing rapidly near many water bores in the agropastoral areas.

7.3 The evidence that some agropastoral practices are causing serious wind erosion and desertification in the soft, sandy erodeable soil areas of some of central Somalia is very concerning, particularly as it is associated with water development, which is continuing in this area at a rapid pace; urbanisation, and an apparent increase in the population of people and livestock.

7.4 This study has identified some uncommon indigenous agropastoral practices which have great potential for decreasing erosion, desertification and possibly increasing sustainable production, as well as decreasing impact of droughts. As these techniques have been proved and adopted locally, future work should be directed at refining these techniques as necessary using applied trials, then to rapidly disseminate the information in an extension program with emphasis on demonstrations. Other useful innovative local agropastoral practices, should also continue to be investigated.

7.5 Strip cropping, has already been adopted by a few local agropastoralists due to this study and CRDP extension efforts, and it would appear to have great potential. The project should put resources into expanding the adoption of this technique though a strong extension program, based particularly on demonstation and technical assistance.

Other simple foreign interventions such as introducing drought resistant, high producing, cow pea and sorghum varieties, and potential pasture and forage species, should be expanded and put though the evaluation, demonstration process.

7.6 The lack of bushes to provide branches for contruction and maintenance of fences around enclosures near major watering points is a major indirect cause of erosion and desertification in these areas. Enclosures near watering points are often abandoned for this reason rather than because the soil can not grow crops, and, once most enclosures are abandoned, they are heavily grazed by the large numbers of the livestock that congregate near water points. As these enclosures were recently cultivated, vegetative cover is usually poor and soil is disturbed. Therefore, they are very susceptible to erosion once the remaining protection, the fences and a little pasture vegetation are removed.

The solution to this problem is not to try and control livestock herding or livestock numbers, as these are very difficult to control under a nomadic communal pastoral system. Reserving areas near villages requires high cost fencing and guards even if extension workers are able to obtain the support of the majority of the local community. Rather, the solution is to demonstrate how the land near the watering points can be productively used by local agropastoralists with the only external input being modest on site evaluation, technical advice, extension and, during the development phase, seed to encourage the rapid adoption of the technology.

Thus, it is recommended that applied trials, demonstrations and other extension work should give priority to refining and developing local live hedge fencing practices and trying other possiblities. This was begun in 1985 by the extension component in the Nooleye area, and local agropastoralists were very interested in adopting the idea, and a few have already started. Finding suitable species for a semi-arid area is not easy, and the present trials which include Parkinsonia and Prosopis species need to be extended to include other introduced and local species. Preparations are now underway to establish a tree/bush species trial at Nooleye in co-operation with the Somali National University, project Forestry, Soil and Water Conservation, and Ecology components and the ODI British Government Forestry co-ordination unit.

With successful live bush hedge fencing and strip cropping, it could even prove possible for agropastoralists to stablise mobile dunes near villages by making them economically productive with a minimum external input.

7.7. Little potential arable land that has not been cultivated before remains, to the best of our knowledge, only about 5 to 10% of the agropastoral area in Ceel Dheer District. Given current trends it will not be long before the cropping cycle will be shortened. In many other sub Sahelian African countries it is often said that at least within access to a watering point, it is the shortening of the cropping cycle, the decreasing of the number of years land is allowed to revert to rangeland and rejuvenate before being cropped again, that is a mjor cause of desertification. This study has contributed to our knowledge on the ecological succession after cropping, and the period of time needed to rejuvenate the land. However, further studies and trials are need to see how this process can be accelerated, and to extend the investigation to other important soil types/ecological units such as the central ridge, Shebelle basin, and western Shebelle alluvials. Local agropastoralists associate some woody legumes with the ability to speed the recovery of the soil, so trials have been initiated but they should be expanded to exploit the apparent potential

7.8 The extension component has been able to establish trial/demonstrations of strip cropping, fence bush hedge planting, and crop and pasture introductions on two APCs in Ceel Dheer district in 1985 with a low input from the project, just the provision of technical advice, encouragement and some seed for the respective agropastoralists. This is a very promising extension method as it requires a relative low external input, yet local people are encouraged to rapidly adopt the technology as they observe local respected agropastoralists adopting it due to their assessment of its potential, they can physically examine and assess the performance of the technology under local condition, and the co-operating agropastoralists in effect become very useful volunatary community extension workers when they talk to friends in bars and tea shops.

It is thus recommended that this program be expanded to include many other agropastoralist. Already many have expressed interest. However great care must be taken in the choice of agropastoralist to ensure they are deeply committed to improving agropastoralism, understand how agropastoralism is causing erosion; are innovative; are chosen in the consultation with the local village committee, elders, or RLA, to involve the community in the selection; and that they come from a representative variety of community wealth strata.

7.9 The project should establish small, applied evaluation/demonstration trials near Nooleye and probably also in Bula Burti district. Some techniques and interventions must be tried under local conditions but also under conditions where the project has adequate control over factors such as grazing. All trials at present are on two agropastoral complexes, and experience has demonstrated the success of interventions are subject to the wims and needs of the owner. The Nooleye trial should commence in the 1986 Gu season to obtain results as soon as possible. These applied trials should evaluate and demonstrate:

- strip cropping/pasture rotation.
- appropriate size of strips needed to stop erosion.
- promising local uncommon agropastoral techniques such as sowing local pasture legumes and desireable grasses in pasture strips and goofs, to reduce erosion, provide more feed for livestock, and improve the soil.
- improved foreign varieties of local crops and pasture species.

- new potential introduced crops and pastures such as mung bean, pigeon pea, Lab Lab, safflower, and millet, most of which are also useful fodder species. Increasing the range of crops grown often improves the ability of the agropastoralists to

survive droughts. Introduced perennial pastures to evaluate should include Stylothanses spp., Cenchrus ciliaris varieties, C. segiterius, and Chenopodium sp.

- agroforestry legume fodder trees which can be grown close to crops, such as Acacia senegal, Termalia sp. and Dalbergia should also be tried. These trees should have potential for wood production, be evergreen fodder trees to provide feed in droughts, and be legumes to improve the soil. Some Australian Acacias have already been ordered.

These trials should not be set up to emulate local APCs, or be grazed heavily as to do so would be difficult and expensive and would defeat their principal purpose, which is to try and demonstrate readily available applied technology that promises to reduce desertification and maintain and/or increase sustainable production. Studies of the local agropastoral system incuding the role of livestock in the system, and how well the introduced technology is adaptable locally will be more appropriately, and more economically done on voluntary agropastoral demonstration units, or elsewhere.

7.10 The investigation described in this study should be expanded and extended to the rest of Ceel Dheer district, then the other two priority districts, Bula Burti and Hobyo and subsequent districts as the project progresses. Aerial photography should be

used as much as possible to provide quantitative data, as long as it is well ground truthed. Any available historic aerial photographs of the area should be obtained and compared to obtain trends in agropastoralism and desertification.

APPENDIX 1

SOME SOMALI AGROPASTORAL TERMS

Somali Name	English
Beer	Farm, cultivated area
Goof	Farm enclosure area, previously cultivated, now not cultivated. Sometimes also used to refer to a oordha or haray.
Oordha	Bush area which has been cleared of trees and bush in preparation for cultivation. Not weeded or cultivated.
haray (xirmo)	Enclosed area (fenced) of bush not yet cleared. Farmer usually plans to clear and cultivate in future, but sometimes is just a livestock enclosure.
Ful	Weed, cultivate with a hoe

Abuur	Plant/Seed/Sow
Goho, goday (beerti waa goday)	Harvest(eg, digir goho. harvest cowpeas)
Cull	Pestel or stick use to grind grain
Maya	Morter grind grain in
Mukarr	Food store, either above or below ground
Ood	Fence
Ceel	Well
Balli or war	Depression in ground holding water natural or man made.
Laas	Temporary well - dry in dry season
Goob	Group of people gathered to work together on a specific task.
Berked	A cement and stone lined below ground water tank.

APPENDIX 2

SOMALI SOIL CLASSIFICATION CEEL DHEERE AREA: SOME PRELIMENARY DATA

Local Name	Description
Ara Acad	White sandy soil in Ali Yabal area, say fertile and can cultivate for 5 years, 10 seasons. Osmaans Hers's farm
Ara Gudood	Red sandy soil Not as fertile as Ara Acad, can cultivate for 5 - 6 seasons.
Gawan	It is a sandy soil which is more fertile, and can be cultivated for 15 seasons. It is the soil of the Galcad area, and some of Nooleye degaan. It is dustry, having some, fine soil particals. The surface often has an algae covering.
Boston	Local Ali Yabal name for type of Ara Acad. Means dusty, has some silt, and a very little clay. General fine grain size, light brown sandy loam.
Ara cad - leb	Dusty Ara cad. (Shadoor area) Similar colour to Ara Acad of Ali Yabaal but said to be more dusty (more silt and clay) & fertile.
Bacad	Term with similar meaning to Ciid. Sometimes Bacaad is also used in this context, but more often the later refers to sand dunes.
Dagcar	Means stony. It is the very shallow red sandy soil overlying limestone and dolomite often cropped in the Bad Bud, Wabxo, Dax area.
Banaan	Sandy calcareous soil of coastal plain (eg. near Ceel Dheer) next to inland ridge. Poor water holding capacity, no cropping.

Ciid	Litterally sand, often term given to area of sandy soil, eg. Nooleye area general classification.
Buur	Often occurring adjacent to Gawan, it is more sandy, and soft, with little dusty, fine partical composition.
Ciigacan	Soil or land previously cultivated, and not yet fertile enough to cultivate again.
Gilgap	Virgin land - land previously uncultivated in the subjective assessment of person using the term.

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The work summerised in this report was carried out from 1982 to 1985 by the author as a minor part of his duties as Range Training and Extension Officer in the Central Rangelands Development Project. The general investigations, case studies, and demonstration/trials described here are still in progress, so the report should be treated as a preliminary document.

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Many CRDP extension staff assisted the author with the field work described here, particularly the Ceel Dheer district extension staff, Adan Mohamed, Hersi Gurhan Housh and Abdulkadir Hassan Weheliye. Counterparts Abdikarim Hassan Osman, Mohamoud Abokor Hussein, Ali Yusuf Ibrahim, Hawo Guled Musa and Saciid Hassan Mohamed and Pastoral Adviser Yusuf Abdi Gelle all at some stage provided patient translation and valuable assistance. The study would not have been possible without the voluntary suport and co-operation of many agropastoralist, particularly the 6 case studies, and the two voluntary demonstration agropastoralist, Omar Osman Hersi and Mohamoud Duqow. Finally, the author acknowledges the forsight, understanding of the General Manager, Abdullahi Ahmed Karani, and Project Manager Mohamoud Ahmed Ayan in supporting this work, although it was not in the original project design.

However, all views, interpretations, recommendations and conclusions in the report are the authors, and are not necessarily those of the CRDP or other organisations or individuals.