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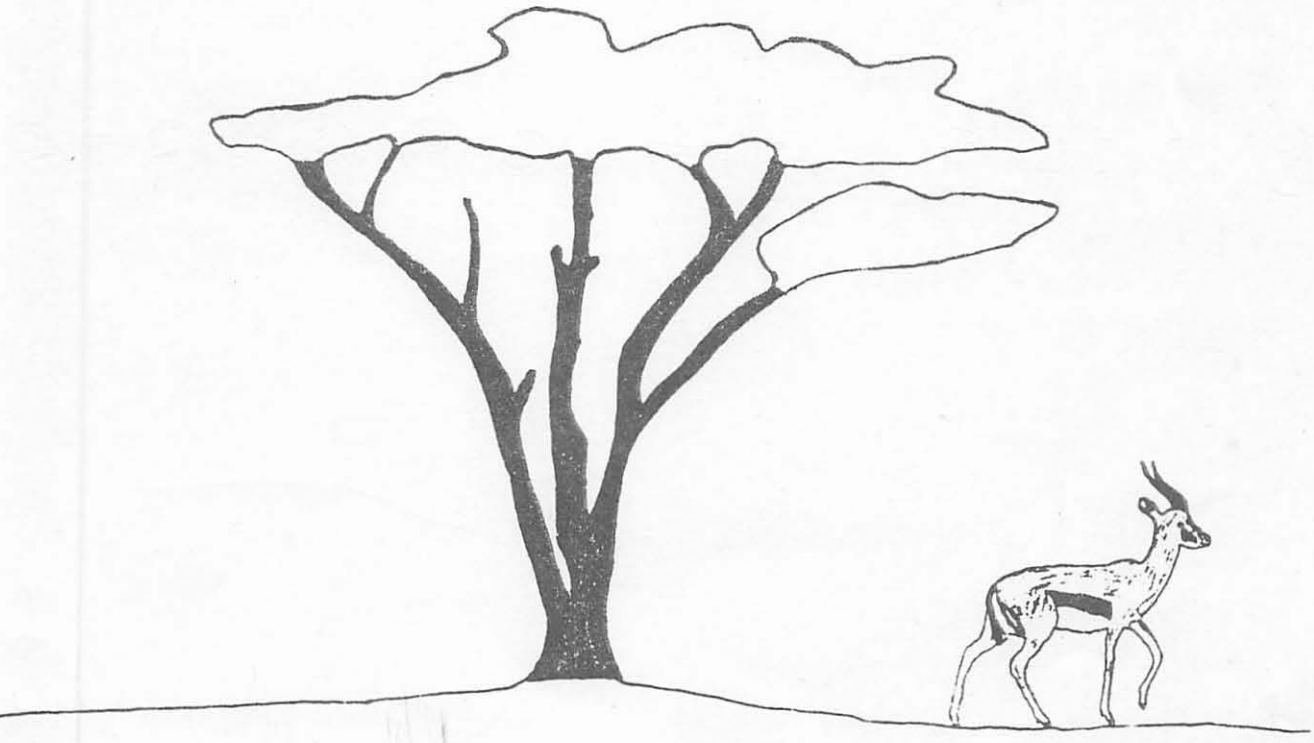

The Somali Journal of Range Science serves as a forum for the presentation of scientific research pertaining to the study, management and use of Somalia's rangeland resources. This journal is published twice yearly. Articles relating to all aspects of natural resource research in Somalia are welcomed. Submitted manuscripts should follow the same general format as used in this issue. Papers should clearly and concisely state the purpose of the research. Unsupported hypotheses and rambling discussion should be avoided. The submission deadline for the next issue will be March 1, 1987.

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CENCHRUS CILIARIS PLANT HEIGHT-WEIGHT RELATIONSHIP

Mahdi Musse Kidar and Jerry R. Barker

Cenchrus ciliaris (Gurde agar or Buffel grass) is a widespread, perennial grass providing valuable forage throughout Somalia (Cope 1985). C. ciliaris may be found growing in a variety of vegetation types ranging from coastal grasslands to Acacia Commiphora thickets providing forage for cattle, camels, sheep, and goats (Herlocker and Kuchar 1986). It also provides cover and forage for an array of wildlife species. C. ciliaris has the potential to be of value in erosion control such as sand dune stabilization because of its rapid growth and tillering ability.

As a result of its widespread occurrence and forage use by livestock, C. ciliaris could serve as a indicator species of grazing intensity. Stoddard et al. (1975) outline the criteria of as desirable indicator species as: 1) an important forage species, 2) occurs throughout the range type, and 3) is consistently utilized throughout the grazing season. The philosophy of the indicator species concept is that when the species are utilized to the proper level, the range must be considered fully grazed (Smith 1965). Any further grazing will be detrimental to the condition of the range site. Likewise, such species are of value to indicate when the range site is suitable for livestock grazing to begin.

For C. ciliaris to serve as an indicator species to grazing intensity, its height-weight relationship must be determined. Therfore, plant height can be quickly measured to estimate the percent forage consumed by livestock (Cook and Stubbendieck 1986). The purpose of this paper is to explore the height-weight relationship of C. ciliaris plants.

METHODS

C. ciliaris plants growing in sandy soil were selected within the American Golf and Tennis Club compound along Afgoi Road, Mogadishu, Somalia. The plants have never been mowed and have been subjected to little if any grazing. All plants collected were mature and in the "soft-dough" phenological stage. Fifteen plants representing the possible size range were measured for height, dug from the ground, and placed into a plant press. The plant press was then placed into a drying oven at 60°C for 48 hours.

After removing the plants from the press, the root systems were cut-off. Beginning at the base of each plant, 2.5 cm increments were removed and weighed to a height of 7.5 cm. Then 5.0 cm increments were removed and weighed to a height of 22.5 cm. The remaining portion of the plants were then weighed singularly.

Data analyses consisted of averaging the increment weight for each height segment and then determining percent increment weight based on mean total plant weight. Regression analysis was used to determine the relationship between plant height and percent utilization.

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RESULTS

The foliage weight of C. ciliaris is not distributed evenly throughout the height of the plant (Table 1). Approximately, 65% of the foliage biomass is located in the bottom 5.0 cm (10% of plant height). This leaves 35% foliage biomass to occupy the remaining 90% of plant height. Such a weight distribution is characteristic of grass species with a predominance of basal leaves (Crafts 1938) such as C. ciliaris.

Table 1. Cenchrus ciliaris plant height-weight relationships. Means are based on the average of 15 plants.

Height (cm)	Increment (cm)	Weight Increment (g)	Accumulated Weight (g)	Weight Increment (%)	Accumulated Weight (%)	Removed Biomass (%)
48.0	25.5	0.2	13.8	1.4	100.0	0
22.5	5.0	0.2	13.6	1.4	98.6	1.4
17.5	5.0	0.5	13.4	3.6	97.1	2.9
12.5	5.0	1.6	12.9	11.6	93.5	6.5
7.5	2.5	2.2	11.3	15.9	81.9	18.1
5.0	2.5	3.5	9.1	25.4	65.9	34.1
2.5	2.5	5.6	5.6	40.0	40.6	59.4
0	0	0	0	0	0	100.0
		13.8		100.0		

A curvilinear relationship exists between plant height and percent utilization (Fig. 1). Very little plant biomass is consumed with the onset of grazing. Almost 90% of the plant height must be consumed before any initial impact on foliage biomass is realized. However, after 90% of the plant height has been removed, percent biomass consumption diminishes rapidly with increased grazing. Based on a traditional rule-of-thumb of 50% forage utiliztion for proper use (Stoddart et al. 1975), C. ciliaris plants would be grazed to a height of approximately 3.5 cm.

DISCUSSION

The height-weight relationships of many western North American grasses have been established (cf. Crafts 1938, Lommasson and Jensen 1943, Heady 1950). The resulting data have been used to develop charts, gauges, tables, etc. to determine forage utilization for an entire range site. These devices are an aid to range managers for monitoring livestock forage consumption and range site condition.

Such information is lacking for Somali rangeland grasses. The data presented herein is a start in obtaining such critical information. However, the data base needs to be extended to other key grass species. The method can also be used for forbs and sedges with accurate results (McDougald and Platt 1976, Harshman and Forsman 1978).

The height-weight method for determining forage utilization assumes that the growth form of grasses is constant among years, seasons and sites to allow the use of such data with reasonable accuracy. However, variation in height-weight relationships have been reported to vary among years, seasons and sites (Heady 1950). Cook and Stubbendieck

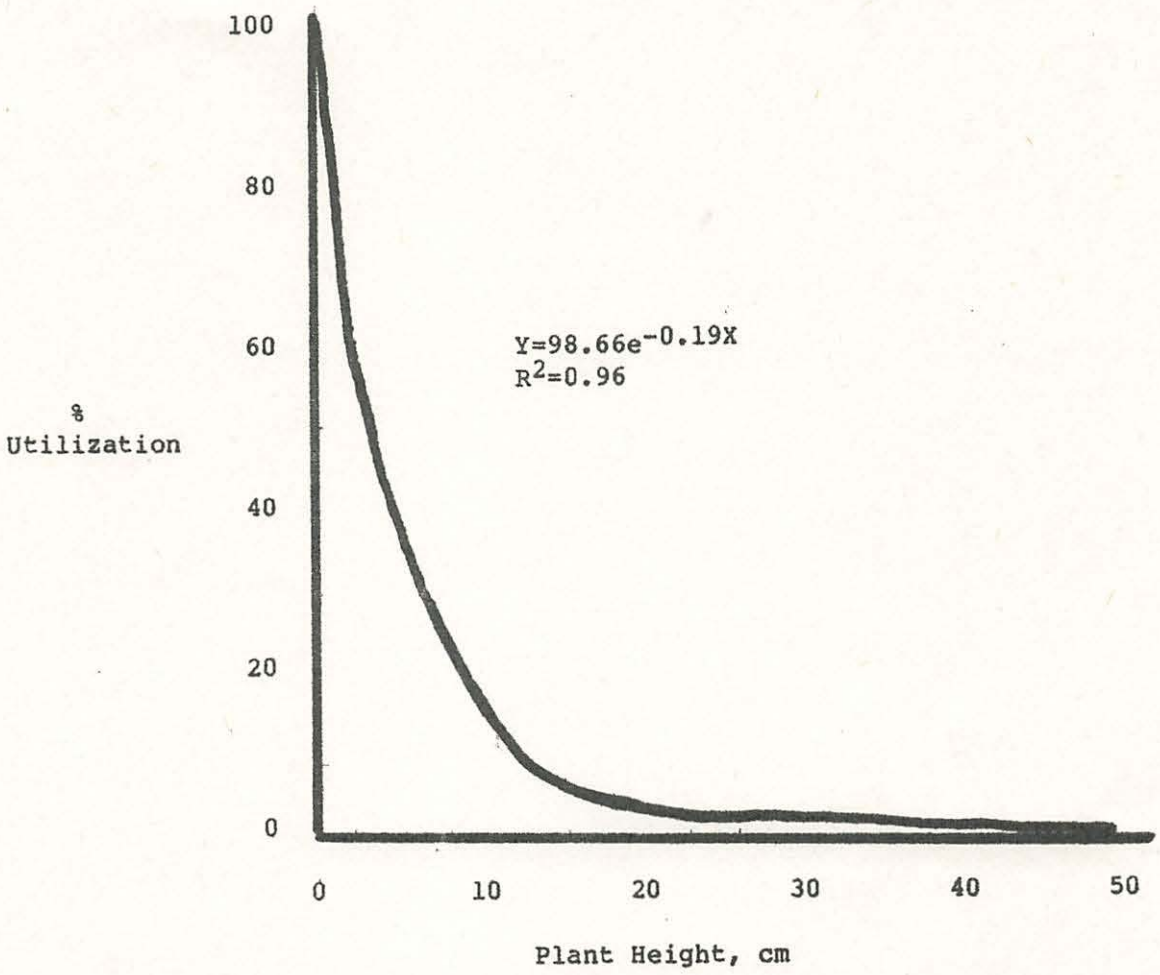

Figure 1. The relationship between plant height and percent utlization for Cenchrus ciliaris.

(1986) point out the such variation can be reduced with the use of tables developed for specific conditions. Once such data has been established, the determination of utilization is fairly accurate except where grazing is restricted to leaves with the stems remaining intact.

To determine percent utilization using the height-weight data for C. ciliaris is straight forward (Cook and Stubbendieck 1986). Random samples of C. ciliaris height are recorded for numerous plants. It is desirable to measure plants ranging from heavily-grazed to lightly-grazed areas. Then percent utilization can be determined directly from Figure 1.

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THE VEGETATION OF THE COASTAL PLAINS, CENTRAL SOMALIA

Dennis Herlocker and Ahmed Musa Ahmed

Background/purpose of study

An essential element to effective range management is an understanding of range condition, which relates the current state or health of the range to its potential (Stoddart et al, 1975). Developing an adequate system of classifying range condition requires considerable knowledge about range sites, plant species palatability and utilization, secondary succession and responses to grazing and other forms of environmental disturbance. At present, such information is extremely limited or altogether lacking for Somalia as a whole and for the Central Rangelands in particular.

This paper initiates the development of a system for classifying range condition of a single, but large, range site on the coast of Central Somalia. It describes the existing and dynamic vegetation patterns not only in order to describe the existing forage resource and to learn something of its potential but also to identfy plant species useable as indicators of different range condition classes.

Description of study area

Location and physiography

A narrow 8-35 km wide strip of perennial grassland extends for about 800 km from Mogadishu along the coast of central Somalia to about latitude 6 degrees 20 minutes north (Fig. 1). This level to gently sloping grassy plain contrasts strongly with the adjacent landscape in both topography and vegetation physiognomy.

The coastal plain grassland has an undulating relief associated with an ancient dune system (RMR, 1979). Steep slopes occur only in northern Ceel Dhere and southern Haradhere Districts where the grasslands extend inland to a large dune field atop a large ridge. Elsewhere, this ridge supports dense shrubland. The coastal plains show no drainage patterns except on the steeper slopes mentioned above which have deep erosion gullies. These gullies, however, seldom reach the coast (RMR,1979).

South of Hobbio (latitude 5 degrees 20 minutes north) the coastal plain, which seldom exceeds 50 m in elevation, is backed by a large 200 - 400 m high ridge dominated by dense shrubland vegetation. North of Hobbio the ridge is absent and the coastal plain occupies the easternmost edge of the large central Somalia plateau that rises gently from sea level at the coast northwestward into Ethiopia. Vegetation of the central plateau bordering the coastal grasslands is characterized by a low growing, sparce shrubland.

Geology and soils

The coastal plains are composed of aeolian and marine sediments dating from the quaternary and pleistocene (Pozzi et al, 1983) which until

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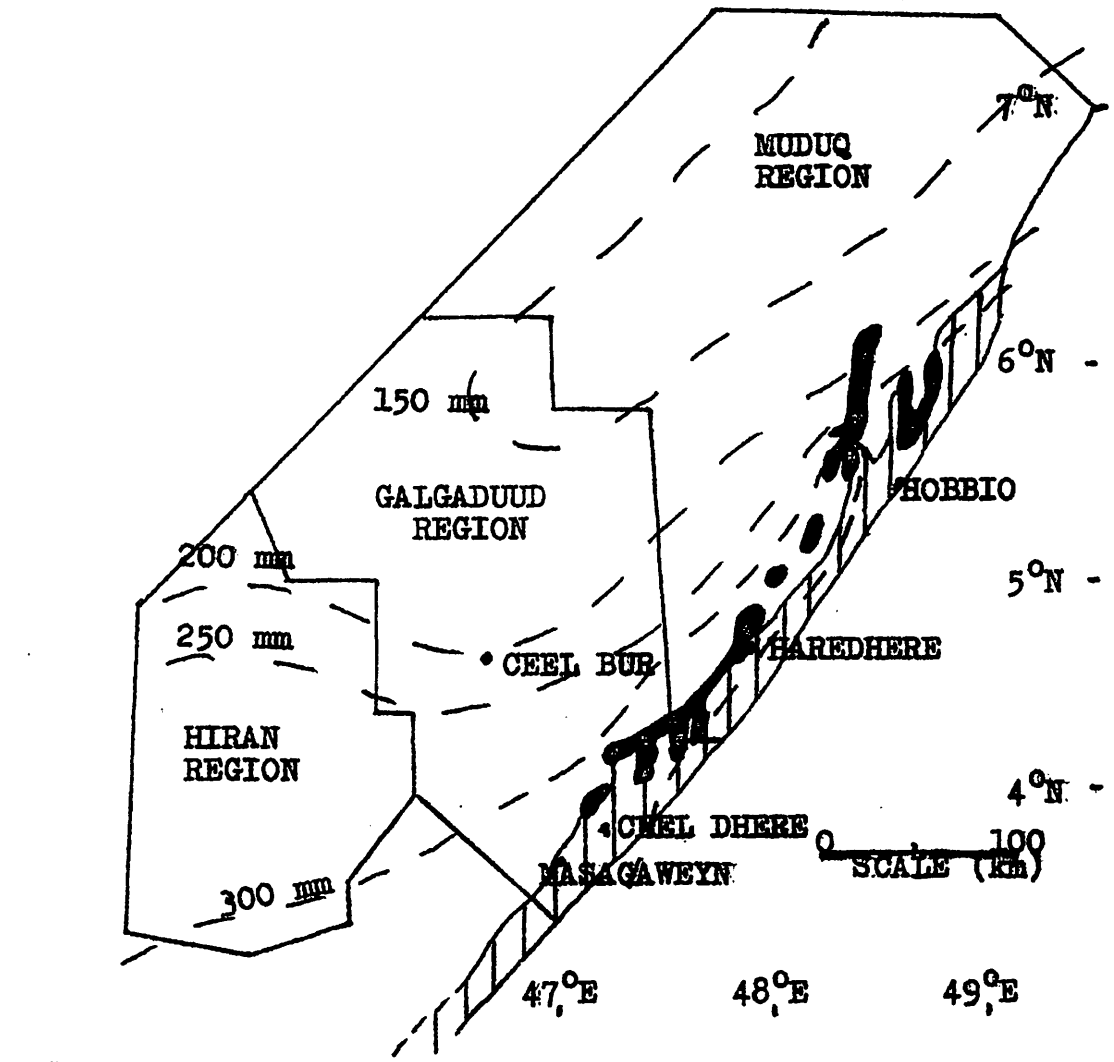


Figure 1. Coastal grasslands and rainfall isohyths in the central rangelands.

recently (geologically speaking) formed the ocean floor (Naylor and Jama, 1984). These sediments overlie pink to brown limestone, which is often exposed by erosion and is occasionally raised into low ridges running approximatelly parallel to the sea (RMR, 1979).

Soils are shallow (RMR,1979) ranging in texture from sand at the surface (Naylor and Jama, 1984) to sandy loam at a dept of 1 m (Frye and Khalif, unpublished data). The soils show little horizon development (RMR, 1979). They are mildy to moderately alkaline but not saline (RMR, 1979; Frye and Hussein, unpublished data). RMR (1979) reports soils in Ceel Dheer District to be generally deep, fine grained silty orange sands with consolodated surfaces susceptible to erosion and gullying on slopes. This probably refers to grassland which occurs on the eastern flank of the large ridge between the plain proper and the large ridge top dune field.

Climate

The climate is semi-arid to arid (UNSO, 1984). Temperatures are warm all year (20-30 degrees C) (UNESCO, 1979; UNSO, 1984). Relative humidity is also high (73-78%) and varies little throughout the year (UNSO, 1984). Rainfall ranges from about 300-400 mm/yr near Mogadishu to under 150 mm/yr north of Hobbio (RMR, 1979; UNSO, 1984) (Fig. 1). There are two rainy seasons per year. The length of the rainy seasons become shorter and more accentuated northward. Thus, rainfall at Mogadishu occurs mostly during April-August (Gu season)and October-November (Dayr season) but at Hobbio mostly during April-May and October-November (UNSO, 1984). Topographic influence of rainfall is probably restricted to the largely shrub covered ridge adjacent to the coastal plain.

The wind system is monsoonal and consists of a southwest and a northeast monsoon. These occur in different seasons; the Xagaa and Jiilaal. The southwest monsoon (Xagaa) is the strongest and has the most influence over the environment, as in the case of direction of movement of sand dunes. Wind speeds are high during the dry seasons but especially so in the north during June - September (Xagaa season) where they attain a monthly mean of 30 km/hr. Wind speed increases northward in the same direction as rainfall decreases (UNSO, 1984). Therefore, the northern part of the coastal plains is probably more xeric than the southern portion.

Geomorphology

Probably the most important geomorphological process acting on the coastal plains is the wind borne movement of sands. That this process has been important in the past can be seen in the now stabilized dune systems that compose the present landscape (RMR, 1979). That it is important today is reflected by the many mobile dunes, dune tracks and blowouts on the coastal plain (RMR, 1979; Naylor and Jama, 1984; Herlocker and Ahmed, 1985). Sands are either blown inland from coastal beach deposits or originate from around wells and villages where heavy grazing has removed vegetative cover. Thus, wind erosion in the coastal plain grasslands reflects a combination of natural (high winds) and man made (overgrazing) events (UNSO, 1984). Movement of wind blown materials northward reflects the direction of the prevailing winds, which are from the south. Within Ceel Dheer District, sand dunes cross the plain to feed the large dune fields which extend into Haradhere District.

A less important process, because it occurs over a smaller area, is water erosion (sheet and gully) of the more compact siltier sands on the slope between the plain proper and the large dune fields atop the large ridge in northern Ceel Dheer and southern Haradhere Districts. Sheet erosion does occur in that region and well incised gullies are common. Eroded materials are deposited at the base of the ridge at its juncture with the coastal plain proper. As a result, there is a patchy occurrence of heavier, clayey soils along this line.

Vegetation

Prior to the inception of the Central Rangelands Development Project (CRDP) in 1982, little was known about the vegetation of the coastal plain. It was classified physiographically as coastal formations (Pichi-Sermolli, 1955). Hemming (1972) commented on the fact that grass and sedge cover extended to within 100-200 meters of ths shore, reflecting the lessened effect of the Indian Ocean on coastal vegetation compared with that of the Gulf of Aden in the north. RMR (1979) physiognomically classified the vegetation as medium density short and very short herbland and grassland and developed a list of common and characteristic plant species based on land system units.

Following the inception of the CRDP, Naylor and Jama (1984) found coastal plain vegetation in Hobbio District to be dominated by Leptothrium senegalense and Indigofera intricata. Other important species were Cenchrus ciliaris, Cyperus sp., and Sporobolus ruspolianus. The vegetation was characterized by a 30-40 cm height, 13% basal cover, mostly fair range condition, low plant vigor and a forage productivity of 1,260 kg/ha (probably net standing crop).

Herlocker and Ahmed (1985) surveyed coastal plain vegetation within Ceel Dheer District, the results of which form the basis for the present paper. Herlocker et. al (1986) showed that protection of heavily grazed vegetation results in rapid recovery characterized by significant increases in total vegetal basal cover and range condition.

Land use

The only land use is a form of semi-nomadic pastoralism. Cattle, sheep, goats and camels are kept but sheep dominate and camels are relatively few. Livestock movements reflect the occurrence of rainfall and subsequent spatial and temporal patterns of available forage, outbreaks of biting flies and presence of permanent dry season water sources.

Livestock use the grassland/shrubland ecotone during the early rains. This allows use of grass species, such as Sporobolus helvolus and S. ioclados, found only here. Livestock also escape outbreaks of a biting fly (Gelmi) which are common along the coast at this time. In some areas, where no wells exist near the grassland/shrubland ecotone, they can also use temporary surface waters on otherwise unwatered range (Herlocker and Ahmed, 1985). At this same time, outbreaks of another biting fly (Ribi) in the dense shrublands of the adjacent ridge force livestock out onto the coastal plain for up to a month and a half until the flies die. During the latter part of the rainy season livestock resident on the coastal plain graze areas increasingly nearer the sea. Finally, during the late

dry season, all grazing is based on shallow wells immediately landward of the coastal beaches.

METHODS

The coastal plain vegetation was surveyed within Ceel Dheer District. Land system unit number 72 of RMR (1979) was used as the initial sampling stratum. Field checks indicated the inland boundary of the coastal plain grassland (land system unit number 72 of RMR, 1979) should be moved up to 6 km eastward in the southern half of the District. This reflected the occurrence of a narrow transition zone of low shrub grassland between the coastal grasslands and dense interior shrubland vegetation. This vegetative community apparently did not appear on the LANDSAT satelite imagery used by RMR to deliniate land system units (Fig. 2).

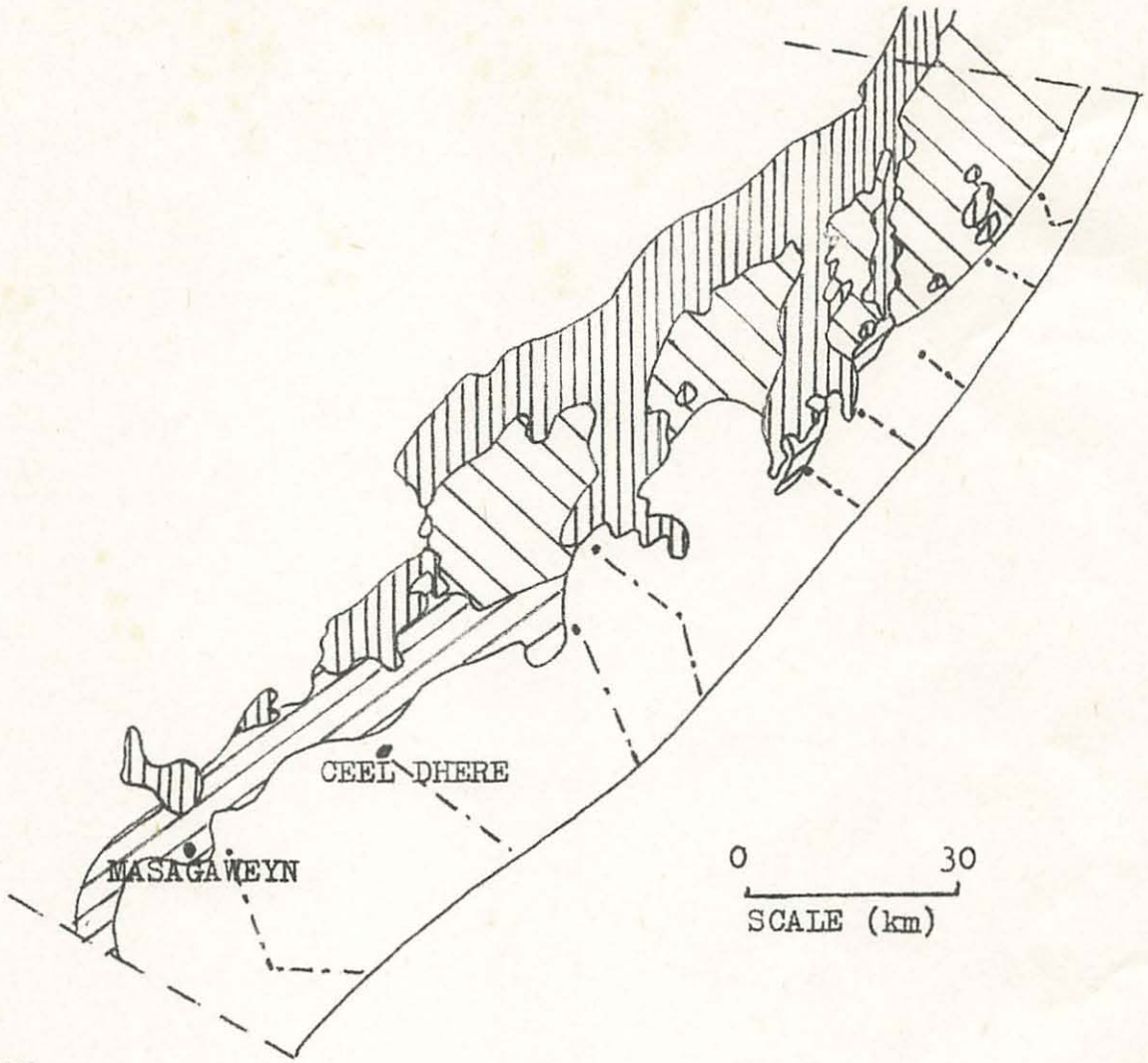
The steeper western half of the coastal grasslands north of Ceel Dheer Village was deliniated as a distinct range site based on its characteristic physiographic, edaphic and vegetative features (Fig. 2).

Sample plots were systematically placed about 2 km apart along routes extending from the edge of the shrubland to the sea. These in turn were spaced about 20 km apart. However, route location and placement of sample plots were often influenced by degree of accessibility (Fig. 2).

Sample plots were 10 meter long measuring tapes laid flat on the surface of the ground at right angles to the direction of travel from shrubland to sea. Litter and plant species vegetal basal cover were determined at 1,000 points along the tape. Points were formed by the junction of each cm graduation mark with the right edge of the tape. These were viewed from above to determine whether they fell on vegetation, litter or bare ground. The same method was used at every second or third plot to measure foliage (aerial) cover. Each plot was classified for range condition using the criteria of Naylor and Herlocker (1983). Two classification components were considered: soils and herb layer. Much of the necessary supporting information for the latter component was developed by this survey. This necessitated a final updating of plot range condition estimates at the end of the survey. Where necessary, the boundaries of the initial sample stratum (land system unit 72 of RMR, 1979) were corrected in the field.

Sixty five plots were used to sample and describe the static picture of the vegetation of the coastal plains grassland range site. The static picture simply reflected mean composition and structure of all plots. The dynamic picture of the the vegetation was sampled and described by relating plots to gradients of environmental impact. The gradients were inferred from 62 plots (stands) of vegetation showing differing relative degrees of vegetative utilization by livestock-which also reflected distance from permanent water-and from 79 plots (stands) of differing range condition as shown by the soil component.

Seventeen of the original plots could not be used to sample the grazing use gradient because they were located in the coastal area where wind erosion was active and dunes, dune tracks, depositional sand sheets and blow outs were abundant. This to the extent that relative degrees of use by livestock-if important-were not readily apparent. Therefore, these plots were not easily comparable with the others. Instead, fourteen additional plots were placed within the "heavy" and "very heavy" use catagories to obtain a better comparison between all catagories. All 79



= DUNE FIELDS

= GRASSLANDS ON FINE TEXTURE SAND SOILS OF THE RIDGE SLOPE

= SHRUB GRASSLAND, PART OF RMR (1972) LAND SITE UNIT 72

= COASTAL PLAIN GRASSLAND RANGE SITE

= SAMPLE ROUTES

Figure 2. Map of coastal plains grassland range site in the Ceel Dhere district.

plots were used to sample and describe the soil based range condition gradient.

RESULTS

Vegetation characteristics: static picture

Mean vegetation basal and foliage (aerial) cover were 4.7% and 19.5% respectively (Tables 1&2). Litter cover was 1.6%. Of the 21 plant species encountered, grasses were the most numerous (62% of all species) and comprised the most basal cover (49.4% of the total) (Table 3). Sedges and dwarf shrubs comprised 24.6% and 24% of total basal cover respectively, almost all of which were contributed by a single species each. In order of importance the dominant species were Indigofera intricata (dwarf shrub), Cyperus chorrdorhizus (sedge) and Cenchrus ciliaris (grass). These composed 23.2%, 19.7% and 13.1% of total basal cover respectively. Two other species, Panicum pinifolium and Leptothrium senegalense, were also important, constituting 7.9% and 7.3% of total basal area respectively. Forbs contributed little to basal cover and annual species were almost nonexistent. Only three species, all forbs, may have been annuals. (Table 1).

Other woody plants that meet the criteria of Pratt and Gwynne (1977) for dwarf shrubs but which are larger and woodier than Indigofera intricata also occur on the coastal plain. Only two species were recorded, Maytenus obbiadensis and Euphorbia cuneata, and these on only 15% of all plots. They amounted to a mean density of 418 plants/hectare and a canopy cover of 1.8% (Table 4).

Vegetation characteristics:dynamic picture

Relationship with distance from water/apparent use

Vegetation over 10 km from water showed little apparent use and had a definite coarse texture arising from a good mixture of grasses of all sizes and shapes including large bunch grass tussocks. This indicated light grazing. Between 3 and 10 km from water the vegetation was still dense but showed less texture and was generally shorter indicating moderate grazing. From about 0.5 to 3 km from water, grasses were short and all of a similar size. The appearance of the vegetation was, therefore, textureless and lawnlike. This implied heavy utilization yet little soil erosion was apparent. Within 0.5 km of water, the original vegetative cover was largely lost, wind erosion had lowered the soil level by up to a meter in depth and the dominant aspect was that of white sand. This was the very heavy use catagory. However, the relationship between use catagory and distance from water varies with the size and use made of the water source. The larger and more used the source the greater the area of heavily utilized rangeland to be expected around it.

Comparison of the four catagories showed the following patterns. Both vegetative basal cover and litter cover were negatively related to intensity of grazing. Vegetative basal cover and litter cover ranged from 1.1% and 1.4% respectively in very heavy use areas to 6.3% and 2.9% respectively in light use areas (Table 5). Range condition (based on soil

Table 1. Actual basal cover and relative basal cover of plant species on the coastal plains range site.

Species	Life Form	Basal Cover (%)	Relative Basal Cover (%)
Indigofera intricata	DS[1]	1.08	23.2
Cyperus chordorrhizus	S	0.92	19.7
Cenchrus ciliaris	G	0.61	13.1
Panicum pinifolium	G	0.37	7.9
Leptothrium senegalense	G	0.34	7.3
Unknown sedge	S	0.23	4.9
Aristida kelleri	G	0.21	4.5
Heteropogon contortus	G	0.19	4.1
Afrotrichloris martinii	G	0.17	3.6
Digitaria nodosa	G	0.17	3.6
Aristida sp.	G	0.08	1.7
Two unknown forbs	F	0.08	1.7
Cymbopogon commutatis	G	0.07	1.5
Enneapogon schimperianus	G	0.05	1.1
Two unknown dwarf shrubs	DS	0.03	0.6
Coelachryum stoloniferum	G	0.02	0.4
Unknown grass species	G	0.02	0.4
Sporobolus brockmanii	G	0.01	0.2
Unknown succulent	DS	0.01	0.2
Total Vegetative Basal Cover		4.66	99.7
Litter Basal Cover		1.64	
Total Basal Cover		6.30	

[1] DS = Dwarf shrub, S = Sedge, G = Grass, F = Forb.

Table 2. Relationship between basal cover and foliar cover by range condition class.

Condition Class	No. Plots	Basal Cover (%)	Foliar Cover (%)	$\frac{BC}{FC} \times 100$
GOOD	4	7.7	25.1	30.7
FAIR	17	2.0	10.0	20.0
POOR	9	1.4	5.9	23.7
MEAN		2.6	10.8	24.1

Table 3. Contribution of different life forms in terms of percentage of total number of plant species and percentage of relative basal cover.

Life Form	No. of Species	Total Species (%)	Relative Basal Cover (%)
Grasses	13	61.9	49.4
Sedges	2	9.5	24.6
Forbs	2	9.5	1.7
Dwarf shrubs	4	19.0	24.0
Total	21	99.9	99.7

Table 4. Density and canopy cover of distinctly woody dwarf shrubs.

Species	Density (Plants/ha)	Total Species (%)	Canopy Cover (%)	Relative Canopy Cover (%)
Euphorbia cuneata	51	12.2	0.02	1.1
Maytenus obbiadensis	367	87.8	1.78	98.9
Total	418	100.0	1.80	100.0

Table 5. Species composition (relative basal cover) of vegetation under different degrees of grazing use.

Use Catagory	Light	Medium	Heavy	Very Heavy	Coastal[1] Plots
No. of Plots	7	40	8	7	17
Heteropogon contortus	27.6				
Cyperus chordorrhizus	17.4	14.3	7.8	12.5	51.5
Aristida Kelleri	14.1	3.4	0.4		
Panicum pinifolium	10.9	8.3	6.3	3.6	11.1
Indigofera intricata	9.7	29.5	13.3		1.8
Cenchrus ciliaris	9.0	13.6	35.9	38.3	12.0
Leptothrium senegalense	5.2	8.0	16.7	2.7	Tr[2]
Unknown sedge	0.5	5.6	1.8	2.7	5.3
Coelachryum stoloniferum	3.6	0.5			
Afrotrichloris martinii	1.1	4.7	1.5		
Aristida sp.	0.6	2.2			
Digitaria nodosa		4.9	1.8	0.9	1.3
Enneapogon schimperianus		1.4			
Unknown dwarf shrub		0.7	0.7		1.3
Cymbopogon commutatis		0.4			10.2
Unknown forb		2.2	7.8		
Sporobolus brockmanii		0.2			
Heliotropium sp.			0.4	2.7	
Pavonia sp.			0.4		
Jatropa obbiadensis			1.5		
Panicum coloratum			0.7		
Brachiaria ovalis			0.4	21.4	
Tephrosia sp.			0.7	2.7	
Unknown dwarf shrub			1.9		1.7
Unknown grass				0.9	3.6
Cynodon dactylon				11.6	
Unknown forb		Tr			Tr
Lencas sp.		Tr			
Total	99.7	99.9	100.0	100.0	99.8
Basal Cover (%)	6.3	5.5	2.7	1.1	2.2
Litter Basal Cover (%)	2.9	1.8	1.6	1.4	0.6

[1] Coastal plots (located in a several hundred meter wide strip along the ocean beach) are in a distinctly different habitat type and are included here for comparison purposes only.

[2] Tr = Trace amount.

criteria only) also improved as grazing intensity decreased. However, the wide spread of different range condition classes, particularly within the "heavy" and "very heavy" use catagories, shows the relationship to be rather loose (Table 6).

Grasses dominated all catagories but were least important (relatively) in the "moderate" use catagory. Sedges were least important in the "heavy" use catagory. forbs were absent from "light" use and most important in "heavy" use catagories. Dwarf shrubs were most important in "moderate" use catagory and absent from "very heavy" use catagory. However, If Indigofera intricata is ignored, then dwarf shrubs are most important in the "heavy" use catagory (Table 7).

Heteropogon contortus, Cyperus chordorrhizus and Aristida Kelleri dominated lightly grazed areas; Indigofera intricata, Cyperus chordorrhizus and Cenchrus ciliaris dominated moderately grazed areas; Cenchrus ciliaris, Leptothrium senegalense and Indigofera intricata dominated heavily grazed areas and Cenchrus ciliaris, Brachiaria ovalis, Cyperus chordorrhizus and Cynodon dactylon dominated very heavily grazed areas (Table 8).

The grass species Heteropogon contortus, Coelachryum stoloniferum, Aristida Kelleri, Panicum pinifolium and Digitaria nodosa all decreased in importance as grazing pressure increased. Persistance increased in order of occurrence except, possibly for Digitaria nodosa, which was not recorded in lightly grazed areas (Table 5).

Indigofera intricata, a dwarf shrub, and the grass species Afrotrichloris martinii and Leptothrium senegalense increased at first under grazing pressure but then decreased. Leptothrium reached its greatest importance under greater grazing pressure and persisted longer than the other two species.

Heliotropium sp., Brachiaria ovalis, Tephrosia sp. and Cynodon dactylon were invaders on sacrifice areas but were very scarce elsewhere.

Cyperus chordorrhizus appeared to respond as a decreaser except that it suddenly increased in sacrifice areas. On the other hand, Cenchrus ciliaris looked like an invader. The remaining patterns were considered too unreliable to warrant further comment without additional sampling (Table 5).

Relationship with soil-based range condition

Plots were then regrouped and compared on the basis of range condition. Range condition was based on soil rather than vegetative factors to avoid circular reasoning. Plots from the coastal area were included in this comparison because each had been given a range condition classification at the time of measurement.

Basal cover was positively related to range condition (soils). It ranged from 0.36% in very poor condition areas to 7.0% in good condition areas. Litter cover was greater in very poor condition than in poor condition areas (1.0% and 0.3% respectively) but otherwise increased as range condition increased (up to 2.7% in good condition areas) (Table 9).

Grasses were most abundant on good condition rangelands and least abundant on very poor range condition areas wheras sedges (Cyperus chordorrhizus) became increasingly important as range condition decreased (Table 10). Forbs were most important in very poor range condition areas. Dwarf shrubs (primarily Indigofera intricata) were most important in good and fair range condition areas and were absent in very poor condition

Table 6. Percentage of total number of plots in each grazing use class by range condition class.

Range Condition Class	USE CLASS			
	Light	Medium	Heavy	Very Heavy
Good	57.1	45.0	12.5	14.3
Fair	42.9	50.0	25.0	14.3
Poor		5.0	50.0	28.6
Very Poor			12.5	42.9

Table 7. Contribution of each growth form to vegetation in different grazing use catagories in terms of relative basal cover (%).

Growth Form	GRAZING USE			
	Light	Medium	Heavy	Very Heavy
Grass	72.1	47.6	63.7	79.4
Sedge	17.9	19.9	9.6	15.2
Forb	Tr	2.2	9.3	5.4
Dwarf Shrub	9.7 (Tr)[1]	30.2 (0.7)	17.4 (4.1)	Tr (Tr)
Total	99.7	99.9	100.0	100.0

[1] Data in parentheses show relative basal cover of dwarf shrubs other than Indigofera intricata. Tr = Trace.

Table 8. Plant species dominating grazing use classes () 10% relative basal cover).

Species	GRAZING USE			
	Light	Medium	Heavy	Very Heavy
Heteropogon contortus	X			
Cyperus chordorrhizus	X	X		X
Aristida kelleri	X			
Panicum pinifolium	X			
Indigofera intricata		X	X	
Cenchrus ciliaris		X	X	X
Leptothrium senegalense			X	
Brachiaria ovalis				X
Cynodon dactylon				X

Table 9. Relative basal cover (%) of each species within soil based range condition classes.

Species	RANGE CONDITION CLASS			
	Good	Fair	Poor	Very Poor
Heteropogon contortus	3.0	4.9		
Leptothrium senegalense	11.1	4.9	3.1	
Aristida kelleri	3.6	4.9	6.8	
Cyperus chordorrhizus	8.6	28.9	25.1	55.5
Unknown sedge	10.9	0.8	14.9	
Cenchrus ciliaris	14.6	8.6	30.9	19.4
Eragrostis sp.	0.4	0.5		
Indigofera intricata	20.7	23.5	3.7	
Afrotrichloris martinii	3.7	3.2	1.6	
Aristida sp.	5.1	0.5		
Panicum pinifolium	9.9	7.3	1.0	
Four unknown forbs	2.1	2.2		
Digitaria nodosa	4.6	2.2	2.1	
Tephrosia sp.	0.1	Tr[1]		
Unknown dwarf shrub		1.1	4.2	
Pavonia sp.			0.5	
Jatropa obbiadensis			1.6	
Panicum coloratum	0.1		1.0	
Brachiaria ovalis			3.7	5.6
Heliotropium sp.				5.6
Cynodon dactylon		0.5		13.9
Unknown succulent		0.5		
Cymbopogon commutatus		3.5		
Enneapogon schimperianus	1.0	0.8		
Coelachryum stoloniferum	0.4	0.5		
Sporobolus brockmani		0.5		
Unknown grass	Tr	Tr		
Limmonium sp.		Tr		
Total	99.9	99.8	100.2	100.0
Total Plant Basal Cover (%)	7.0	3.7	1.9	0.4
Litter Basal Cover (%)	2.7	1.1	0.3	1.0

[1] Tr = Trace.

Table 10. Contributions of each growth form to vegetation in different soil based range condition classes in terms of relative basal cover.

Growth Form	SOIL BASED CONDITION CLASS			
	Good	Fair	Poor	Very Poor
Grass	57.5	42.8	50.2	38.9
Sedge	19.5	29.7	39.8	55.5
Forb	2.2	2.2	0.5	5.6
Dwarf Shrub	20.7 (Tr)[1]	25.1 (1.6)	9.5 (5.8)	Tr (Tr)
Total	99.9	99.8	100.0	100.0

[1] Data in parentheses show relative basal cover of dwarf shrubs other than Indigofera intricata. Tr = Trace.

areas. If Indigofera is excluded, dwarf shrubs were most important in poor condition areas but were absent from both good and very poor condition areas.

Cenchrus ciliaris, Indigofera intricata and Leptothrium senegalense dominated good range condition areas; Indigofera intricata and Cyperus chordorrhizus dominated fair condition areas; Cenchrus ciliaris and Cyperus chordorrhizus dominated poor condition areas and Cenchrus ciliaris, Cynodon dactylon and Cyperus chordorrhizus dominated very poor range condition areas.

Leptothrium senegalense, Panicum pinifolium, Afrotrichloris martinii, Digitaria nodosa, Enneapogon schimperianus and the forb Tephrosia sp. all decreased in importance as range condition decreased (Table 9).

Heteropogon contortus, Indigofera intricata and Coelachryum stoloniferum at first increased in importance before decreasing again or disappearing entirely as range condition decreased.

Aristida Kelleri, Cyperus chordorrhizus, Brachiaria ovalis, Cynodon dactylon and the forb Heliotropium sp. acted as invaders. Aristida Kelleri invaded poor condition areas whereas the other species invaded and were most important on very poor condition areas. Heliotropium was present only on the latter areas (Table 9).

The patterns of Cenchrus ciliaris, Cymbopogon commutatis, Jatropa obbiadensis and an unidentified dwarf shrub species are less clear. The latter three species might be late invaders or invaders only on still relatively well vegetated sites.

Information from other sources

Because the results of the two approaches did not always agree and because neither way of relating plots to environmental gradients could be considered as superior, the results of both in terms of defining indicator species were compared with those of a recent enclosure study on coastal plain grassland at Ceel Dheer Village (Herlocker et al., 1986) and with my personal judgement based on four years field experience in the area (Table 12).

Indicator species

The results show perfect agreement on five species, acceptable agreement on nine species and considerable doubt about the remaining three species. Panicum pinifolium, Heteropogon contortus, and Afrotrichloris martinii are shown as decreasers; Indigofera intricata, Coelachryum stoloniferum, Leptothrium senegalense and Cenchrus ciliaris as increasers and Heliotropium sp., Brachiaria ovalis, Cynodon dactylon, Aristida Kelleri, Cyperus chordorrhizus, Jatropa obbiadensis and Cymbopogon commutatis as invaders. Digitaria nodosa, Enneapogon schimperianus and Tephrosia sp. are possible decreasers (Table 12).

Except for the final three, the above species were then incorporated as indicator species into the range condition classification guide developed by Naylor and Herlocker (1983). Range condition was reevaluate on all plots using these new vegetative criteria as well as the original soils criteria. The results are shown in Fig. 3 and Table 13.

Table 11. Plant species dominating soil based range condition classes.

Species	SOIL BASED CONDITION CLASS			
	Good	Fair	Poor	Very Poor
Cenchrus ciliaris	X		X	X
Indigofera intricata	X	X		
Leptothrium senegalense	X			
Cyperus chorrdorhizus		X	X	X
Cynodon dactylon				X

Table 12. Range condition indicator status of major plant species based on four different sources of information.

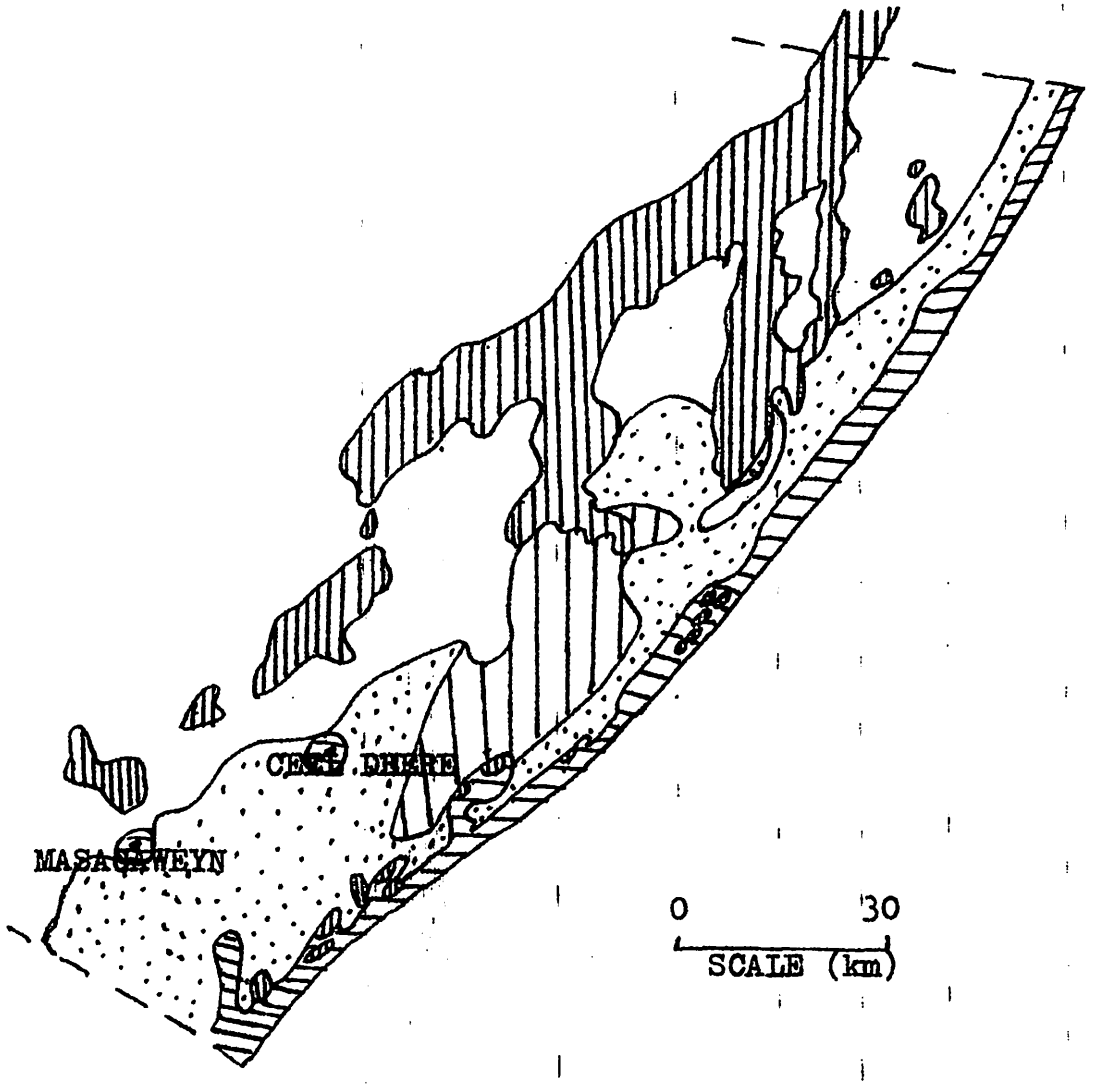
Species	SOURCE OF INFORMATION				
	Grazing Use	Condition Class	Enclosure Study	Personal Judgement	Final Status
Panicum pinifolium	D[1]	D	D	D	D
Indigofera intricata	Ic	Ic	Ic	Ic	Ic
Heliotropium sp.	Iv	Iv	Iv	Iv	Iv
Brachiaria ovalis	Iv	Iv	Iv	Iv	Iv
Cynodon dactylon	Iv	Iv	Iv	Iv	Iv
Heteropogon contortus	D	Ic	D	D	D
Coelachryum stoloniferum	D	Ic	Ic	Ic	Ic
Aristida Kelleri	D	Iv	D	Iv	Iv
Digitaria nodosa	Ic	D	Ic(?)	D	D(?)
Enneapogon schimperianus	Ic	D	D(?)	D(?)	D(?)
Leptothrium senegalense	Ic	D	Ic	Ic	Ic
Atrotrichloris martinii	Ic	D	D	D	D
Tephrosia sp.	Ic	D	D	(?)	D(?)
Cenchrus ciliaris	Iv	(?)	Ic(?)	Ic	Ic
Cyperus chordorrhizus	(?)	Iv	Iv	Iv	Iv
Jatropa obbiadensis	(?)	(?)	Iv	Iv	Iv
Cymbopogon commutatus	(?)	(?)	(?)	Iv	Iv

[1] Decreaser = D; Increaser = Ic; Invader = Iv; (?) indicates some doubt as to status.

Table 13. Species composition (relative basal cover) of condition classes for vegetation. Range condition is based on both soil and vegetative charateristics.

	CONDITION CLASS		
Species	Good	Fair	Poor
Indigofera intricata	23.2	27.4	2.3
Cenchrus ciliaris	22.2	6.8	11.3
Panicum pinifolium	11.8	8.7	5.4
Cyperus chordorrhizus	9.9	17.7	51.0
Leptothrium senegalense	9.8	8.4	1.6
Digitaria nodosa	7.1	2.6	
Heteropogon contortus	5.1	4.2	
Aristida kelleri	4.8	5.1	3.1
Unknown sedge	0.6	6.2	8.2
Afrotrichloris martinii	0.2	6.4	0.4
Cymbopogon commutatis		0.4	11.7
Eragrostis sp.	0.7	0.4	
Enneapogon schimperianus	2.6		0.4
Three unknown forbs	1.4		
Aristida sp.		3.1	
Unknown dwarf shrub		0.9	1.6
Coelachrum stoloniferum		0.7	1.2
Sporobolus brockmanii		0.4	
Leucas sp.		Tr[1]	
Total	99.4	99.4	98.2
Total Plant Basal Cover (%)	8.3	4.5	2.6
Total Litter Basal Cover (%)	2.4	1.9	0.3

[1] Tr = Trace.



= VERY POOR (DUNES)

= POOR

= FAIR

= GOOD

Figure 3. Range condition classes for a coastal plain grassland range site.

Range condition

most of the rangelands (83.2%) within the coastal plain grassland range site are in fair condition or better although a significant amount (16.8%) are also in poor or worse condition. Poor condition rangelands are situated adjacent to the coast or are centered on inland villages (Ceel Dheer and Masagaweyn). Good range condition areas are far from permanent water.

DISCUSSION

Comparison with Hobbio District

The results of this survey and that of Naylor and Jama (1984) show the same species to dominate coastal plain grassland in both districts. The major difference being in the relative importance of species in each district and in the high importance of Sporobolus ruspolianus in Hobbio District. Basal cover (13.0%) is also much greater in Hobbio than Ceel Dheer District (4.7%). Differences in relative importances between districts could be due to different amounts or combinations of successional stages of vegetation, resulting from differences in livestock grazing intensity, or to a more xeric climate in Hobbio District. The relatively drier climate in Hobbio District might also explain the importance there of Sporobolus ruspolianus compared with Ceel Dheer District. The high basal cover of vegetation in Hobbio District is difficult to explain except, perhaps, as a simple transposition error of basal for foliage cover.

Growth form/physiognomy

Despite the two most dominant plant species being a dwarf shrub (Indigofera intricata) and a sedge (Cyperus chordorrhizus), grasses were the most abundant growth form and provided the most basal cover over the entire coastal plain. Grasses also dominated all but one "livestock use" and range condition (soils) class, the exception being very poor range condition where sedges dominated. This resulted from a single species (Cyperus chordorrhizus) being the dominant or, often, the only pioneer invader species on deposits of wind blown sand.

The low importance of forbs and annual grasses is a phenomenon prevailing throughout the rest of the district in grasslands and shrublands alike. The relatively high (although low in absolute terms) importance of forbs in "heavy" use and very poor range condition areas probably reflects their generally low palatability and likely status as invaders in the early stages of succession.

Two types of woody plants were differentiated during the survey, although both were called dwarf shrubs following the classification of Pratt and Gwynne (1977). The first type, typified by Indigofera intricata, was borderline between a woody forb and a wholly woody dwarf shrub. Although eventually classed as a dwarf shrub, this species was small enough to appear as an integral part of the herbaceous layer. The second type of woody plant was entirely and definitely woody but seldom exceeded 0.7 meter in height and was often prostrate and spreading (as in the case of Maytenus obbiadensis) . Canopy cover provided by these

distinctly woody shrubs was only 1.8% (less than grassland basal cover). Thus, woody plants (large dwarf shrubs, shrubs and trees in this case) are not an important component of the coastal plains vegetation. It therefore appears that the coastal plains grasslands have been correctly named.

The Doum Palm (Hyphenae ventricosa) represents a third type of woody plant (shrub - low tree) which, although not recorded on the survey, sometimes appeared to be locally abundant. This species grows up to 3 - 4 meters in height and often forms open stands in the grassland that may be visible from some distance away. This makes it appear more abundant than it is.

Naturally occurring grasslands having only an insignificant woody component, are rare in Africa and are thought primarily to reflect edaphic factors that overide the otherwise prevailing influence of climate (Michelmore, 1939; White, 1962; Langlands, 1967; Vesey-FitzGerald, 1970; 1973; Jackson, 1978). The position of the coastal plain grassland within the landscape (i.e., a narrow low lying level strip of grassland with abrupt transition to the sea on one side and, for most of its length, a similarly abrupt vegetative transition to a densely shrubbed ridge on the other) certainly implies a strong topographic, geologic, edaphic or sea related influence for its grassland vegetative character.

The little soils information available shows no obvious edaphic obstacles to the growth of woody vegetation (Frye and Hussein, unpublished data). RMR (1979) has suggested high winds as a major factor shaping the vegetation and, in fact, UNSO (1984) show that winds may attain 30 Km/hr over a period of 4 months during the major dry season. However, at present, there is insufficient information available on the environment of coastal plains grassland to justify any more than speculation.

Although the shrub Solanum arundo is abundant within the village, Tables 7 and 10 imply that woody plants apparently do not survive, either as relicts or as invaders on very heavily used, very poor range condition areas. These areas have lost their original vegetative cover and are subject to intensive wind erosion both in terms of removal and deposition. The more woody species (excluding Indigofera intricata) do invade heavily grazed but well vegetated areas and this might eventually lead to significant invasions of woody vegetation on overgrazed coastal plains grassland. As heavy use of the area around Ceel Dheer Village probably dates from 40-50 years ago when most of the 12 or more wells were dug there (Holt, pers. comm.), invasion by woody species may, in fact, be a slow process but still one requiring further study because once established, they may become difficult to eradicate.

Environmental relationships

Neither of the two methods of relating plots to perceived or implied gradients of "environmental impact" was superior to the other. Plots were related to the "degree of use by livestock" gradient by being grouped within areas of rangeland showing apparently differing degrees of "use". Plots were not classified on the basis of their individual characteristics These plots were also relatively few and not completely representative of the entire coastal plain because they did not include plots from the highly wind eroded coastal edge. The latter could not be included because the degree of use by livestock - if any - was obscured by wind erosion.

Range condition based on soil characteristics allowed all plots to be related together against the same gradient, i.e., a more inclusive gradient formed by "environmental impact", which included the effects of both grazing and wind erosion. It was understood that the latter may also result, at least in part, from the former. This approach had the largest sample size, was most representative of conditions prevailing on the

coastal plain, and also included individual range condition estimates for each plot. Range condition was based entirely on soil characteristics (Naylor and Herlocker, 1983) to exclude circular reasoning resulting from the close relationship between vegetation and range condition (Dyksterhuis, 1949; Humphrey, 1962).

These are all positive points. However, soil characteristics, although the ultimate manifestation of poor range condition (Ellison et al., 1951), respond more conservatively to environmental change than do those of vegetation (Wilson and Tupper, 1981) and, as a result, are not particularly sensitive indicators of range condition. Therefore, in order to get the best possible grasp of the relationship between coastal plains vegetation and environmental impact (disturbance) or, in other words, of its successional status, the results of the two approaches above were compared with other sources of information. One was the result of two years protection of heavily grazed mid-fair range condition grassland by a small fenced exclosure near Ceel Dheer (Herlocker et al., 1986). The other was my personal judgement based on four years field experience on the coastal plain.

Dynamic vegetational patterns

Compositional patterns of coastal plain grassland vegetation are neither uniform nor static. The major factors influencing vegetational patterns are grazing by livestock and wind erosion. The decreasing influence of grazing on vegetation composition and structure with increasing distance from water is clearly shown by increasing vegetative and (usually) litter cover and, except for the immediate vicinity of wells, increasing plant height and physiognomic texture (roughness) of the vegetation.

Physiognomic texture, which was assessed occularly, results from increasing amounts of large bunch grasses. Changes in relative importance of plant species with distance from water also reflects the differential impact of grazing. Clearly then, grazing is not uniformly distributed throughout the coastal plain grassland and this was reflected in the composition and structure of the vegetation.

Dynamic patterns of vegetation in space and time are also implied by the distinct changes in plant composition and structure between different soil based range condition classes. This reflects the effects of both grazing and wind erosion although wind erosion may also be, to some extent, the result of overgrazing. However, whether and to what extent this is true is unknown.

The specific influence on vegetation patterns by wind erosion is less clear because it was studied in less detail. It was not distinguished from that of grazing on an individual plot basis. However, its influence can be inferred by the somewhat different vegetative patterns demonstrated by the two different methods of plot comparisons (grazing use and soil based range condition) throughout the coastal plains (Tables 5 & 9). Although wind erosion activity is most abundant near the coast (mobile sand dunes, dune tracks, depositional arms and blow outs, both presently mobile and recently stabilized), it is also very evident in many places across the coastal plain to the bushland edge, primarily in the form of elongated deposits of wind blown sand. Most of these are now stabilized by pioneer plant species such as Cyperus chordorrhizus and, in some cases, Aristida kelleri (Figure 4).

Although none were sampled during this survey, additional compositional variation is undoubtedly contributed by vegetation of the many small semi-permanent (seasonally used) nomadic hut sites scattered across the coastal plain. This appears to be distinct from that of the surrounding vegetation, probably reflecting the inputs of urine and feces

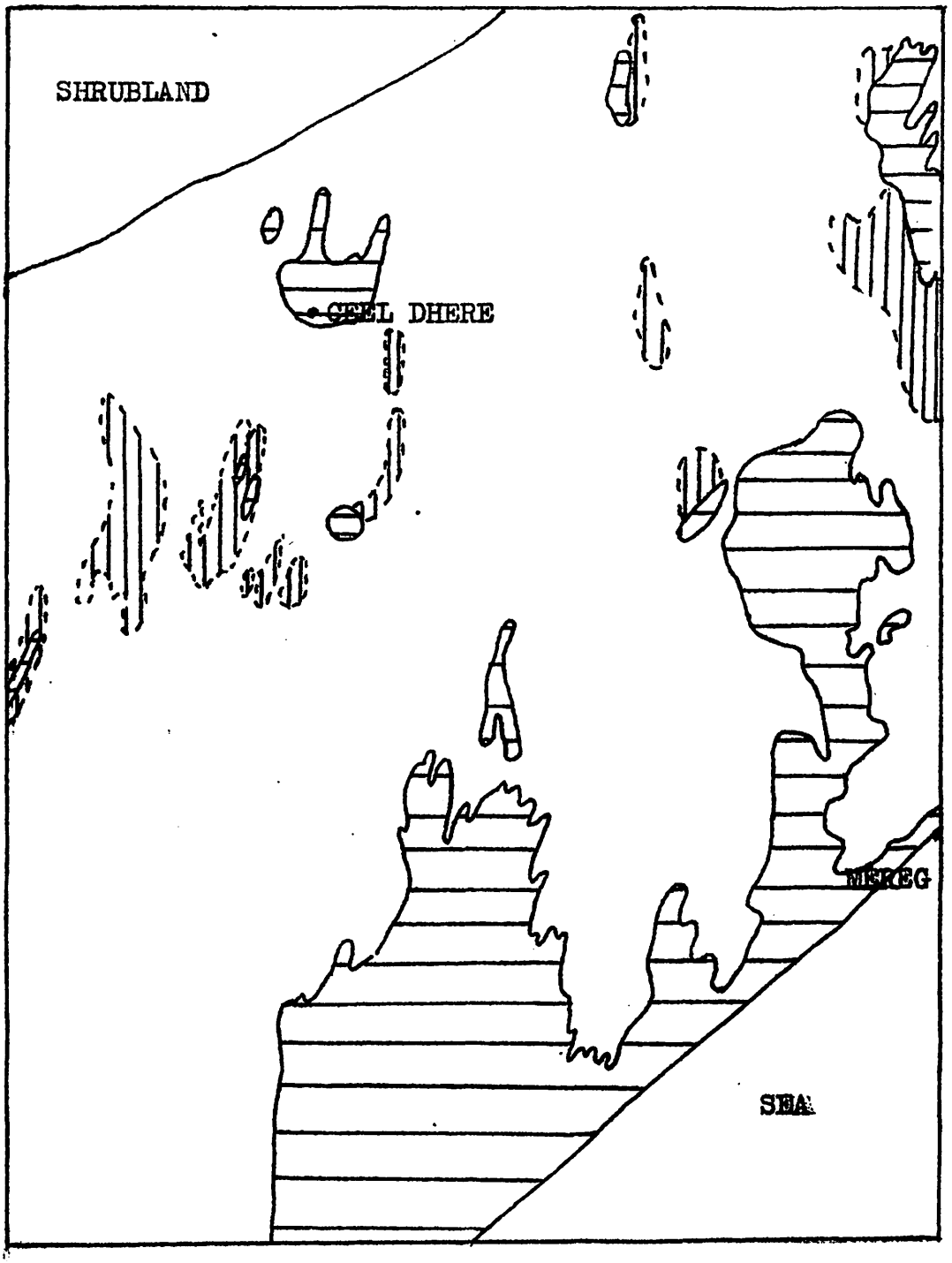


Figure 4. Areas of active wind erosion and stabilized sites of past erosion on a section of the coastal plain grassland.

from herds of livestock bedded around nomadic huts at night.

The dynamic patterns of vegetation, whether spatial or temporal, are expressed more clearly in terms of relative cover of species than by actual species dominance. For example, the only species dominant within a single "livestock use" or range condition class were Heteropogon contortus and Panicum pinifolium (light use); Brachiaria ovalis (very heavy use) and Cynodon dactylon (very heavy use and very poor range condtion). In particular, Cenchrus ciliaris, Cypress chordorrhizus and Indigofera intricata tend to dominate, depending on the classification, two to three catagories of livestock use or range condition each. This simply points out the dominant position of these plant species within the coastal plains grassland as a whole.

Dynamic patterns are more clearly expressed in terms of relative importance (% total basal cover) of individual species. These patterns are most evident when individual plant species are viewed in terms of those that decrease from light to heavy use and from good to poorer condition (decreasers); those that increase at first but then event-ually decrease (increasers) and those that become important in heavier use and poorer condition areas (invaders) (Dysterhuis, 1949). A few of these indicator species require further comment.

Decreaser species

Panicum pinifolium is the only decreaser species about which the original two types of classification agreed. However, this palatable grass species (Herlocker and Kuchar, 1986) can also be strongly stoloniferous and has used this capability to quickly increase in cover when heavily grazed grassland has been fenced (Herlocker et al., 1986). It is also a strong dominant/codominant with Cyperus chordorrhizus in a narrow (few hundred meters wide) strip of fairly open sandy soil immediately adjacent to the coastal beach. It gives the impression here of being in a distinctly early successional stage of vegetation. Possibly there is also some influence here of wind blown salt from the sea as was commented on by Hemming (1972).

Heteropogon contortus is abundant in range sites adjacent to coastal plains grassland and is most abundant within the latter range site near the grassland/shrubland boundary. Therefore, its occurrence may reflect a transistional gradient of some kind across range site boundaries rather than a true decreaser status for the range site as a whole. The other species noted as probable or possible decreasers composed too small a proportion of the sample to allow much discussion.

Increasers

Cenchrus ciliaris, considered to be highly palatable on the coastal plains (Herlocker and Kuchar, 1986), has been difficult to catagorize. This is probably at least partly because it seems to act as a very late increaser. Cenchrus ciliaris is a very robust species apparently able to withstand not only heavy grazing but also some deposition of wind blown sand. It is the very last species of original stands of coastal plain grassland to be killed out by deposits of wind blown sand arising from blowouts or approaching mobile barchan dunes. This makes it appear as an invader in the tabular data.

Invaders

The above ground shoots of Cyperus chordorrhizus arise from a deep rhizome, which may extend for several meters or more. This allows this sedge, which is highly palatable to sheep (Herlocker and Kuchar, 1986) to pioneer on bare sand and to keep abreast of continuously growing deposits of wind deposited sands. Cyperus chordorrhizus is a particularly active invader of such areas.

Most wind movement of sand takes place near the coast but numerous depositional arms have also extended clear across the plains to the shrubland edge in recent times (Fig. 4). This is why Cyperus chordorrhizus showed up most clearly as an invader when all plots were compared on the basis of soil based range condition. These plots included 17 plots from near the coast where wind erosion was active. It is for this same reason that this species appears to be much more important in the very poor range condition class (soils) than in the heavily grazed "use " class. The latter areas tend to be sources of wind blown sand around villages rather than areas of deposition. The relatively high importance of Cyperus chordorrhizus in the lightly and moderately grazed "use" and fair to good range condtion (soils) catagories may reflect simple persist-ance once it has become established on depositional sand sheets within otherwise lightly grazed areas.

Aristida Kelleri, a bunch grass of low palatability (Herlocker and Kuchar, 1986), shows up as either a decreaser (use catagories) or invader (soil based range condition). The confusion may be explainable by the following: (a) it is an invader, although not so active as is Cyperus chordorrhizus, on newly deposited sands arising from blow outs and mobile barchan dunes; (b) it is then probably able to persist in the face of competition with other plant species but (c) cannot tolerate heavy, or possibly even moderate, grazing and will dissapear when so grazed, even though of low palatability, close to water. Another perennial Aristida species appears to act in the same manner within the shrubland area of the district. Hemming (1973) notes that Aristida Kelleri also occurs on overgrazed rangelands in northern Somalia.

A few species were restricted to certain localities within the coastal plain. Cynodon dactylon, Brachiaria ovalis, which are palatable and Heliotropium sp., which is of low palatability, (Herlocker and Kuchar, 1986) occurred only on heavily grazed (sacrifice) areas around wells. Cynodon and Heliotropium also were often abundant on hut sites scattered about the plain which were regularly used on a seasonal basis by local nomads. The vegetation of these hut sites differed distinctly in composition from adjacent vegetation, probably reflecting accumulated urine and feces of livestock kept there overnight.

Cymbopogon commutatis appears most abundant on relatively bare sandy areas of old dune tracks. Jatropa obbiadensis appears to invade heavily grazed grasslands that still retain most of their vegetational coherence. It is unpalatable (Herlocker and Kuchar, 1986).

Range condition based on both soil and vegetative features

Range condition appears to be related to distance from permanent water. Good range condition occurs far from water and poor range condition is centered on permanent water points such as villages and the

numerous shallow wells along the coast. Very poor range condition areas are mobile sand dunes that have formed within the larger areas of poor condition. Poor condition around villages has resulted from overgrazing by livestock. Poor condition areas near the coast probably result from combination of a natural ongoing geomorphological process (high winds blowing beach sands inland) and overgrazing around coastal wells. In th southern half of Ceel Dheer District mobile dunes have extend ed the arm of poor range condition deep into otherwise fair and even good condition rangeland.

CONCLUSIONS

Coastal plains vegetation is truely grassland although it is dominated by Indigofera intricata (dwarf shrub), Cyperus chordorrhizus (sedge) as well as Cenchrus ciliaris (grass). Woody plants are unimportant. Basal cover is 4.7%, foliage cover 21.1%, litter cover 1.6 and shrub canopy cover 1.8%.

Compositionally and structurally, the vegetation is neither uniform nor static but reflects different levels of grazing and, in some areas, combination of grazing and naturally induced wind erosion (blow outs, sa dunes etc.). Variation is also added by the distinctly different vegeta tion composition of the many seasonally occupied hut sites scattered across the coastal plain.

The compositional and structural response of coastal plains vegetation to livestock use and to soil degredation implies vegetational successional patterns useful in identifying plant indicators of range condition. Plant species decreasing in importance as grazing pressure increases (decreasers) are: Panicum pinifolium, Heteropogon contortus ar Afrotrichloris martini. Species that first increase but eventually decrease (increasers) are Indigofera intricata, Coelachryum stoloniferum Leptothrium senegalense and Cenchrus ciliaris. Species that invade heavily grazed areas (invaders) are Heliotropium sp., Brachiaria ovalis, Cynodon dactylon, Aristida kelleri, Cyperus chordorrhizus, Jatropa obbiadensis and Cymbopogon commutatis.

Use of these indicator species within the context of the range condition classification guide of Naylor and Herlocker (1983) showed tha most of the coastal plains vegetation was in fair condition but that the were also significant amounts of good and poor condition vegetation. Range condition primarily reflects distance from water (intensity of grazing).

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A GLOSSARY OF SOMALI IDENTIFICATION TERMS FOR WILDLIFE AND LIVESTOCK

T.L. Thurow, A.J. Hussein, and M.A. Ahmed

When conducting field studies it is often very helpful to know the native terminology. Such basic knowledge can be used to avoid confusion and to focus interviews on the specific subject of interest. This text provides lists of terms used for identification of mammal and bird wildlife species and a list of basic terms used for livestock.

The interest (and hence the descriptive terminology) of a Somali nomad or agriculturalist depends to a large degree on the animals practical usefulness. For example, the camel has many descriptive terms which classify various stages of development and condition but there is little interest in naming passerine birds (except those which damage crops). The consistancy of terms among individuals is also a function of practical usefulness and/or conspicuousness of the species. For example, the names which describe livestock or different species of gazelles, predators or other large mammals remain fairly consistent throughout Somalia. However for many species of wildlife the names vary between regions or even between individuals in the same region. The Somali names provided in the following tables are those which seem to have the most widespread use in central Somalia.

Table 1. List of scientific, English and Somali names for the families of mammals found in Somalia.

ORDER SUBORDER	FAMILY	ENGLISH NAME	SOMALI NAME
Insectivora	Erinaceidae	Hedgehogs	Kulley-calibanjar
	Soricidae	Shrews	Tik
	Macroscelididae	Elephant Shrews	Walosandher
Chiroptera			
Megachiroptera	Pteropodidae	Mostly Fruit Bats	
Microchiroptera	Emballonuridae	Insectivorous Bats	
	Nycteridae	Insectivorous Bats	Fiidneer
	Rhinolophidae	Nectar Eating Bats	
	Vespertilionidae	Vespertilionid Bats	
	Molossidae	Free-tailed Bats	
Primates			
Prosimii	Lorisidae	Lorises	Gumbo, Ghettris
Anthropoidea	Cercopithecidae	Old World Monkeys	Koro, Daanyeer
	Hominidae	Man	Aadni
Tubulidentata	Orycteropodidiae	Aardvark	Saddex-suulley, Guarandi
Lagomorpha	Leporidae	Rabbits	Bakayle

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Table 1 (continued).

ORDER	FAMILY SUBFAMILY	ENGLISH NAME	SOMALI NAME
Rodentia	Sciuridae	Squirrels	Dabagaale
	Cricetidae	Cricetid Mice/Rats	
	Muridae	Murid Mice/Rats	Jiir/Dooli
	Dipodidae	Dipodid Mice/Rats	
	Hystricidae	Porcupines	Kashiito, Caanoqub
	Thryonomyidae	Cane Rats	
	Bathyergidae	Mole Rats	Dooli
	Ctenodactylidae	Gundis	
Mysticeti	3 families	Baleen Whales	Nibiri
Odontoceti	7 families	Porpoises/Dolphins	Qulunquul
Carnivora	Canidae		
	Caninae	Jackels and Foxes	Dawaco
	Lycaoninae	Hunting Dogs	Yeyduur
	Otocyoninae	Bat-eared Foxes	Dawaco- Madaw
	Mustelidae		
	Mustelinae	Weasels	Dabacadeeye
	Mellivorinae	Ratels	Xoordubur
	Viverridae		
	Viverrinae	Genets	Mukulal, Zebad
	Herpestinae	Mongooses	Kadabshiir
	Protelidae	Aardwolf	Habahuf, Weer
	Hyaenidae	Hyaenas	Waaraba
	Felidae		
	Pantherinae	Big Cats	Shabeel, Libaax
	Acinonychinae	Cheetahs	Haarimacad
	Lyncinae	Caracals	Gududane
	Felinae	Smaller Cats	Mukulel
Proboscidea	Elephantidae	Elephant	Maroodi
Hyracoidea	Procaviidae	Hyraxes	Baoni
Perissodactyla	Equidae	Asses and Zebras	Guburi, Farow
	Rhinocerotidae	Rhinoceroses	Wiyil
Artiodactyla	Suidae	Pigs	Doofaar, Gomme
	Hippopotamidae	Hippopotamuses	Jeer
	Giraffidae	Giraffes	Geri
	Bovidae		
	Cephalophinae	Duikers	Sakaromuri
	Madoquinae	Dikdiks	Sakaaro
	Raphicerinae	Small Antelopes	Gonges
	Dorcatraginae	Beiras	Baira
	Oreotraginae	Klippspringer	Alakud
	Tragelaphinae	Bushbucks	Dool, Godir, Derdir
	Hippotraginae	Oryx	Bicid
	Reduncinae	Reedbuck/Waterbuck	Balanco
	Alcelaphinae	Hartebeestes	Herole, Siig
	Gazellinae	Gazelles	Deero, Cawl Gerenuk, Dibitag
	Bovinae	Buffalo	Gisi

Table 2. List of scientific, English and Somali names for the families of birds found in Somalia.

ORDER	FAMILY	ENGLISH NAME	SOMALI NAME	SPECIES IN SOMALIA [1]
Struthioniformes	Struthionidae	Ostrich	Goroyo	1
Podicipediformes	Podicipedidae	Grebes	Quuq-quuqle	1
Procellariiformes	Procellariidae	Petrels, Shearwaters	---[2]	5
	Hydrobatidae	Storm Petrels	---	1
Pelecaniformes	Phaethontidae	Tropicbirds	---	1
	Pelecanidae	Pelicans	Uburow	1
	Sulidae	Boobies	---	2
	Phalacrocoracidae	Cormorants	Malaay Saluug	3
	Anhingidae	Anhingas	Boolo-boolo	3
	Fregatidae	Frigatebirds	---	1
Ciconiiformes	Ardeidae	Herons, Egrets	Abooto-yaxaas	16
	Scopidae	Hamerkop	Aboodi	1
	Ciconiidae	Storks	Hantooli, Qumalaula	7
	Threskiornithidae	Ibises, Spoonbills	Bolon-boolo madow	6
	Phoenicopteridae	Flamingoes	Bolo-bolo quuto	2
Anseriformes	Anatidae	Ducks, Geese	Boorlab	15
Falconiformes	Sagittariidae	Secretary Bird	Dafo	1
	Accipitridae	Vultures, Hawks	Xuunsho	43
	Pandionidae	Osprey	Mallay quudato	1
	Falconidae	Falcons	Galay shimbir	12
Galliformes	Phasianidae	Quails, Francolins	Kabaraay	6
	Numididae	Guineafowl	Digiiran	3
Gruiformes	Turnicidae	Button Quail	Barbaar-guul	1
	Rallidae	Rails, Crakes	Xiid webi	11
	Heliornithidae	Finfoots	---	1
	Otididae	Bustards	Jugley	8
Charadriiformes	Jacanidae	Jacana	---	1
	Rostratulidae	Painted Snipe	Moolodhabe	1
	Haematopodidae	Oystercatchers	---	1
	Charadriidae	Plovers	Wiiro-wiiro	18
	Scolopacidae	Sandpipers, Snipes	Fiin	25
	Phalaropidae	Phalaropes	---	1
	Dromadidae	Crab Plover	---	1
	Burhinidae	Thicknees	Wiiro-wiiro dhibicley	3
	Glareolidae	Coursers, Pratincoles	Xiid-xiid	6
	Stercorariidae	Skuas	---	4
	Laridae	Gulls, Terns	Shimbir-badeed	25
	Rynchopidae	Skimmers	---	1
Columbiformes	Pteroclididae	Sandgrouse	Ceel-joog	4
	Columbidae	Pigeons, Doves	Qooley	16
Psittaciformes	Psittacidae	Parrots	Babqaa	2

[1] Species numbers are from Ash, J.S. and J.E. Miskell. 1983. Birds of Somalia -- their habitat status and distribution. English Press, Nairobi. 97 pp.

[2] --- = Somali name unknown or species are not differentiated and thus a name may be nonexistant.

Table 2 (continued).

ORDER	FAMILY	ENGLISH NAME	SOMALI NAME	SPECIES I SOMALIA
Cuculiformes	Musophagidae	Turacos	Dhoore	2
	Cuculidae	Cuckoos	Tunbuli	12
Strigiformes	Tytonidae	Barn Owl	Guumeys caddey	1
	Strigidae	Owls	Guumeys	9
Caprimulgiformes	Caprimulgidae	Nightjars	Dhulwas	10
Apodiformes	Apodidae	Swifts	Baal-fllaar	9
Coliiformes	Coliidae	Mousebirds	Cali food	3
Trogoniformes	Trogonidae	Trogon	Dacayow	1
Coraciiformes	Alcedinidae	Kingfishers	Webi jud	10
	Meropidae	Bee-eaters	Shiraay	8
	Coraciidae	Rollers	Canni-cani	5
	Upupidae	Hoopoe	Hud-hud	1
	Phoeniculidae	Wood Hoopoe	Sixiroole	3
	Bucerotidae	Hornbills	Quud-quuto	7
Piciformes	Capitonidae	Barbets	Shoklo	7
	Indicatoridae	Honeyguides	Habaasley	4
	Picidae	Woodpeckers	Dhow-dhowley	6
Passer	dae	Larks	Gebley	24
	Hirundinidae	Swallows	Baal-falaar	10
	Dicruridae	Drongos	---	2
	Oriolidae	Orioles	---	3
	Corvidae	Crows	Tuke	5
	Paridae	Tits	Habis	1
	Remizidae	Penduline Tits	---	1
	Timaliidae	Babblers	Qabxanbuli	4
	Campephagidae	Cuckoo Shrikes	---	1
	Pycnonotidae	Bulbuls	Wareey	7
	Turdidae	Thrushes	Tuke-cade	30
	Sylviidae	Warblers	Deewaad-caare	47
	Muscicapidae	Flycatchers	Daba-kurus	14
	Motacillidae	Wagtails, Pipits	Jirow	14
	Malaconotidae	Bush Shrikes	Dur tog	13
	Laniidae	Shrikes	Tog	9
	Prionopidae	Helmet Shrikes	---	4
	Sturnidae	Starlings	Gobta shimbirta	14
		Oxpeckers	Dhow dhowle	1
	Nectariniidae	Sunbirds	Fiido dhugato	13
	Zosteropidae	White-eye	---	1
	Ploceidae	Weavers	Cagarow	36
	Estrildidae	Waxbills	Malayka	13
	Fringillidae	Buntings, Canaries	---	10
			TOTAL	639

Table 3. List of Somali terms for classification of livestock (Xoolo). Note that although s... of the terms are spelled the same the inflection of different syllables makes a subtle differen... in the pronunciation.

ISHKIN (LARGE STOCK (CAMELS AND CATTLE))

GEEL (CAMEL)

MALES		FEMALES	
SOMALI TERM	ENGLISH MEANING	SOMALI TERM	ENGLISH MEANING
Qurbac	Newborn to 1 year old		
Nirig	1 to 2 years old	Nirig	Newborn to 2 years old
Qaalin	2 to 5 years old	Qaalin	2 to 5 years old
Awr	5 to 14 years old	Hal	5 to 14 years old
Baarqab	Breeder		
Dhufaan	Castrated (this term applies to all types of livestock)		
Koran	Castrated beast of burden		
Gool	Fattened castrate		
Raray	Beast of burden		
Duq	) 14 years old	Duq	) 14 years old
		Irmaan	Lactating
		Gaani	Not lactating
		Rimay	Pregnant
		Goloof	Not lactating, not pregnant
		Abeer	Infertile
		Kalddhal or Curad	Calved for first time
		Gabbaan	Late milking; close to dry
Horweyn	All adult camels	This distinction is made when spliting herds in the dry season and is based upon ability to travel.	
Aaran	Newborn to 3 years old		

LO (CATTLE)

MALES		FEMALES	
SOMALI TERM	ENGLISH MEANING	SOMALI TERM	ENGLISH MEANING
Weyl	Newborn to 1 year old	Weyl	Newborn to 1 year old
Dhaley	Newborn to 2 months old		
Saraar	2 months to 1 year old		
Qaalin	1 to 3 years old	Qaalin	1 to 3 years old
Dibi or Boor	) 3 years old	Sac	) 3 years old
Baqay	Castrated male	Maxan	Infertile
		Horway	Not lactating; ready to breed
		Curad	Calved for first time
		Badho or Gabno	Low milk producer

Table 3 (continued).

AHDI (SHEEP AND GOATS)

MAQAL (IMMATURE SHEEP AND GOATS)

IDO (SHEEP)

MALES		FEMALES	
SOMALI TERM	ENGLISH MEANING	SOMALI TERM	ENGLISH MEANING
Nayl	Newborn to 6 months old	Nayl	Newborn to 6 months old
Baraar	Weaned until 2 years old	Sabeen or Baraar	Weaned until bred
Wan	) 2 years old	Lax	) 2 years old
Sumal or Jamal	Breeder	Tebis	Not pregnant
Jar or Malooli	Castrated	Mardhal	Lambed for first time

RIYO (GOATS)

MALES		FEMALES	
SOMALI TERM	ENGLISH MEANING	SOMALI TERM	ENGLISH MEANING
Waxar	Newborn to 6 months old	Waxar	Newborn to 6 months old
Orgi	) 6 months old	Ceesan	6 months to 2 years old
Waaley	6 months to 2 years old	Ugub	1 to 2 years old
Jar	Castrated	Ri	) 2 years old
Goor	Breeding male	Tebis	Not pregnant

MARKET TERMS FOR SMALL STOCK (ADHI)

SOMALI TERM	ENGLISH MEANING
Ahmin	Young, fattened males (usually meant for overseas markets)
Dhaqad	Fertile females (usually sold to pastoralists for building their flock)
Daabaxad	Old or sick animals (usually sold for local meat consumption)