1988 – 1989

Ali, Hussein Mohamed 1988 ***Cordeauxia edulis: production and forage quality in central Somalia***. MSc, Oregon State Univ., 62p.

INTRO: Somalia is located in the arid and semi-arid region of northern east Africa. The entire country is within the tropics lying between 2° south to 11° north latitude and between 30° and 53° east longitude. Topography is mainly rolling hills but with highlands along the northwest section of the country. Surface water is a limited resource for the majority of the nation. There are two small permanent rivers in Somalia, the " Jubba" and "Shebeelle ", both running in the southern part of the country. The Jubba adds its water into the Indian Ocean while the Shebeelle ends in sand swamps near the ocean. There are a few streams called "Waadi" in the northern part of the country. These streams are dry except during the rainy seasons when they carry the excess runoff water from the highlands.

More than two-thirds of Somalia is rangeland and is used by nomadic pastoralists for grazing. These nomads have herds of camels, goats, sheep and cattle. Livestock production from native rangelands is the most important agricultural enterprise of the country (Box 1968).

The climate is dry and hot year-round. Precipitation is bimodal in which there are two wet and two dry seasons. Rainfall comes as closely spaced thunder storms. The2 amount of precipitation is unpredictable and long-term droughts are common. Dry seasons are usually longer than wet seasons for the majority of the country.

Dry seasons are limiting factors for livestock production in the nomadic pastoral economy because of forage scarcity and its poor quality for herbivores. Dry twigs and weathered grass are the only available forage through the dry season. For much of Somalia however, where evergreen shrubs occur they are important and valued for their nutritional quality even if not highly palatable.

Few species of evergreen shrubs exist on Somali rangelands, however one, Cordeauxia edulis (Yeheb or jicib), grows in Central Somalia in a habitat dominated by deciduous shrub species. Other evergreen plants exist such as Boscia, Cadaba and Maerua, however they never represent more than 2% of the canopy cover (Kuchar 1987). C. edulis may fulfill the primary criteria of quality dry season forage, being a regionally abundant, evergreen leguminous shrub. C. edulis is reported to be important as a forage plant, as a producer of seeds that are eaten by Somalis, and as an alleged medicinal plant (Kuchar et al. 1985). Seeds are harvested during each wet season.

Two growth forms of C. edulis exist. They are found mostly in distinct stands, although mixtures may occur. Both forms have similar characteristics and grow within3 the same general plant communities, though there are some differences.

International and national interest in C. edulis as a potential plant for cultivation has been steadily building. At present only wild populations exist, but these could be domesticated if the biology and regeneration requirements of the species were known. C. edulis is threatened with extinction from most of its habitat and deserves careful protection and detailed tests in

cultivation. There is little known about the biology, productivity or forage quality of C. edulis. The objectives of this study were to determine gross morphology, phenology, soil relationships, forage production, and forge quality of C. edulis.

Behnke, RH jr. 1988 ***Range enclosure in central Somalia*****.** ODI Pastoral Devel. Netw. Pap. 25b, 28p.

Important on privatization, and on CR/CRDP.

Bowen, M Roderick & Neil M Bird 1988 ***A partially annotated bibliography of forestry in Somalia***. Overseas Devel. Natural Resources Institute, ODA, Glasgow and NRA, Mogadishu, Somali For. Ser. 1, 176p.

'Forestry' is seriously misleading, though since the impetus and genesis for this vol is tree planting, even in semi-desert they like to call it forestry.

"The decline in the quality of all vegetation types throughout the country is a theme that runs through many papers from the early 1930s to date." Many reports emphasize the need for protection of forest & forest reserves, and prep and implementation of management plans for rehabilitating (formerly) treed areas, by afforestation with fast-growing, drought-hardy multiple-use species, promoting village forestry, programs to conserve treed land. There have been many tree growth trials, but more are called for, both for native and exotic species. A 1984 FAO study concluded that woodlot plantations have in general failed due to poor species choice and techniques and inadequate protection, with reluctance by villages to maintain communal plantings. Lack of basic records on past and present tree-promotion activities is cited as a major handicap in another 1984 FAO report.

An earlier example of similar emphasis on range management, recommending deferred or rotational grazing, was Lawrie JJ, 1960, The introduction of forestry and range management to the nomadic stock-rearing community in semi-arid Somaliland, Proc 5th World For. Congr., p363-365. Early attempt at range closure failed because of local opposition to what was seen as gov imposition, yet the graziers must continue to be told about the merits of such management till they themselves demand action.

Gums & resins (mainly frankincense) are no.3 export earner (1985: $2.8M), after livestock and bananas, though total trade in gum-resins may be considerably greater.

They note a scarcity of publications on tree planting, and their conclusion is as follows: Lack of trained local staff at all levels has handicapped and continues to limit efforts both to manage the natural forest lands and to plant trees. The future of plantation forestry within the country, either rainfed or irrigated, seems open to serious doubt. It is thus self-evident that more attention will have to be given to managing the existing rangelands to ensure an adequate, continued supply of charcoal and fuelwood - the primary energy sources of Somalia." *(Another reason for emphasis on range mgmt!)*

The veg has had only ltd investigation. Even today, many plant communities remain poorly studied. What little work there is, is largely confined to N Somalia and is 2 or more decades old.

Drechsel, P & W Zech 1988 ***Site conditions and nutrient status of Cordeauxia edulis (Caesalpiniaceae) in its natural habitat in central Somalia*.** Econ. Bot. 42: 242-249.

A thinly documented effort on yicib ecology but does give hard data on soil and leaf chemistry. Emphasis on soils, suggesting the kinds of soils yicib is restricted to and presenting a soil profile from near Mataban, with chemical analysis. Good data on leaf nutrient analyses and suggesting that these include the first data on mineral content.

Study area: Matabaan. Emphasizes that all reports indicate it only grows in the *haud*[*hawd*], a landscape of vivid red sandy soil of the Jesomma formation, of red sandstones and breccia. They state that the Haud is in the northeastern corner of Ethiopia; it is actually southeastern corner as per their map (Fig. 1). "Natural regeneration of the yeheb is restricted mainly to homogeneous deep red sands with high rainwater infiltration. Surface run-off is negligible. These areas have no incised drainage system, and nearly all the rainfall quickly percolates into deeper soil layers; losses due to evaporation remain low (Glover 1950; Hemming 1966; Watson et al. 1982)."

Mean rainfall <220 mm [wrong?] but generally >150 mm. Extremely skimpy description of vegetation.

In some areas hawd sands overlie limestone or gypsum (many refs), obscuring the precise boundary between sandstones and limestones (Mohr 1962). Other than these hawd sands (and unconfirmed references to yicib also on soils with traces of lime or gypsum), most cent. Somalia soils seem unsuitable, mostly having shallow calcareous or gypseous parent materials. Their map (Fig. 1) indicates 5 yeheb localities which they title recent Yeheb sites. I agree with 4 of them but not the one near Adawilif in C Somalia between Dusa Mareb and Galcayo, I have never heard of such a locality and suspect the soils are limestone-based like most of C Somalia except eastern Hiraan Region. I also do not agree that pillar termitaria occur in the hawd; in Hiraan Region I only saw them at the extreme E edge of the region where the sandy soil overlies very shallow limestones as in neighboring Galgaduud Region. (But pillar termitaria are reported from the main Haud that straddles Somaliland-Ogaden.)

Soil description from near Matabaan: typic torripsamments (USDA system) or rhodi-haplic arenosols (FAO), very weak ochric A and is noncalcareous, free of gypsum, & sandy; hues between 2.5YR and 10R of desert sands indicate almost complete dehydration of the iron-coatings to hematite; CEC extremely low (2.1 meq/100 g in A, to 3.8 in B_3), pH 7.3, salt-free (no chlorides or sulfates), poor fertility with (from A to B_3 horizons) total Ca 1.72-2.94 meq/100g, Mg 0.28-0.52, K 0.13-0.29, Na 0.01-0.03; available P 4.6-3.5 ppm, B 0.1-0.4(mixed) ppm, Cu 0.12-0.29 ppm, Fe 7.9-11.2(mixed) ppm, Zn 0.27-0.10 ppm, Mn 4.6-3.6(mixed) ppm; silt 1-2%, clay 7-9%.

Distinguish 2 'subspecies', small- and large-leaved, as suggested by Elmi Ahmed Nuur, NRA, Beledweyne. Separate chemical analyses for the two; note there are differences, but no

suggestion of significance. The nutritional value of foliage for livestock is discussed; it appears suboptimal compared to tropical legumes but energy-rich (5.6-5.85 MJ/kg DM).

Graham, Olivia 1988 ***Enclosure of the East African rangelands: recent trends and their impact***. ODI Pastoral Devel. Netw. Pap. 25a, 11p.

Important on privatization in rangeland, examples from Kenya & Somalia. Must see this if examining this issue. Also see biblio. (Note that there are plenty of papers on range privatization out there, it has become a substantial subset of range studies in ENE Africa. Also see Drysdale 2005 on a related issue, demarcating farm boundaries of former Somali refugees back from Ethiopia.)

Herlocker, Dennis J, Ahmed M Ahmed & Thomas L Thurow 1988a ***Response of vegetation of the Acacia nilotica/Dichrostachys kirkii shrubland range site to land use intensity, Ceel Dhere District, Somalia.*** Somali J. Range Sci. 3: 1-11.

Shrub [tree] & dS cover using circular 100 and 10 m^2 plots; ht & crown diam of each shrub. Herb layer along 10 m transect of 1000 pts at each site (I think this is leaf cover, not canopy cover). Subjective ratings to get to range condition. Plant strata & heights would be useful.

Nooleye is central in this CT which extends NE-SW subcoastally (40-50 km from the coast). Note that the A. reficiens-D. kirkii CT is basically SW from this CT, starting ± at Balcade and extending SW, also subcoastally.

<u>*Dichrostachys kirkii*</u> The dominant of shrub layer in *Acacia nilotica-D. kirkii* bushland and *Acacia reficiens-D. kirkii*bushland in C Som. Nooleye is central in the former CT which extends NE-SW subcoastally (40-50 km from the coast). The *A. reficiens* CT starts ± at Balcade and extends SW, also subcoastally. Both are on sandy soil which is deeper on the *A. nilotica-D. kirkii* type. In the *A. nilotica* CT, *Dichrostachys* shows a stable relative cover of c9-12% at a distance of 1 to >20 km from waterpoint. Its response is markedly different in the *A. reficiens* CT, where it peaks at c55% relative cover 5 km from waterpoint, beyond which a rapid decline. This difference probably reflects differing degrees of competition from *A. nilotica*.

<u>*Acacia horrida*</u> In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, gradually increases in relative cover with distance from waterpoint, peaking at c10% relative cover at 12 km from water

<u>*Acacia nilotica*</u> In Ceeldheer Dist, C Som, *A. nilotica-Dichrostachys kirkii* is an important bushland on sandy soil, extending NE and SW from Nooleye, subcoastally (40-50 km from the coast). *A. nilotica* rapidly increases in relative cover with distance from waterpoint, peaking at c35% relative cover at 7-12 km from water, then declining to almost nil at 23 km.

<u>*Acacia mellifera*</u> In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, very low cover within c7 km of waterpoint, then gradually increasing to c10% relative cover at 22 km. Rarer in *Acacia reficiens-Dichrostachys kirkii* bushland.

Acacia reficiens In southern Ceeldheer Dist in C Som and extending into Middle Shabelle Region, *A. reficiens-Dichrostachys kirkii* is an important bushland on sandy soil, subcoastally (40-60 km from coast). In bushland dominated by *A. nilotica* it is rare or nil within c18 km of waterpoint, then abruptly increasing in cover beyond this distance

Indigofera ruspolii In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, peak abundance at c30% relative woody cover at 1-5 km from waterpoint, declined to 12 km, then leveled off at 11% relative shrub cover beyond this distance from water

Solanum incanum In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, very abundant within a couple km of waterpoint, decreasing rapidly with distance and disappearing at c7 km from water

Solanum jubae Invader of recently abandoned farms in C Som. In *Acacia nilotica/Dichrostachys kirkii* bushland on sandy soil in C Som, fairly low but stable relative cover from 1-20+ km from waterpoint; slight rise with increasing distance, due to crowns of original invading individuals getting larger than an influx of more individuals. Unsuitable for firewood or fencing.

Cynodon dactylon In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, relatively abundant within 3 km of waterpoint, not found beyond c7 km

Blepharis edulis(?) Increaser in bushland in C Som. In *Acacia nilotica-Dichrostachys kirkii* bushland on sandy soil in C Som, relatively abundant in herb layer within 7 km of waterpoint, then gradual decline to almost nil at 20 km. Uncommon in neighboring *Acacia reficiens-D. kirkii* bushland.

Herlocker, DJ, TL Thurow & BB Buh 1988c ***Post-cultivation succession of a rainfed agricultural system in central Somalia***. CRDP/NRA, Mogadishu, unpub., 15p.

Nooleye. Shrubland [bushland] on sandy soil. 15 fields of known fallow age, 2-55 yrs. Rainfall 250-300 mm. 10 transects/field, 100 pts/transect (thus 1000 pts/field).

147 Dichrostachys kirkii A major post-cultivation species on sands in C Som; codominant not only in early stages of succession but also at 40-50+ yrs, possibly due to cutting of potentially dominant acacias. On sands in a C Som study, rapidly established with *Solanum jubae* in fallow and codominant in the first decade. Declined to c10% relative cover by 20 yrs, then slowly increased to 25% relative cover after 50 yrs. Cover negatively related to that of *Acacia horrida*. Of little use for construction or fencing.

250 Solanum jubae Ubiquitous and locally exceedingly abundant in bushlands and shrublands of C Som, especially secondary types. A dominant in early stages of old-field succession on sands, enhanced by rapid establishment and growth. In a C Som study, rapidly established with *Dichrostachys kirkii* in fallow and codominant in the first decade. Slow progressive decline in relative cover from 30 to <10% after 50 yrs. Crown diam levels off at 3 m after c20 yrs. Of little use for construction or fencing.

147 Acacia horrida A study of this exceedingly common species in C Som found that in agropastoral areas on sands it may peak in dominance c20 yrs after farm abandonment, thereafter steadily declining. Cover negatively related to that of *Dichrostachys kirkii* which gradually attains dominance in older (30+ yrs) fallow. Crown diam gradually increases to c3 m after 50 yrs.

147 Acacia nilotica Together with *A. reficiens* may be a potential climax species on sands in arid C Som, though its ascendance to climax-dominant status is prevented by cutting. Crown diam gradually increases to c3 m after 50 yrs. (Herlocker et al. 1988c)

147 Acacia reficiens On sands in parts of C Som it may be a potential climax species, though its ascendance to climax-dominant status may be prevented by cutting. Crown diam steadily increases, reaching 2½ m after 50 yrs. (Herlocker et al. 1988c)

148 Indigofera ruspolii May be indifferent to seral stage or stocking rate. In a C Som post-cultivation study, maintained a fairly low but constant cover despite major seral changes in the tree-shrub layer. (Herlocker et al. 1988c)

332 Aristida sieberiana In a C Som study on sands, the strong herb-layer dominant the first few years of fallow, but evincing a marked decline within a decade due to continual heavy grazing pressure. Thereafter it maintained a low steady cover to at least 50 yrs. In lightly grazed areas it could become a climax codominant. New growth is palatable but becomes unpalatable when bearing its abundant spike-like seeds; post-seed palatability is low at best. (Herlocker et al. 1988c)

332 Leptothrium senegalense In areas with agropastoral activity in C Som, achieves dominant status in herb layer within c30 yrs after cultivation and levels off at c50 yrs. This is under conditions of fairly heavy grazing; in lightly grazed areas it would be replaced by *Afrotrichloris hyaloptera* and *Aristida sieberiana*. (Herlocker et al. 1988c)

148 Crotalaria dumosa In a C Som study on sands, the dominant forb in 15-25 yr fallow, thereafter slowly declining to at least 50 yrs

332 Dactyloctenium scindicum In a C Som study on sands, maintained a stable moderate cover in fallow to at least 50 yrs despite conditions of fairly heavy grazing. Probably invades newly abandoned farms and survives thereafter by opportunistically invading small open areas e.g. as opened by shrub cutting.

332 Cenchrus ciliaris In a C Som study on sands, maintained a stable moderate cover in fallow to at least 50 yrs despite conditions of fairly heavy grazing

280 Commelina forskalaei Abundant in early fallow on sands in a C Som study

063 Psilotrichum Abundant in early fallow on sands in a C Som study

332 Afrotrichloris hyaloptera On sands in C Som may become a herb-layer dominant in lightly grazed areas but intolerant of heavy grazing pressure

Hiraan Region. Mukayle village in W. Bulo Burte Dist. The clan west of Shabelle River is known as Geel-jeel (camel lovers). The acacia-commiphora bushlands west of river mostly on stony limestone/silt mosaics (in contrast to sands to the east). Well stocked with palable browse e.g. acacias, commiphoras, grewias, satanocrater, barleria, blepharispermum, indigofera, dalbergia, euphorbia cuneata.

Photo: Peter Kuchar

Jabriil, AY, MA Awale & JR Barker 1988 ***Coppicing ability of Acacia horrida*. Somali J. Range Sci. 3: 31-33.**

Coppicing may be used to increase forage availability of Acacia horrida for stock & game and shows promise as a management tool to increase forage production. Cutting puts coppiced growth within easy reach of stock. A possible management plan: cut to 3-5 dm, only harvest part to help vs. erosion; harvested material used for fuel, buliding material; then protect for at least 1 yr to allow regrowth and replenishment of CHO reserves.

This has implications for general management to increase fodder production - e.g. note lots such unavailable fodder in taller acacias.

Madany, Michael H 1988 ***Summary report: Performance of woody species & crops at the Leprosy Hospital Demonstration Garden, Labadaad Island****, Jilib District, Somalia, 1985-1988*. World Concern, Muqdisho, 17p.

Rates a bunch of woody species, native and exotic. Main uses also given. *Unfortunately, no critical discussion of ecol. or taxonomic groups.*

The top-rated ('exceptional performance'): Acacia nilotica, Albizia lebbeck, Annona muricata, Cajanus cajan, Cassia siamea, Casuarina cunninghamiana, Faidherbia albida, Ficus sycomorus, Leucaena leucocephala, Moringa stenopetala, Prosopis chilensis, Psiadia guajava, Thespesia danis.

Madgwick, Jane 1988 ***Riverine forest in the Jubba Valley: A vegetation analysis and comments on forest conservation.*** Biogeographia 14: 67-88.

17 20x20 m plots in 3 stand areas. *No summary relevé but main types and main spp given in a messy way. Dhesheeg = shallow depression between levee and floodplain edge. (see more detail in Madgwick 1986)*

Mah, Ahmed M & Thomas L Thurow *1988* ***Interrelationships of Acacia horrida cover with range forage on shrubland in central Somalia.*** Somali J. Range Sci. 3: 34-37.

Excessive shrub cover can limit stock production by reducing herbaceous production and by formation of thorny thickets which prevent grazing under the shrub canopy.

In general, herb standing crop decreases as woody canopy cover increases (several lit refs).

In this study S of Afgoi on poor-condition range, individual *A. horrida* shrubs were randomly selected and under each, several random locations were sampled with 0.25 m^2 plots (quadrats). Canopy cover estimated. A total of 49 quadrats sampled under canopies and 11 outside of canopies. Biomass clipped, dried, weighed for biomass, and regression of canopy cover vs. herb biomass.

Found strong negative correlation between shrub canopy cover and forb standing crop, and a weak positive correlation with grass biomass. Sedge biomass peaked at 65% shrub cover. Forb biomass negatively correlated with shrub cover. The combined relationship was weak negative correlation of herb biomass with canopy cover.

Note rel. between litter accumulation and cover: from 0-100% canopy cover, litter biomass = c1200-3000 kg/ha. (thus at the common canopy values of c30-40%, litter would be c1800 kg/ha) Litter accumulation, mostly leaf biomass produced by the shrub, may make it difficult for herb seedling to establish. The range site was in poor condition and with improved condition, perennials would be expected to reestablish and change the biomass/cover curve. Shrub cover reduction would be expected to benefit herb (particularly forb) forage production.

Shire, Saad Ali & Mohamud I Asser 1988 ***Economic aspects of some traditional food plants in Somalia***, p.106-120 *in* Proc. Nat. Workshop on Promotion of Under-exploited Traditional Food Plants in Somalia, Mogadishu, 12-15 Nov. 1988, Min. Agr., Somali Dem. Rep., Mogadishu, 140p.

Yicib (*Cordeauxia edulis*) Each plant produces c5 kg of nuts. "When the fruits are in season individuals and small parties called 'ARAH' set out to gather them taking along supplies of water and food on camel backs. The nuts are gathered in pods which are buried in hot sand to facilitate splitting and extraction." Since it is arduous work, nut collection is usually the men's task. Nut-gathering also coincides with a period of low demand for men's labor (peak demand being in dry season when stock have to be taken frequently to WPs).

The nuts are roasted to improve preservation by killing infesting larvae and hardening the shell vs. further penetration; the nuts entering in trade are generally roasted. They are sold in towns in small amounts as a snack food. They constitute an important secondary income for nomadic gatherers. Nut eaten raw, dried, boiled or roasted. Young tender nuts relished by children and eaten by travellers to quench thirst as they have high water content. Dried nuts sometimes eaten though not quite as tasty and are difficult to preserve. Boiled nuts are eaten as a staple, while roasted nuts are appreciated as tasty snacks.

Leaf sometimes tea substitute; tea reddish. Leaf extracts yield a red dye used for coloring hair and cloth. Excellent firewood which burns easily even when wet. Building material for huts and corrals. Even more important as browse for camel and goat, sometimes sheep, during dry season.

"The ye-eb plant has a high potential in meeting the nutritional needs of the people and livestock particularly at times of seasonal scarcity. It adapts well to dry climates and marginal soils where other crops are unreliable or can not be cultivated. It not only thrives in infertile soils but enriches them by fixing atmospheric nitrogen. The high oil content of the nut makes it viable for industrial exploitation; and it can be an important source of commercial dye due to the remarkable concentration of easily extractable pigments in leaves (12.7% of dry matter [3]).

In spite of its economic importance, it is generally acknowledged that plant population has been declining noticeably in recent years. Over exploitation of the plant by both men and animals due to increased population is probably the primary cause of its decline. The construction of water reserves in the growing area has accelerated the process of degradation. This made possible the continous presence of people and livestock in the area resulting in overgrazing and overutilization of the plant. Spontaneous and deliberate bush fires have also taken a toll on the plant population.

To arrest any further decline, the growing area should be turned into a reserve where grazing and exploitation of the plant are regulated. Basic research on the natural and the socio-economic environment of the plant should be conducted. Its physiological and growth characteristics should be studied. Research on its cultivation and on the development of new technologies for conserving and processing the nuts should be also supported."

Barker, Jerry R, Dennis J Herlocker & Steve A Young 1989a ***Vegetal dynamics in response to sand dune encroachment within the coastal grasslands of central Somalia***. Afr. J. Ecol. 27: 277-282.

Barchan dunes were stratified into 5 zones, based on visual cover and composition differences and sand deposition. (That's fairly slack. How about some harder physical criteria such as slope, sand integrity etc?) Point-transects, intercepts. The % cover data arc-sine transformed. Cyperus chordorrhizus, the dominant plant of dune fields in the coastal plain of central Somalia, was the outstanding dominant along the leading arms of barchan dunes, to 20% cover or even more. Most of the common grasses were unable to grow or thrive on the leading arms of barchan dunes.

Barker, Jerry R, Dennis J Herlocker & Steve A Young 1989b ***Vegetal dynamics along a grazing gradient within the coastal grassland of central Somalia***. Afr. J. Ecol. 27:283-289.

Grazing gradients extend from large wells on highly overgrazed range, far into range receiving minimal grazing. All 4 stock classes graze. The only common native ungulate is Speke's gazelle, independent of free water. Soemmering's gazelle migrate from adjacent shrubland during prolonged drought and to avoid biting flies.

Condition classes: VP, P, F, G. Transects running 9 & 5 km from large wells. Intercept cover using a tape. Condition increased from VP near wells to G distant from wells. Rising condition corresponds to increased plant cover, litter cover, grass cover, and species diversity. Forb cover increases with distance from wells, peaking at 12%, then a gradual decline to c5% at distance. Shrub cover peaks more distantly than forbs, at c10-12%, then apparent decline. Grass cover progressively increases to max of 33% at distance.

A very informative table (Tab.2) showing the progress of individual graminoids and forb species from G to VP condition.

Bird, NM & G Shepherd 1989 ***Charcoal in Somalia: a woodfuel inventory in the Bay Region of Somalia. Final Report of Energy Planning Study ODA***. Prepared for Somalia National Range agency, Somalia Min. Livestock, Forestry & Range Mogadishu, Somalia. Somali Forestry Series, Issue 2, ODNRI, UK, 134p. (paper in Herlocker website)

Abst. At present the bushland in the Bay Region of Somalia contains sufficient wood for less than two years supply of charcoal for Mogadishu. Early results indicate that growth rates of the main charcoal-producing trees are not fast enough to replace those felled, so the bushland is being destroyed. The charcoal industry is causing hardship to the people of the Bay region by causing a shortage of fodder for the feeding of livestock and of poles for house building. Recommendations are made as to the re-siting of the charcoal industry and the management of the bushland

Darkoh, MBK 1989 ***Desertification in Africa***. J. East. Afr. Res. Devel. 19: 1-50.

A dangerously dogmatic paper, lots of flat statements & pronouncements with absolutely no support. Some really are platitudes. Here's a blatant example: "Before the advent of colonial rule, Somalia possessed good range resources that were in stable equilibrium with, and capable of sustaining the use made of them by the people." In one sentence it's able to ponder the myth of man in balance with nature, and white man as the cause of its loss! Note that it is conceded that there were lower numbers of both humans and animals but doesn't mention that lack of modern medicine helped promote this.

Note how insidiously he puts the blame on colonialism for desertification even in Somalia. Although the Somalis have remained rather staunchly traditional in their livestock use patterns, and although they have changed less than many African cultures, it's white man who is blamed for their pasture problems: "With the advent of colonialism, however,[i.e. to put an end to the pastoral idyll] the cattle economy became monetized, and livestock markets were opened. The monetization and marketing of cattle was facilitated by the introduction of veterinary drugs and the establishment of trading posts and provision of water along all sorts of tracts and trails that crisscrossed the rangelands. These trading establishments exposed the nomads to a variety of tastes and attractions which had to be satisfied through increased commercialization and massive increases in herd numbers. Consequently, the modernization of the economy completely upset the stable equilibrium which had originally existed between man and grazing land. The result has been the deterioration of pastures and rangelands."

Does he mean that it was all hunky-dory before? What about internecine conflicts [clannishness is the bane of peace in Somali regions], surely, they must have had some effect on populations and patterns. Or that the nomads' tastes changed. They didn't change a bit. They still wanted livestock - and it was mostly camels, not cattle - and their chief urge was to have as big a herd as possible, not to sell for Western goods, but to gain prestige, bride wealth, etc., i.e. the same traditional reasons, but using modern means (boreholes, vet. drugs) to achieve these.

The root cause of desertification is "a maladjusted development process that has failed to provide people with a rational way of making a living."

Has a useful footnote on the southward-advance-of-Sahara thing that Lamprey started, with the addition that his figure of 100 km/yr has been questioned by various workers (p48).

Drought is not desertification, though their effects may be very hard to tell apart. Drought is temporary, desertification is generally 1-way.

Drechsel, Pay, Wolfgang Zech & Martin Kaupenjohann 1989 ***Soils and reforestation in the Central Rangelands of Somalia***. Arid Soil Res. Rehab. 3: 41-64.

The Mudug Plain encompasses most of C Somalia except the Shabelle Valley and W Hiiraan Region. It is a slightly rolling tableland with large basins. It comprises marine sediments of Upper Jurassic to Middle Eocene limestones, gypsum, anhydrites and evaporites, with bedrock

often outcropping. Large areas are covered by variably consolidated red to pale sands. The westernmost part, in E Hiiraan Region, has red Haud sands based on Jesomma sandstones.

Gives some attention to the basal materials in the Shabelle Valley. The part that belongs to the floodplain is filled to 8-20 m with calcareous river deposits. Most seem to be ancient quaternary sediments and nowadays are flooded only during a few years.

Did 50 soil profiles between Bulo Burte & Galcayo. Soil topo sequence of Shabelle Valley near Beledweyne, & a couple other topo sequences. Details on soil chem. Eight types described. Soils are classified in accordance with the revised legend of Soil Map of the World by FAO-UNESCO 1988.

At Beledweyne the Shabelle River is of medium salinity during the October flood, and at low flow in February has high salinity. The floodplain soils near Bulo Burte and Beledweyne are usually calcareous, of loam to clay texture, and contain different amounts of powdery gypsum and soluble salts, especially in the subsoil.

Six profiles in a 4 km topo sequence (W?) from the Shabelle near Beledweyne.

Soil 1. Sali-calcaric fluvisol on recent alluvial deposits near the river. Varies from loam to clay loam and silt clay loam. Soil pH c8. EC increases from 1 mS/cm on the surface to 4.3 mS/cm in the subsoil. CEC c20-25. $CaCO_3$ 23-28%. Organic C 6 mg/g in the topsoil, declining to 2 mg/g in the subsoil. This particular soil is susceptible to rapid salinization after irrigation, which conforms to the description of Watson et al. (1982) of many abandoned irrigation fields along the river. Natural regeneration of these sites seems difficult and severe erosion occurs. The vegetation here includes Acacia zanzibarica (not seyal as stated), A. tortilis, Salvadora persica, Ziziphus spp.

Soil 2. Chromi-calcic vertisols developed from ancient quaternary river deposits 1-2 km from the river. Texture: clay c50%, silt 30%, sand c20%. Soil pH c8-8.5. EC increases from 0.3 to 4.5 mS/cm downward through the profile. CEC 26-33. CaCO3 c30%. Organic C 3.6 mg/g in the topsoil, declining to 1 mg/g in the subsoil. Formerly used for cropping and grazing but now very scanty plant cover, with some Acacia zanzibarica trees and A. tortilis shrubs. Such soils around Bulo Burte have a higher potential for reforestation due to low salinity.

Soil 3. Calcari-takyri sodic solonchak. Also common 1-2 km from the river, where associated with the vertisols due to increasing salinity. After loss of vegetation the surface horizons are partly eroded and/or covered by a thin layer of windblown fine sand. Sand 60% at surface, 40% below 3 cm depth and progressively decreasing. Clay 16% in top 18cm, rising to 45-55cm below 18 cm. Sodic throughout the profile with exchangeable Na (ESP) 20-29% and high salinity. ECe values may be similar to those of sea water. Soil pH c8. CaCO3 c25%. Organic C only 1.5-2 mg/g throughout the profile.

At the borders of the floodplain the fine-textured river sediments gradually change to limestone rubble and fragments. From c2-3 km the soils are orthi-calcaric cambisols, orthi-calcaric regosols and calcari-lithic leptosols. Due to the high amount (40-80%) of $CaCO_3$ in the soils,

exchangeable Ca accounts for 80% or more of the CEC. Soil pH generally 7.8-7.9. Compared to other soils of C Somalia, relatively high OM (2.2-3.0%), N, P and Zn. These soils support Commiphora-Acacia bushlands.

Soil 4. Orthi-calcaric cambisol. Stoniness 1-4% down to 50 cm depth, 30-60% in deeper subsoil. Clay 20-24%, silt 28-37%, sand 44-48%, but at depth (100-150 cm) clay 9%, silt 13%, sand 78%. CEC 13-14. EC only 0.2-0.6 mS/cm. $CaCO_3$ 50-70%. Organic C 1.4-2.6 mg/g. Virtually no gypsum.

Soil 5. Orthi-calcaric regosol. 3-4 km from the river, on hillsides. Stoniness 60% at 0-20 cm depth, 70% below that. CEC 16-20. EC only 0.13-0.20 mS/cm. $CaCO_3$ 65-78%. Organic C 6-17 mg/g. Virtually no gypsum.

Soil 6. Calcari-lithic leptosol. 4 km from the river, on hills. Stoniness 80% at 0-10 cm. CEC 19. EC only 0.17 mS/cm. $CaCO_3$ 42%. Organic C 13 mg/g. Virtually no gypsum.

Two profiles Dusa Mareb.

Soil 7. Eutri-luvic arenosol in a limestone depression near Dusa Mareb. It has the same properties as the red rhodihaplic arenosols developed from the Jesomma sandstone near Mataban. Both are free of easily soluble salts and lime. Organic C, N and P are very low. Due to the low OM and clay content, CEC ranges between 5-13 me/100 g. Ca occupies c70% of the exchange complex. Red sands show more exchangeable K than pale sands. High hydraulic conductivity in the topsoil, lower in deeper horizons. This soil profile has no stones, 85-90% sand, 2-5% silt, 4-13% clay. Soil pH ($CaCl_2$) 7.1-7.3, pH (H_2O) 8.2-8.3. EC 25-45 µS/cm. $CaCO_3$ 0%. CEC 5-6.5.

Soil 8. Areno-eutric leptosol on limestone plateau near Dusa Mareb, and associated with calcari-haplic arenosols. The leptosols are associated with limestone outcrops. The soil profile has 50-85% stoniness, 82-83% sand, 9-12% silt, 6-8% clay. Soil pH 7.7-8.5. EC 60-115 µS/cm. $CaCO_3$ 0.3-0.9%. CEC 9.5.

Elmi, AA 1989 ***Camel husbandry and management by Ceeldheer pastoralists in Central Somalia***. ODI Pastoral Devel. Netw. Pap. 27d, 36p.

Looks at all aspects (i.e. sociological & managerial) of camel pastoralism except diet. An important paper on the customs & techniques of husbandry of a Somali group. Read for detail.

Ceeldheer envir. unique in having no human or animal predators (except for a few canids).

Note the importance of flies in the stock movements (& his wretched documentation of these - not even a genus given, & riibi are said to both bite & sting which is impossible).

Dry season is divided into 3 parts:

1. kalhoraad early dry

2. kaldhexaad mid-dry season; much-reduced green forage & evergreens sought; scarcely enough forage. Watering interval 13 days & more intake than earlier

3. kaldambeed late dry; weight loss, especially milking camels; watering interval still 13 days but largest intake.

Much on watering.

The pastoralists can tell which plant species increase milk production & can tell from the smell of the milk the plant species consumed.

Camel owners become very suspicious when they encounter something new or extraordinary. Points out potential dangers of fieldwork, where unlucky events are attributed to the presence of the investigator. Also emphasizes the peaceful, cordial relations of these pastoralists among themselves. *Sounds kind of idealized.*

Elmi, AA nd. ***Importance, traditional management and research needs of camels in Somalia***. Sympos. on Human & Cultural Understanding? 8p.

A very useful, quotable (citeable) summary of camel prominence in Somalia.

"Traditional livestock production systems in Somalia involve camels as a source of food, prestige, and security against environmental disasters. Many livestock production planners and researchers, especially foreign experts, have overlooked the usefulness of camels for Somali nomads and its importance in the national economy."

"Camels utilize a diversity of plant resource that could not be exploited by cattle for human benefit. They are drought resistant, disease tolerant and efficient converters of food and water to milk and meat. Millions of people depend on them for food, transportation, draft, hides and skins." Their hides, skin and hair are used in shoemaking, mats and belts. "Somali nomads raise camels for security, social prestige and as price index for other livestock and human lives. The life of a man killed is worth 100 camels, a woman 50 camels; and one camel is equivalent to 20-30 goats or sheep and about 5-10 cows."

Camel eats a diversity of vegetation perhaps to dilute the toxicity of some forage species. (Williams 1975).

"Camels rarely compete for forage with other livestock." Some experts have therefore suggested that pastoralists lacking camels in arid and semiarid parts of the world could add camels to their livestock complement and increase stock production with no reduction in numbers of cattle and shoats, because camels do not compete with these species.

"It is obvious that camels have the capacity to maintain themselves, grow and improve their condition on ranges which cannot support cattle. They are more efficient in using shrubs and trees than cattle and can do better in arid and semiarid environments."

"Human lives could be improved by increasing milk and meat production from camels. Income of nomads could be boosted through potential market increases for camel products and by-products. Increased camel production through research with carefully designed and implemented projects could minimize pastoralist dependency on foreign food donation."

"Despite the economic value of camels, their ability to survive in harsh environments better than cattle or small ruminants and their tolerance to drought and water stress, little is known about behavior, reproduction, diet and breed of camels. Research has completely neglected the species." Research needs: capability of camel to utilize diverse plant resources; diet selection and shifts; ability to dilute toxic plants; secondary compounds consumed; breeding; improved milk and meat production.

"The availability of forage, water, and salt together with avoidance of insects and diseases determine migratory movement of the nomads, their concentration around boreholes during dry seasons and dispersing behavior during wet periods."

Four seasons in Somalia:

1. SPRING: April, May and June is the first major rainy season. Outbreak of ticks and tickborn disease are common. A fresh, dusty new home is prepared for camels. In the new corral, camels get rid of ticks attached to their body by rubbing themselves on the dusty ground. Spring is a calving and breeding season. Separate corrals of thorny acacia bushes are built for milking and dry camels to minimize disturbance on nursing camels at night. In the day, dry and milking camel herds browse/graze together.

When sufficient forage is available in the vicinity, camels are kept in the corral until late morning for several reasons: (1) to wait for the evaporation of dew on green grasses, shrubs or forbs; otherwise camels walk far and fast from home in search of dew free pastures, thus requiring late evening grazing/browsing; (2) to keep camels close to the camp area with minimum labor force; (3) to milk late, especially when calves spend the night with their mothers or when wanted to milk twice for family consumption and for cash and sale; (4) to reduce day-long herding difficulties.

During this season, camels are seldom watered. The forage is green and lush and provides the amount of water required. Camels also drink free water accumulated in natural ditches, abandoned boreholes and roads. Unless forage availability becomes scarce or outbreak of ticks and diseases occur, movement of camels from one place to another is restricted.

2. SUMMER: July, August, and part of September is the first short, dry season in inland areas. It is hot in the northern coasts but humid and rainy in southern coastal areas. This season is windy. Camels are protected from wind by thick, thorny bushes and tree branches if the camels are moved to a new camp. Otherwise, additional fencing is added to the existing corral to shelter and protect from the wind. Sometimes the corral is built inside a busy[bushy?] area so that the natural bushes break the wind velocity and serve as additional fence. Calves either stay with their mothers or are separated depending on the milk need of the family.

Efficient use of available forage is limited by the dry, dehydrating, windy weather or the summer season. Maximum efficient utilization of forage is obtained by frequent watering of the whole herd whether milking or dry. In the northern regions, the interval between two consecutive waterings is shorter in the summer than the winter (see below). In winter, forage is not as plentiful as summer forage. The more forage that is dry the camel consumes in a short time, the more water it requires (i.e., maximum forage consumption corresponds to frequency of watering). Conversely, forage is limited in winter and camels spend more time in search of food.

3. FALL: Part of September, October, and November is the second short, rainy season in the south; and August, September and October in the north. Management of camels is like that in spring season. If forage, water, disease and tick problems are limited, camels can stay on the same range in winter.

4. WINTER: December, January, February and March is the second and longest dry season. It is cold and dry in the north, but hot and dry in the south. Camels generally remain in the same corral as the fall season with frequent cleaning of dung from the corral. Dung is removed more than once per week to minimize tick infestation. Unlike the rainy seasons, camels are released from the corral early in the morning and come back late in the evening, allowing 9-12 hours foraging. If sufficient forage is available in the vicinity and water is at a reasonable distance, the herd is not divided into milking and dry groups. Small ruminants also stay with camels. Two advantages are associated with keeping the herd together: (1) the family stays together, and (2) there is no need of extra labor for herding divided camels, sheep and goats.

Factors that necessitate division of camel herds into dry and milking, are forage and water availability, time, and family need for milk.

(a) Forage and water availability - When water is plentiful but forage is scarce, the milking camel herd and small ruminants remain close to water sites. The dry herd moves far away from water in search of satisfactory forages. Dry herds usually water once every once every week or two. When both water and forage is limited, the whole camel herd and small ruminants are moved together to a place where water and forage are simultaneously available. If not, the milking herd, together with flocks, is moved close to water locations, while the dry camels are herded away from water for best ranges. The milking camels are watering every 3-7 days. This varies from region to region and with camel conditions. In Lower Shabelle where permanent river water exists, they are watered every 3 days. In the "haud" (far inland), camels forage one day's walk from wells with calves and spend a night on well sites. Otherwise, when without calves, they walk back at night to their calves. The interval of watering in this case is about one week. Supplemental feeding is provided by cutting unreachable *Acacia* branches, collecting pods or looking for certain types of plants such as *Loranthus* species growing on top of large trees. One of them is "Quadaw" which nomads believe increases milk production, and another is "dhillowyahan", which is believed to break thirst when consumed by camels. This natural forage supplementation is required to avoid long distance walking in search of forage which reduces milk production.

(b) Calving time - Herd division also takes place at times of birth when calving time coincides with lack of forage in the present settlement, and at the same time rainfall starts. Those giving

birth remain in site, while dry ones follow the rain. This period of separation is short, and reunion is resumed quickly unless drought dictates prolonged division.

(c) Family need for milk - This is an important factor for camel division, too. Milk requirement is either for family consumption, selling for cash to buy grains, or both. The milking herd, together with sheep and goats, remains near villages around water locations with the care of women, children and elders.

Calf-human milk competition is remarkable in the pastoral Somali society. If a calf is born dead or dies after birth, owners would not let the camel dry. They bring another calf, run the maternal fluid on it, prevent drying and the dam from seeing the calf. The dam usually accepts the foster calf as her own. If not, she is severely punished by piercing a sharp stick in her nostrils, wrapped with a rope tightly to partially suffocate her, and the anus is closed with two pieces of wood that exactly fit each other and are tied with a rope on both ends to prevent defecation. One of the front legs is bent and tied so that it will not move. The dam stands on three legs with the adopted calf in front of her. The owner frequently checks whether the calf nurses or not. The punishment continues until the camel completely accepts the calf. Sometimes the skin of the dead calf is used for milk stimulation without punishing the camel or when the owners think it is inappropriate to punish.

Healthy newborn calves are not allowed to suck the colostrum, for it is believed to increase calf mortality; nor is it consumed by humans frequently, but it is milked onto the ground. Milking out the colostrum immediately after birth stimulates and enhances more milk production and helps udder muscle relaxation.

(d) General managment - Camels are provided with salt, salty soil, salty water or foraged salty plants. Salt and salty soil are given at the onset or shortly after rains when forage is expected to be abundant. When it is limited in the dry season, camels are grazed/browsed on salty plants or watered with natural salty water. If neither is available, salt is dissolved in water and given to them. Camel owners believe that salty water cures defective udders and other defects and enhances efficient use of dry period forage. The Somali people, like many camel owning people of the world, have evolved management systems that fit their culture. Little has been done to increase production or improve management in a modern sense. Indeed, the traditional management systems are poorly understood by those outside the culture. Hence, they have not been tested to determine if they should be altered.

Friis, I & K Vollesen 1989 ***Notes on the vegetation of southernmost Somalia, with some additions to the flora.*** Willdenowia 18: 455-477.

"The major ecological results of the study of the flood plain will be published separately elsewhere." *(I haven't seen this.)*

Based on May-Jun 87 in field. c650 coll's. *I'm shocked by spelling mistakes in the sci names, considering that both authors are taxonomists.*

How heartwarming to see all those cautious cf's on the acacias! - even taxonomists have trouble with apparently major common species.

Lit rev & homologizing of veg types p.457-9. The veg types described in this rept (p.459-467) are of the most primitive, old-fashioned reconnaissance kind as only taxonomists seem able to do - lists of species in each layer, no idea of relative abundance, the briefest of comments on community extent & height. And note sci. authorities in the plant names help clutter up what is actually a very uninformative 'vegetation' account.

The lit rev of veg. is mainly Pichi-Sermolli 1957, some mention of Moomaw 1960, & use of White's19 83 classification: mention of some of the early Italian studies.

Two groups:

(1) Somalia-Maasai Acacia-Commiphora deciduous busland & thicket (with a no. of types based on substrate). Some types are Ac-Com, others Ac; & from clay to sand, also dune type, riparian forest, granite outcrops.

(2) Zanzibar-Inhamb. regional mosaic: scrub forest, ev. bushland, edaphic grassland.

The S-M Ac-Com decid B & Bt veg: "This is by far the most extensive vegetation type in S Somalia; it is typically a dense bushland, with woody plants up to c. 5 m tall, occasionally with emerging trees. The woody cover may be thinner due to poor substrates or due to destruction of the natural vegetation." On clay plains usually much Acacia. "Succulents are fairly common, especially on the clay plains." [Is that due to more disturbance, or a natural thing?]

Open Commiphora B on limestone, gypsum and sand: Acacia edgeworthii, A cf reficiens, A cf senegal, A cf horrida, C ellenbeckii, C myrrha, C africana, C corrugata, C cyclophylla, C incisa.

Open Com. B on pale clay: Ac cf horrida, Ac cf paolii, C erosa, Kirkia tenuifolia.

Ac-Com B on limestone and red sandy soil derived from this [really? doesn't sound possible]: Acacia spp [4781,4784,4814], C erythraea, C aff confusa, C samharensis, C alata, C ellisiae, C rostrata, C ?sennii, C alaticaulis.

Similar, on limestone: C gurreh, others.

Clay depressions: Ac oerfota.

Ac B on pale clay: Ac reficiens almost pure stand, some Ac oerfota.

Ac-Com B on sand from granite: Ac senegal, C boiviniana

Ac B with Terminalia on pale clay: Ac cf seyal, Term spp.

Ac-Com B on dark alluvial clay (along Shabeelle plain): Ac bussei, A nilotica, C boiviniana, C lindensis, C aff paolii; locally Ac oerfota dom, or Terminalia brevipes.

Ac W or B on coastal dunes:

Old inland dunes at Balcad: Ac zizyphispina, C african a

Dunes S of Marka: Ac nilotica, Ac tortilis, Ac zanzibarica

Dunes at Baraawe: Ac tortilis, A senegal, A horrida

S-M riparian forest. Mimusops fr, etc.

Granite outcrops ('buur'): C boiviniana

Zanz-Inhamb. scrub F, B, edaphic G (Ac zanzibarica).

Hussein, MA 1989 ***Husbandry and management of camels in Somalia, Ethiopia, Kenya and Djibouti.*** Options Médit. Sér. A: Séminaires No.2: 37-44.

Very general, mainly for Somalia.

Kuchar, P 1989a ***Range sites of Hiiraan Region, Central Rangelands*****.** CRDP Tech. Rep., LBII-USAID, Mogadishu, 33p.

Hiiraan Region covers c30,000 km^2 in the SW part of the Central Rangelands (CR), with 3 districts, Jalalaqsi in the south, Buulo Burte centrally and Beldeweyne in the north. Field work was done in 1985-88. Most of the region was visited and sampled except western Beledweyne and most of western Jalalaqsi. The text describes the landforms, general vegetation, the 19 range sites and condition of the range, and discusses the more important species of each site. Maps accompanying the report delineate the range sites, range condition, and extent of perennial grass cover.

The region has a diversity of range sites (in vegetational terms equivalent to community types or community-type classes), with various production potentials, patterns of land use and range condition, and unique combinations of dominant and subordinate plant species. Unifying features of all sites are a bimodal and unreliable rainfall averaging 250-350 mm over most of the region, the year-round stress of very high evaporation deficit, structural dominance of bushland (with few exceptions), high livestock populations particularly of camel and goat, and a concentric pattern of range deterioration whose severity is inversely proportional to distance from permanent water. Range in good condition is, with few exceptions, more than 25 km from permanent water, and of the 1138 stands that were sampled, not a single one failed to show stock use.

Much of the range is well below its production potential, i.e. it supports, on a sustaining-yield basis, significantly fewer animals than it could under optimal ('climax') conditions of plant cover

and composition. It is particularly deficient in perennial grasses, which are entirely absent from large tracts. The Hiiraan rangelands nonetheless support a healthy livestock industry and perhaps the richest pastoralists in the CR. This may be attributed to better rainfall than in the rest of the CR, lack of serious erosional problems or 'desertification', better dry-season forage resources, and perhaps a better floristic composition.

Because woody plants provide most of the cover, biomass, and food for livestock in Hiiraan, and because woody species are richly diversified through the various plant communities and range sites, it was felt that a treatment of range sites emphasizing the woody layer would be appropriate. Vegetation and range condition were sampled in 1138 stands. These are approximately circular unmarked ½ ha sites (equivalent to circle of diam 80 m or square 70x70 m). They were selected by driving along the few roads and maze of oil-exploration cutlines and stopping at c2-3 km intervals. Based on a walk-around at the site (plot), basic physical and biotic attributes were quantified in three categories:

as descriptors (landform, slope, soil) or ordinal-number ratings (termitaria, cultivation, lopping)

as % cover (rock, pebble, litter, grass, forb/annual, dwarf shrub, shrub, tree)

as 0-3 point scale for condition ratings (erosion, trails, litter, perennial grass, dung, hedging)

In 685 plots, all woody species seen were listed and each assigned a % cover (crown cover, 'ecological' cover) whole or decimal number based on ocular estimate. Cover less than 0.5% was assigned either + (=0.3% for calculation purposes) or p (=0.03%). In 434 of these plots, for each woody species (where possible) an estimate was made of crown diameter and min, max and mean plant height. Unknown species were collected as 'scraps' or herbarium-quality specimens. More than 2500 herbarium numbers were amassed, most from Hiiraan. These 685 plots were the primary source for range site descriptions and classification.

In 453 plots, physical and biotic attributes were estimated as above, but only a few of the main woody species were listed and assigned a % cover value. The data were included in the general description of range sites and range condition.

Hiiraan has c850 vascular plant species which includes 535 that are partly or fully woody, 230 herbaceous forbs and 84 graminoids. Hiiraan has a diverse plant cover. The unique environmental circumstances of a bimodal rainfall, combined with a long history of uninterrupted evolution in this dry region, has a major share of the impetus for development of this rich vegetation that includes a number of endemics. The variety of landforms, and the presence of the Shabelle River cutting the district down the middle, has further added to the diversity.

The range sites and vegetation are closely identified with landforms and soils, and they follow rather well the landform types set forth in RMR 1979 Central rangelands survey, Somali Dem. Rep. & Resource Manage. & Res, London. The most distinctive feature of the region is the Shabelle Valley, 30-45 km wide over most of its length, which splits Hiiraan into two dissimilar vegetational and physiographic subregions. The N-S alignment of the Shabelle Valley is

reflected in parallel alignments of landforms in the valley area. The dominant landform is the alluvial silt plain, 8-10 km wide over most of its length in Hiiraan but broadening in southern Jalalaqsi District. Also important are limestone hills, silt valleys, and sand plains.

In terms of range ecology, three unique features differentiate the alluvial plain from the rest of the region. They are: (1) a long, intense history of settlement and cultivation, (2) a long history of uninterrupted use by livestock, and as a result of these, (3) an extreme deviation from natural vegetation to a thoroughly depauperate flora and vegetation, and the poorest range condition of the region. Wind erosion is causing some silt removal and redistribution on the plains, and has in some spots left a deflation crust of small pebbles that are evidently colonized only with great difficulty. Significant water erosion is confined to gullies and the area within c100 m of the river.

In Buulo Burte and Beledweyne Districts the alluvial plain is flanked on both sides by a series of limestone hills. These are rounded prominences, ridges and stony plateaux with a local relief of 15-50 m, increasing to 80-100 m near Beledweyne. These hills interdigitate with small (unmappable) and moderate-sized valleys of heavy yellowish silts, generally heavily farmed and overused. Some of these areas grade into sandy soils, which form another distinct landform, found mainly in Buulo Burte District.

Level sands cover some of the larger inter-valley areas especially E-centrally between river and escarpment. Dissecting these valleys are broad wadis and alluvial fans. These flows originate on the escarpment and cut across the valley sands; they range from silty sands to silt loams, and occasional patches of clays. Because these areas all have a better water supply, they have been intensively cultivated. Aborey, the largest village in this area, is sited at the N edge of one of the largest 'flows'. Being locales of rather intensive agricultural activity, these plains are generally in poor condition, particularly in terms of erosion. The eastern side of the Shabelle Valley, mainly in Buulo Burte District, has some serious water-erosion problems, and is the only part of the region with significant erosion impact on rangeland.

Also aligned N-S, and forming the E boundary of the Shabelle Valley, is an escarpment signifying a major fault parallel to and 20-25 km east of the river. Consisting of rapidly weathering sandstones, the escarpment is 50-100 m high and, though prominent on the landscape, has slopes mostly <5º.

Above the escarpment lies an enormous, deep, ancient sandplain. (These sands can be unconsolidated to 30 m or more. A bore drilled by the CRDP Water Project had fine sand to 32 m, then sand alternating with sandstone for the rest of the 120 m profile.) This area, known as the hawd (in deference to the true hawd in the region of northern Ogaden region in Ethiopia and southern Somaliland), covers most of eastern Hiiraan east of the escarpment. Because until very recently much of the hawd lacked year-round water sources, and possibly also due to peculiarities of its plant composition, the hawd has the region's largest contiguous area of rangeland in good condition and supports the largest populations of stock especially camel. Here and there in the hawd - mainly northernmost and southernmost Buulo Burte District - are small areas of outcropping sandstone, and these, though generally too small to map, are regarded as part of the escarpment vegetation type.

The hawd has rather flat to very gently terrain, and proceeds in a series of broad shallow steps downward east. Some of these steps include broad (1-5 km) shallow (10-25 m) bowls which have slightly heavier soils due inwash and a thicker, taller bushland distinct from the hawd. Most of the hawd has no surface drainage pattern because all rain immediately soaks into the sands.

Toward the eastern boundary of Hiiraan, the hawd sands become shallower and somewhat more silty, and limestone outcrops become evident. These so-called shallow limestones mark the end of the hawd and the start of an enormous land unit encompassing much of CR north of Hiiraan, it is the Mudugh limestone plain, only a small part of which is in Hiiraan. Also associated with these shallow sands at the boundary are broad flat very shallow depressions consisting of very pale silts, whose vegetation shows a distinct connection with some Shabelle Valley and W Hiiraan types.

The sandstone escarpment terminates rather abruptly in southern Buulo Burte. Here valley and hawd sands both grade rather abruptly into stable dune sands. These are a coastal formation extending inland as far as southernmost Hiiraan and forming the characteristic rolling terrain of E Jalalaqsi District. Most of the fossil dune substrate is remarkably stable. The only sand-dune problems in Hiiraan are localized at the W edge of the dune fields, where the dunes are tallest, most exposed, and most affected by cultivation and other human activity in the adjacent alluvial and sand plain.

Landforms are most complex in the area just E and SE of Buulo Burte, where sandplains, valley silts, alluvial plains, limestone hills and dunes all come together, and all have the added burden of intense human activity.

Western Hiiraan has virtually no sand. Almost all the land is a complex of low limestone outcrops with pockets and small plains of silts. This mosaic pattern is startlingly developed in W Beledweyne, where vegetation arcs form zebra-like bands on aerial imagery. A mosaic is also well developed through much of W Buulo Burte and Jalalaqsi, where it is evident as a fine stipple pattern on Landsat. This mosaic creates some problems in vegetation sampling and range assessment, as it entails the integration of 2 very dissimilar land facets, (1) patches of thick bushlands usually in good condition and having much palatable browse and sometimes a thick perennial grass cover, and (2) rather barren intervening areas of patchy, sparse scrubby, weedy shrubs and forbs, no perennial grasses, and various signs of heavy stock impact.

Two landforms unique (in the region) to W Hiiraan are gypsum plains and basalt plains. Gypsum plains, recognizable as areas of very light-colored surface generally with sparser woody cover than adjacent vegetation, are found in W Jalalaqsi (and likely W Beledweyne). Some of the far-W stands still have good stands of Terminalia spinosa, but Terminalia woodland has been eliminated over much of the area. Basalt plains, areas of rich brown stony soils, are found in one area of W Buulo Burte. Some of these have been farmed and that is why they are in poor condition despite their good potential.

Range sites

The range sites (Table 1) are presented as two major groups, Sand series and Limestone series. There are 8 sand types and they are restricted, except for a very small area, to the eastern half of the region. They include recent and ancient wind deposits, and in situ soil developed from sandstone bedrock which is also included within this series. Some soil profiles are deep, others with limestone or sandstone near the surface, but none actually have any significant amounts of surface limestone.

The limestone series of 11 types includes all of the area west of the river, as well as some of the Shabelle Valley on the east side and a few areas to the far east. The topography ranges from rugged hills to absolutely level plains; soil textures include very stony surfaces, silts, and clays, but sands are essentially absent.

Table 1. Range sites and associated landforms of Hiiraan Region.

SAND SERIES

1 ARISTOLOCHIA RIGIDA - TRIBULOCARPUS DIMORPHANTHUS

Active dune sands.

2 LOEWIA GLUTINOSA - CORDIA SPP.

Stable dune sands.

3 CAESALPINIA TROTHAE - CORDEAUXIA EDULIS

Southern hawd sands.

4 BOSWELLIA MICROPHYLLA - CORDEAUXIA EDULIS

Central hawd sands.

5 BOSWELLIA NEGLECTA - CORDEAUXIA EDULIS

Shallow bowls in hawd.

6 ACACIA EDGEWORTHII - INDIGOFERA RUSPOLII

Valley sands.

7 CAESALPINIA TROTHAE - COMMIPHORA CHIOVENDANA

Shallow sands over limestone.

8 ACACIA SENEGAL - COMMIPHORA CHIOVENDANA

Sandstone escarpment.

LIMESTONE SERIES

9 ACACIA SENEGAL - COMMIPHORA STELLATOPUBESCENS

Limestone hills.

10 TERMINALIA SPINOSA - COMMIPHORA SPP.

Gypseous silts.

11 ACACIA REFICIENS - ACACIA HORRIDA

Pale silt flats.

12 ACACIA TORTILIS - COMMIPHORA SPHAEROPHYLLA

Silt valleys within limestone hills.

13 DALBERGIA COMMIPHOROIDES - SATANOCRATER RUSPOLII

Limestone/silt mosaic.

14 TERMINALIA ORBICULARIS - DALBERGIA COMMIPHOROIDES

Arced silts.

15 ACACIA ZANZIBARICA - DUOSPERMA LONGICALYX

Basaltic clay plains.

16 ACACIA ZANZIBARICA - CORDIA SINENSIS

Alluvial silts.

17 ACACIA NILOTICA - ACACIA ZANZIBARICA

Alluvial clays.

18 SUAEDA MICROMERIS - LIMONIUM AXILLARE

Saline plain.

19 ACACIA ROBUSTA - MIMUSOPS FRUTICOSA

Riverbanks and floodplain.

top genera

Acacia [Senegalia+Vachellia]		20.5% cover
Commiphora	15.1	
Indigofera	5.9	
Grewia	3.8	
Euphorbia	3.0	
Cordia	2.6	
Terminalia	2.5	
Dalbergia	2.2	

top families

Mimosaceae	22.1
Burseraceae	17.2
Papilionaceae	9.6
Tiliaceae	5.8
Acanthaceae	5.7
Caesalpiniaceae	5.6
Euphorbiaceae	4.2
Boraginaceae	3.8
Combretaceae	3.1
Compositae	2.4
Malvaceae	2.1

Both series have a large range of habitat and vegetation types, from grasslands to shrublands and bushlands, though bushlands are overwhelmingly dominant in each. The two series are comparable in the numbers of dominants and subordinate taxa, though most dominants are restricted to one or other of the series. The large livestock populations, particularly of camel and goat, attest to the abundance of feed primarily in the form of browse. These two classes feed more on woody plants than on herbaceous growth, and this is reflected in the richness of woody vegetation, notably bushlands. This type of vegetation covers c80% of the region and would potentially cover >90%.

Bushland is characterized by a well-developed tall-shrub and tree layer at 2-5 m with emergents to 10(-13) m. Within 1 or 2 km of permanent water this layer is poorly developed, usually degraded to a shrub layer with decimated cover (5-20% canopy). Otherwise, the tall-shrub/tree layer has (30)40-50% cover. Average woody cover in eastern Buulo Burte District is 36%. Because this includes all stands, whether pristine or degraded, it suggests that woody cover in relatively natural vegetation should be near 50% and could in fact be even higher were it not for the dense pattern of trails created and maintained by livestock. Stands have 15-40 species though usually dominated by one or a few of these. Some species are wide-ranging through many vegetation types, others unique to specific range sites. Most species are deciduous though some (e.g. some Acacia and Terminalia species) retain their leaves into the dry season, and about 10% of the bushland flora is evergreen. This evergreen component, rarely more than 2% cover in most range sites, is disproportionately important in getting stock through the dry season and is exceedingly important in the unique case of yicib (Cordeauxia edulis) in the hawd, and perhaps Satanocrater on limestones.

A dwarf-shrub layer is also usually well developed in bushland. It is not as rich in species and tends to be more strongly dominated by a few particularly tenacious low shrubs. Outstanding is Indigofera ruspolii.

Also part of bushland, though not critical to its definition, is a herb layer. It has 2 components, an ephemeral growth of annual forbs and grasses, extremely variable in amount and composition, and very much a seasonal phenomenon. The composition and biomass of this layer was not assessed, as it was felt that the time spent gathering the data would not be worth the effort because the layer probably has negligible impact on the stock economy. The second component, perennial grasses, classically has great significance in the stock economy, or to be more correct, it has great potential significance, and is often a good index of range condition in bushlands. Basal cover of perennial grasses averages out at about 1% in the bushlands but has a very uneven distribution. In general, the areas within 5 km of water have no perennial grass cover, trace amounts are found within 20 km, and prominent grass cover only begins beyond 20-25 km from wells and boreholes. There are some startling exceptions, but in general grass cover is not high and cannot be providing a large amount of feed for stock.

A moderate grass cover is desirable and possible in the bushlands, notably those on sands and rocky soils, and management plans include rehabilitation of this cover. Unfortunately, in these areas the types of perennial grasses that are present and tend to reestablish are not leafy, bulky forms. The overwhelmingly dominant grass genus on the poorer soils is Aristida, and even the perennial species of Aristida cannot be ranked as high-quality forage. Some of the aristidas, e.g.

A. anisochaeta, the dominant of some sandplains, are not easy to assess, as they can grow either as annuals or short-lived perennials, and this naturally strongly affects the assessment of range condition. Some bona fide perennials such as A. kelleri and A. hemmingii are dominants in some areas, but despite their perennial status and their favorable ratings by at least some nomads, these are stemmy grasses with narrow, often threadlike leaves carrying very little mass and clearly not as nutritious as species of Panicum, Sporobolus, Afrotrichloris, Cenchrus, Leptothrium and other widespread though less abundant perennials.

The vast areas of bushland on heavy soils especially silts, notably the region west of the river, carry or have the potential to carry a luxuriant cover of large perennial grasses, especially Schizachyrium kelleri and Chrysopogon plumulosus. A much stronger case could be made for rehabilitating these areas, rather than the Aristida-dominated sands, because the Chrysopogon zone has the potential to carry much higher biomasses of more nutritious and palatable grass. The innumerable silt pockets scattered over the shallow limestones in western Hiiraan may at one time - before nomads' incursions - carried a luxuriant cover of perennial grasses. There is no reason to suppose that the highly patchy distribution of perennial grass cover today is natural. It is, rather, the reflection of intense land use, for both stock feed and thatch and, more locally, shifting cultivation.

Evergreens are a special category in the Hiiraan rangelands. These shrubs and trees are low in diversity and generally sparse in cover, and they are generally low in palatability. Nevertheless, they play an important role in stock nutrition in the dry season when deciduous plants are leafless and essentially useless as fodder sources. Only 21 taxa of evergreens are represented, with Cadaba, Maerua, Balanites widespread, but they include two of the most important range species in Hiiraan.

In eastern Hiiraan yicib (Cordeauxia edulis) is an outstanding dominant on deep hawd sands and the mainstay of the large browser populations, while uur-dhugaal (Satanocrater ruspolii) plays a similar if lesser role on the west side. The exceptional stock populations, especially of camel and goat, and the relative wealth of the pastoralists in areas dominated by these evergreen shrubs, are probably not coincidental. Nevertheless, research is needed to ascertain the precise contribution of these plants to the pastoral economy, and what implications this may have on management here and elsewhe

The main exceptions to bushland cover in Hiiraan are the following.

(1) Grasslands. Areas with excellent perennial grass cover but little or no woody cover can be found here and there in the region. There are three basic types of grasslands, (a) pockets of grassland, perhaps fire-derived and at least in some cases fire-maintained, on the hawd sands east of the escarpment (mostly Aristida), (b) very slight broad depressions on alluvial plains (mostly Sporobolus), and (c) floodplains with Echinochloa. This last type is restricted to parts of southern Jalalaqsi District, whereas the other two are more widespread.

(2) Shrublands. According to some classifications, shrubland is woody vegetation with canopy at 1-2 m. Natural shrublands appear to be restricted to parts of the hawd, especially the E-central area W of Maxaas, and this is floristically closely related to the typical hawd bushlands. The

reason for the dwarfed stature is not known but may be related to extremely nutrient-poor soils or perhaps history of use. Most other areas of shrubland in the region, the bulk of them in the Shabelle Valley, are the consequence of land overuse and/or fallow following shifting cultivation. They have a generally poor and weedy cover.

(3) Woodland. True woodland may once have been common in the region, mainly in the valley and the western area, and may have been composed largely of Terminalia spinosa, perhaps with other Terminalia species. Vestiges of such woodland exist in the far W, e.g. W of Gobyaxaas, but because these are premier timber species, they were probably the first to be eliminated by settled pastoralists as they colonized the region. It is probably unrealistic to aim at reestablishing Terminalia woodland, but those areas still having these trees, which are under pressure from charcoal burners, need urgent protection.

A second woodland type, also present only in vestiges of its probably dominant past distribution, is Acacia nilotica woodland on the alluvial plains of the Shabelle River. These plains have had more ecological impact than any other area of Hiiraan and perhaps of all CR, so one would not expect to find anything resembling the original climax vegetation. However, stands of the woodland type still exist, and are more luxuriant in southern Jalalaqsi and southward into Jowhar. A variant has Balanites instead of the Acacia, and yet another variant, perhaps seral, has thick Acacia zanzibarica.

(4) Forest. Forest was, even in the ancient past, probably not a major vegetation type in Hiiraan, but the thin discontinuous ribbons of riparian woodland and forest are certainly only fragments of its past expanse.

(5) Dwarf-shrub grassland. One range site, rather anomalous in several respects, fits this category. Aside from this, areas dominated by low shrubs (<1 m tall) and with little or no overstory can safely be said to be strongly altered plant communities, usually in poor condition.

Kuchar, P 1989b ***Erosion problems in Hiiraan Region, Somalia*****.** LBII-CRDP-USAID Tech. Rep., Mogadishu, 8p.

Erosion has for many decades been a serious problem in parts of the country especially the north. The general impression is that a great part of the deterioration of British Somaliland vegetation has been in recent years (says Edwards 1944) but is progressing rapidly and likely serious and probably irreparable loss will ensue; this is particularly true of the *Acacia bussei* zone. Some reference to range overuse and erosion in N Somalia by Gilliland (1952).

Acacia bussei open woodland covers large areas of Somaliland, total c50,000 km^2. But over large tracts all the trees are dead, and a range of speculative reasons were formulated by earlier workers. Formerly the associated grass was Chrysopogon aucheri, now overwhelmingly Sporobolus variegatus, a low dense stoloniferous grass able to resist quite heavy grazing and a very good sand binder. Speculation that the acacia trees died due to reduced amount of water reaching the roots following destruction of the perennial Chrysopogon aucheri cover by heavy grazing. Where A. bussei woodland has been destroyed, a considerable increase in unpalatable Sansevieria ehrenbergii and Aloe rigens. Southward is haud-type acacia-commiphora bushland

and it is not severely impacted because lack of permanent water means strictly seasonal use by stock. (Hemming 1966a)

These early studies in N Somalia have seen a correlation between range deterioration and proximity of water points. The same for the coastal plains of C Somalia, where range condition is related to distance from permanent water (Herlocker & Ahmed 1986). In eastern Bulo Burte District in Hiiraan Region, there is a direct relationship between range condition and distance from permanent water. The only range in good condition is >25 km from wells and boreholes. (Kuchar et al. 1986)

Hiiraan has 19 range sites (Table 1), but virtually all areas with significant soil erosion or potential erosion are in the Shabeelle Valley, and are a function of slope and of high stock impact given the proximity of the Shabeelle R. The only erosional areas outside the valley are some sand plains E-centrally, and the dune system of eastern Jalalaqsi District (range site 2) which, although currently quite stable, has the potential for wind erosion.

Table 1. Range sites and associated landforms of Hiiraan Region

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SAND SERIES

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Active dune sands.

2 LOEWIA GLUTINOSA - CORDIA SPP.

Stable dune sands.

3 CAESALPINIA TROTHAE - CORDEAUXIA EDULIS

Southern hawd sands.

4 BOSWELLIA MICROPHYLLA - CORDEAUXIA EDULIS

Central hawd sands.

5 BOSWELLIA NEGLECTA - CORDEAUXIA EDULIS

Shallow bowls in hawd.

6 ACACIA EDGEWORTHII - INDIGOFERA RUSPOLII

Valley sands.

7 CAESALPINIA TROTHAE - COMMIPHORA CHIOVENDANA

Shallow sands over limestone.

8 ACACIA SENEGAL - COMMIPHORA CHIOVENDANA

Sandstone escarpment.

LIMESTONE SERIES

9 ACACIA SENEGAL - COMMIPHORA STELLATOPUBESCENS

Limestone hills.

10 TERMINALIA SPINOSA - COMMIPHORA SPP.

Gypseous silts.

11 ACACIA REFICIENS - ACACIA HORRIDA

Pale silt flats.

12 ACACIA TORTILIS - COMMIPHORA SPHAEROPHYLLA

Silt valleys within limestone hills.

13 DALBERGIA COMMIPHOROIDES - SATANOCRATER SOMALENSIS

Limestone/silt mosaic.

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Arced silts.

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Basaltic clay plains.

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Alluvial silts.

17 ACACIA NILOTICA - ACACIA ZANZIBARICA

Alluvial clays.

18 SUAEDA MICROMERIS - LIMONIUM AXILLARE

Saline plain.

19 ACACIA ROBUSTA – MIMUSOPS FRUTICOSA

River banks and floodplain.

Eastward and westward beyond the Shabeelle Valley, slopes are generally very low and erosion is only very locally noticeable. Some slope bases have minor gullying, and wind deflation patches can be found in areas of silt under very heavy stock impact. Erosion cannot therefore be considered a significant problem in most of Hiiraan outside of the Shabeelle Valley.

Six areas of erosion have been delineated in Hiiraan and are mostly related to specific range sites. Two of the areas represent the only serious erosion problems in the region, while the other four are relatively mild, both in appearance and in impact on vegetation and plant production.

1. Pediments of the sandstone escarpment. Water erosion is very severe in large sections below the sandstone escarpment in E Hiiraan and covers about half the Acacia edgeworthii - Indigofera ruspolii RS. Curiously, virtually all this impact is in Buulo Burte District whereas Beledweyne has very little of this sort of below-escarpment erosion.

The combination of significant (if rarely steep) slopes, strong alteration and reduction of the natural plant cover through pastoralism and shifting cultivation, and concentrated water flow from the escarpment, has caused a lot of sheet erosion, and gullying is so severe in some places as to have dissected the landscape into a badlands topography.

Conventional rest-rotation management may reduce erosional rates on some of this land, and grazing blocks in this habitat have been negotiated with the Halgen and Aborey Range & Livestock Associations (RLA's) with the hope of rehabilitating some of the land. However, this arrangement will probably not help the more seriously affected areas, which are beyond the point of self-healing.

No recommendations are being made for those areas, notably the 'badlands' sections, as it is likely that rehabilitation costs (seeding, planting, mulching) would, at least presently, not justify the gain.

This range site has a lot of areas with shifting cultivation. In the areas under cultivation, e.g. around Aborey, superior systems of water harvesting, which not only gather the water more effectively but reduce erosion, have been examined by CRDP on a trial basis (Holt 1989), and should be more widely encouraged.

2. Sand dunes. The W flank of the dune system in southern Hiiraan has been recognized as a distinct range site (Table 1). This area has some serious, though very local, problems with active

dunes. The relief is more extreme here than in the rest of the dunefield. The dunes are more exposed to wind, and their development and growth is exacerbated by cultivation along the river. The three major active dunes all appear related to noda of relatively recent, intense agricultural activity.

The total area of active dunes is a small part of the range site, but the whole foredune zone may be near a destabilization threshold. The steeper slopes, presence of local bare areas and blowouts, intensified agricultural activity, the heaviest stock use of the whole dune system, and since 1987 the burden of new refugee camps, suggest trouble ahead, though it is hard to tell exactly what is needed to set off full-blown destabilization.

The foredune system needs protection from excess cutting, but especially from heavy grazing, for the ground cover is probably more important than the woody canopy in keeping sand from blowing.

NRA and CRDP have had a strong mandate for dune rehabilitation in central Somalia, and through their 10-year existence have devoted a lot of resources to this activity, in Hiiraan as well as other parts of the CR. Dune stabilization is a high-profile activity which, though very demanding in resources, shows clear dividends both in the specific sense to ameliorate the living conditions of individual pastoral groups, and in the general sense as an effective campaign against desertification.

Hiiraan's active dune areas are minuscule compared to the dune fields of Ceel Dheere, Xarardheere and Hobyo. However, much of this coastal dune system has been deemed 'natural' (CRS), i.e. a product of geomorphology and climate rather than human impact, and furthermore, this dune system is beyond our project's resources to stabilize. The Ceel Dheere dunes have very poor range condition and poor along a fairly narrow coastal strip (Herlocker et al. 1987). The dune stabilization activities undertaken by the project were largely to prevent dunes from engulfing villages, wells and roads, rather than as a means of upgrading range condition.

At Jameeco Shin in southern Buulo Burte, the main effort was to prevent a dune from swallowing up the village. This effort was deemed a success though the cost was considerable in terms of WFP resources, project equipment, fuel and personnel, and in materials, particularly commiphora shrubs removed from other sites. The total area stabilized here was .

East of Jalalaqsi, dune stabilization was funded by ?Oxfam as well as NRA/CRDP. The stabilized area serves as a showcase for the project's activities in the Region.

It is obvious that the cure (dune stabilization) is a far more expensive proposition than preventative medicine, i.e. preventing dunes from forming. Prevention requires guards to patrol areas set aside from stock use and wood removal.

3. Stable dunes. Most of the dune field that covers eastern Jalalaqsi District and recognized as the Loewia glutinosa - Cordia spp. RS, has a good stable bushland cover and essentially no erosion. However, the fact that it is a dune system, which at one time in the past was active, should give cause for caution.

We do not know the climatic conditions under which this dune field formed, but we can be certain that impact from human activity (cutting, clearing, grazing, cultivating) was less than at the present time. We may well be approaching some impact threshold, beyond which the whole dune system could destabilize. This is not meant to sound ominous or doomsdayish, but the fact is that we cannot, with the information that we now have, predict the future course of this dune system. That is why range managers and especially the district staff should be alert for any signs of blowouts within this dune zone.

4. Sand plains. Most of the hawd, covered by two main range sites, the Boswellia microphylla - Cordeauxia edulis RS and the Caesalpinia trothae - Cordeauxia edulis RS, has insignificant erosion. The lack of obvious drainage patterns as seen on Landsat imagery testifies to the ability of the sand to rapidly absorb rainfall. However, some areas of sand, mainly in Buulo Burte District, show a moderate degree of erosion, about a 1 on the 0-3 scale of Naylor & Herlocker (1984). Hawd sands grade eastward into shallow sands over limestone, and some of these areas are experiencing mild erosion.

One band of erosion is just above the escarpment with, for unknown reasons, a broad fanning out at the S end. Heavy stock movement combined with the shallow hawd slopes above the escarpment have in combination led to a moderate degree of erosion. Most of this does not look as if it will worsen, but there are a few areas, e.g. at the top of the escarpment N-NE of Halgen, with some pedestalling and chanelling, to the extent that root systems of some of the shrubs are being exposed.

The other main area of erosion on these sands coincides with the poor range codition around Maxaas and Muqokoori. Erosion here is mild, and was not a significant contributor to the poor rating of these areas as gauged by a variety of physical and biological parameters. The inescapable conclusion is that exceptional stock populations have caused some erosion in a region not prone to erosion. There is no cause for alarm, at least not for erosion, for there are other range characters, such as hedging and lack of perennial grasses, that need more immediate attention.

The Muqokoori centre of erosion inexplicably extends westward into rangeland otherwise gauged in fair to good condition. The reason for this is not certain, though it may be linked to the presence of shallow basins.

These basins or bowls, 1-5 km wide, are shallow concavities that receive some inflow from surrounding areas of hawd, therefore exhibit more erosion than the normal hawd surface. The soils here are red or brown tinged (whereas normal hawd has orange to yellow surfaces), and carry a plant cover distinct enough to merit its own range site designation, the Boswellia neglecta - Cordeauxia edulis RS. Some of these basins are seasonal watering places for stock, while others carry a lot of grass...

5. Rocky hill/ silt valley mosaic. The limestone hills along the Shabeelle Valley are dissected by numerous small - and a few large - valleys with heavier soils and lacking a coarse fraction. Most of these valley portions have been changed from the original Commiphora-Acacia bushlands to a degraded scrubby cover of weedy shrubs and woody forbs, and with much

reduced perennial grass cover. The loss of ground cover, together with direct physical changes of the ground surface due to high stock populations and to nomadic camps which are common in these valleys, have led to water erosion. Gullying is evident in places, along with a slow, chronic loss of surface soil layers.

Erosion is not nearly as serious here as beneath the escarpment, and most of these valleys could be rehabilitated by resting.

The rocky hills themselves experience erosion but not much can be done about this, and it will never become serious due to the stable rock surface. Some patches of escarpment, with a mixture of rock and sandy surface, seem to be experiencing a very rapid loss of material, with pedestalling, etc., and channels being cut in through the soft, rocky portions. Here again, nothing short of complete protection may help reduce this action and would probably have only limited effectiveness as the erosional processes on the escarpment are largely a natural expression of slopes and rainfalls.

6. Alluvial plains. The alluvial plain of the Shabeelle River has soils mostly of silt texture and recognized as the Acacia zanzibarica - Cordia sinensis RS. Clay pockets on the plain are designated as the Acacia nilotica - Acacia zanzibarica RS. These clay patches, which form no more than 5% of the plain, generally carry a vigorous perennial grass cover and are in good condition.

The silt sections, on the other hand, are in poor condition, indeed the overall worst condition of any of the region's range sites, particularly considering the way range condition is properly assessed, as deviation from climax.

Parameters such as hedging, grass cover, dung, etc. have all contributed to the overall poor rating, but erosion has not been a strong contributory factor. That is because only very locally has erosion been obviously severe - mostly in a narrow strip near the river. Although erosion has been an ongoing process on these plains from the time, they were first affected by pastoralists and agriculturists, it has been a slow, steady deterioration, rather than any spectacular change in the surface.

The main erosional process on the plains is wind-induced. The bare surface, exposed by cultivation and continual loss of plant cover through grazing and cutting, is losing its silt cover, and in places has come to a sort of end-point in erosion, where a veneer of pebbles completely covers the surface.

These patches, usually <1 ha in size, are usually barren because nothing is able to colonize them, and they represent the worst effect of erosion on the plains.

A scarification program was at one time suggested, though never carried out.

Erosion on the alluvial plains is not spectacular and does not appear to give cause for alarm, but it is taking some of the potentially most productive land into a very unproductive state. Resting

and protecting the land would let it rehabilitate, but grazing blocks are not possible here as they are in the interior bushlands, due to mosaic of farming and informal land ownership.

If litter has any function in lessening erosion, this will require research. Based on some litter biomass vales, clearly litter abundance varies greatly (Tab.2)

Table 2. Litter in some CR vegetation stands (ST), Oct 1987, based on 1x1 m samples. All litter, woody portion included.

			litter (g)		relative % cover		
		% litter					
ST	no	cover	leaf	twig	dicot	grass	
1122	1	55	106.7	444.7	90	10	at least 2x bulk in most area
1124	2	5	4.3	11.2	75	25	
1126	3	15	6.7	38.6	90	10	
1127	4	15	23.2	16.2	15	85	
1128	5	30	10.8	133.7	15	85	
1129	6	c15	*	533.2	0	100	(basal cover) grass: great thick sward
1131	7	20					
1135	8	18	34.7	7.3	55	45	
1136	9	c7	*	264.4	0	100	(basal cover)
1137	10	7	15.5	1.7	1	99	
1138	11	15	31.9		5	95	
1141	12	60	33.5	201.0	2	98	

1143	13	30	53.4	7.1	50	50	
1145	14	25	38.1	6.9			Thespesia lvs.
1146	15	14	18.2	5.9	0	100	Thin-looking, but normal for salt flat CT
1148	16	2.5	6.8				mostly fr
1152	17	55	205.7	404.8			
1153	18	18	93.2	498.0	95	5	twig is 5 of the 18%
1154	19	27		395.5			twig is c4 of the 27%

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Kuchar, P 1989c ***Hedging indicator species in Hiiraan Region, Somalia*.** CRDP, draft rep., 13p.

Abstract

Hedging, which is the degree to which woody plants are browsed back by herbivores, is a valuable indicator of stock impact and range condition in areas dominated by woody cover. The extensive bushlands of Hiiraan Region have a sizeable flora of shrubs and trees, and large browser populations, notably camel and goat, and here hedging is the single most useful range condition indicator. The response of different woody plant species to browsing varies. The more common woody species of Hiiraan are listed (together with their Somali names, some updated) in these categories: sensitive hedgeable (15 species), normative hedgeable (65), insensitive hedgeable (61), and unhedgeable (73).

Introduction

The rangelands of central Somalia consist largely of deciduous bushlands. Grasslands, dwarf shrublands and low shrubby vegetation types are found on the coastal plain (Herlocker & Ahmed 1986). In the interior, low vegetation is found mainly in parts of Mudug Region. The bulk of the interior has bushlands, i.e. vegetation dominated by shrubs and trees forming a distinct canopy at 2-5(-8) m (Herlocker et al. 1987). This physiognomic form is particularly well developed in Hiiraan Region, where an estimated 90% of the region is potentially bushland and c80% is presently dominated by bushlands.

Assessment of the condition of the range, i.e. its production status with respect to the climax state, is normally done by observing a range of physical and biotic parameters (Naylor & Herlocker 1984). In bushlands the degree of hedging, i.e. how heavily plants have been browsed back, is an extremely valuable indicator of stock impact, and of overall range condition. Hedging is probably the single most valuable condition indicator of the Hiiraan rangelands.

Most of the tree and shrub species in Hiiraan Region are utilized by browsers. A survey of the 220 commonest woody species (Kuchar 1989) found that only 10% were unpalatable. In other words, 90% were utilized to some degree or other. But by no means all species that are utilized will actually show signs of use. In some, only the leaves are taken, and the crown will not exhibit any distortion following utilization. Others are infrequently browsed because they are not highly palatable or have crowns that are out of reach. Finally, at least half the 500 or more woody species of Hiiraan (Kuchar 1988) are rare or uncommon enough that, at least for now, they are not worth mentioning in the context of indicator value.

Hedging categories

Woody range plants may be arranged in 5 categories in terms of their response to browsers:

1. Sensitive hedgeables. These species are preferentially and easily hedged even at light to moderate browsing rates, and at high browse rates may be wiped out or become indistinguishable

from moderate rates of use. They are therefore the best indicators of light use, but insensitive at the heavy-impact end.

2. Normative hedgeables. These species faithfully reflect stock impact: at light browsing rates they show light hedging, which grades to heavy hedging under heavy browse impact. Abundant, wide-ranging species in this category are the most preferred indicators of hedging.

3. Insensitive hedgeables. These species show little if any hedging at light and medium browsing rates and only begin to be hedged under heavy stock impact. They therefore make good indicators of high stock pressure, and in terms of hedging as an impact parameter may be the only useful indicators under very high stocking rates, but they are insensitive to light stock use. A particularly notable example is *Indigofera ruspolii*, a very abundant tall dwarf shrub and shrub to 1.5 m. It usually looks untouched though pastoralists laud it as a great browse.

4. Unhedgeable. This category includes unpalatable species that are never browsed, and some palatable species which however never (or virtually never) show signs of hedging, usually because only leaves and not twigs are taken, or because they are almost always out of reach (e.g. *Albizia anthelmintica, Delonix elata*). A few species are palatable but when taken, the whole plant is taken (e.g. *Aristolochia rigida*), leaving no sign of use.

5. Unpredictably hedgeable. These are shrubs which have no clear correlation between degree of use and degree of hedging, usually because they are rarer species that have not been observed enough for a correlation to have been developed. A few common species also seem variable in their hedging response; Euphorbia cuneata and Gardenia fiorii are two examples.

Easily confused with the truly sensitive species are certain shrubs and trees that are always heavily hedged (even though not necessarily overly sensitive to hedging), thus giving the appearance of being sensitive. Many of the evergreens are in this category. They resist browse impact well but are so heavily browsed in the dry season that they show a high degree of crown distortion. They are not very useful indicators of hedging over most of the scale of impact seen in Hiiraan, and a range man would probably do well to avoid incorporating them in the hedging index. However, they may be of some value in areas very lightly used by stock, where they may exhibit something less than the uniformly heavy hedging that one normally encounters.

Common indicator species of hedging in Hiiraan Region are listed, together with Somali names), in the categories of sensitive, normative, and insensitive species (Tables 1-3). Those in bold are particularly widespread and accordingly useful. Also listed (Table 4) are the more common species which are not hedged, the main reasons being either their unpalatability or inaccessibility.

Table 1. Common woody species in the sensitive hedgeable category.

---

xBalanites aegyptiaca kulan

xBalanites rotundifolia	kulan, shillin
xBoscia coriacea	dhegayare, qalaanqal
xBoscia minimifolia	meygaag
Boswellia microphylla	muqle
Bourreria orbicularis	hamir, himir
xCadaba baccarinii	jiic, jo', qalaanqal, jawjaw
xCadaba heterotricha	higlo, qalaanqal
Commiphora alaticaulis	dibayaxaas
Cordia suckertii	hamir, guday, cuddo
xDobera glabra	garas
xMaerua angolensis	jiic, lamaloshe
xMaerua sessiliflora	jiic, qalaanqal
xMaerua subcordata	qalaanqal
Opilia campestris	jo'

NOTE: It is notable that the majority (marked x) are evergreen.

Table 2. Common woody species in the normative hedgeable category.

Albizia anthelmintica	reydab
Albizia obbiadensis	bilcil, hoyim, huyum
Allophylus rubifolius	waxarababis, waxaro abaabis
Anisotes involucratus	marjis, mirdhis
Asepalum eriantherum	xajiin, xajiin-caseeye, qabac

Bauhinia spp	bilcil
Blepharispermum fruticosum	baanyo, gahaydh
Bottegoa insignis	gora adei
Cadaba farinosa	caanamacays, qalaanqal
Cadaba glandulosa	kish, qalaanqal
Cadaba mirabilis	kish, qalaanqal
Caesalpinia oligophylla	dansey
Carphalea glaucescens	burbursi, garda
Caucanthus albidus	jecjec, mindhicirood
Caucanthus edulis	marmarood, mardaf, mindhicirood, sirsiriq
Cleome hanburyana	geed irmaan, subagle
Coffea rhamnifolia	dhiingaras
Combretum aculeatum	mardaf, sorog cad
Combretum angustipetalum	cidigod, marlaas
Combretum hereroense	sorog
Commiphora albiflora/velutina	dhundhus, qaroon
Commiphora gurreh	gunre
Commiphora aff. oddurensis	afgub
Commiphora paolii	shabfarood, caanamacays
Commiphora 'sabulosa'	quraar, quraar cad
Commiphora sphaerophylla	xagar
Commiphora truncata	muqle, gondod
Cordeauxia edulis	yicib, gud

Cordia monoica	docol, deelaal, mareer qoox, mareer deylib
Cordia sinensis	mareer, mareer docol
Croton spp	caduur geel, bahiye
Dalbergia commiphoroides	dhuyac
Dalbergia uarandensis	dabakar
Dichrostachys kirkii	dhiigtaar, sagaarogal
Duosperma longicalyx	sarin, yacay
Gossypium somalense	balanbal, suuf, suuf duur, suuf-cawlood
Grewia bicolor	dhebi
Grewia erythraea	mudhcanyo, dhamaag, miracas, miriyood
Grewia penicillata	ohob, hohob
Grewia tenax	dhafaruur, muryo
Grewia villosa	kabash, gomosh
Hildebrandtia africana	hiiran, hiirin, danyo
Hildebrandtia sepalosa	hiiran, hiirancad
Hildebrandtia somalensis	hiiran cade, marmarooq
Indigofera schimperi	dharqo
Indigofera spinosa	xajiin, qodax
Indigofera volkensii	geed xajiin, nagaar
Justicia kucharii	qaalmo waalis
Justicia potamophila	dhegdheg, fiido-fiidole
Kirkia tenuifolia	doofaar qod
Limeum fruticosum	hiiran

Limonium axillare	dabayood, habo, kuuskuus
Ochna inermis	hamir, qoqoble
Ormocarpum muricatum	laamolood, dakakar, maroodi-makaraan
Pentanopsis fragrans	geedcawleed gaab, qarjowle guduud
Pleuropterantha revoilii	lug-keliya, geed macalin
Premna resinosa	jacjac, jacjacle
Psydrax graniticola	do'
Satanocrater paradoxus	uur-dhugaal
Satanocrater ruspolii	uur-dhugaal
Sericocomopsis pallida	yacay, sufur cad, geedcad, wancad
Sesamothamnus busseanus	saw, salalmac
Strophanthus mirabilis	dablasooroor, dhuumood, jacjacle
Terminalia polycarpa	hareeri
Wrightia demartiniana	xay, xayey

Table 3. Common woody species in the insensitive hedgeable category.

Abutilon spp.	balanbal, balambal
Acacia horrida	sarmaan, galool
Acacia oerfota	gumar
Acacia ogadensis	cadaad, cadaad geri
Acacia paolii	gumar
Acacia reficiens	qansax

Acacia stuhlmannii	qaydari, gumar
Acacia zanzibarica	jiiq, fulaay, waadhi
Barleria argentea	nagar, geed-xareed
Barleria brevispina	odaxtool, xiddig, mici too'
Barleria glandulifera	sunfur weyne, nagaar-ubaxle
Barleria mucronifolia	xiddib, qodax, macayritile
Barleria proxima	qodaxtool, qodex
Barleria quadrispina	macay-ritile
Boswellia neglecta	mirafur, muqlo-jareer
Caesalpinia erianthera	qoodhi, jirmo
Caesalpinia trothae	geel-reeb, gorgor
Commiphora bruceae	caano-macays
Commiphora chiovendana	qaroon
Commiphora cyclophylla	quraar, hablosubke
Commiphora ellenbeckii	dhirindhir, dhintaar, caanamacays, raxanreeb
Commiphora gileadensis	ilka cadeey, dhasayn
Commiphora gracilispina	raxanreeb, dhirindhir xaws
Commiphora horrida	gabrar, dhiti
Commiphora incisa	raxanreeb, naxareeb, waraabe-reeb, xoday
Commiphora kua	beeyo, xagar, dhammaaji, dhiintaar
Commiphora stellatopubescens	gundod, malmal-cadde
Corchorus cinerascens	geed cad, gicad
Cordia somaliensis	deelaal, mareer

Heliotropium aegyptiacum	madax cadeeye, xajiin farole
Heliotropium laxum/rariflorum	ruqso-maadoobe
Heliotropium longiflorum	food-cade, cariig, garawle
Heliotropium sessilistigma	
Heliotropium steudneri	food-cade, suntaar, xajiin madoobe
Heliotropium zeylanicum	geed-biyood, xajiin madoobe
Hermannia spp.	saalaweyneeye, afkudufanle
Helinus integrifolius	hiram madow, shabanshab madoobe
Indigofera coerulea	dharqo dharqo madow, dharqo-jini
Iphionopsis rotundifolia	gagabo, gagabey
Ipomoea citrina	buris-celis, shafee cay
Ipomoea donaldsonii	waraabe hergal, buulo-lood
Indigofera ruspolii	qurbaan, qurdhubaan
Lannea cotoneaster	wacanri
Lawsonia inermis	cilaan, eyreb
Leucas abyssinica	yublulac, yacay
Lycium shawii	surad, surad-cad
Maerua oblongifolia	qabdha, kish
Oxygonum altissimum	geed qarar
Parkinsonia aculeata	geed walaayo
Senna ellisiae	jiriir, jaleelo
Sesamothamnus rivae	saw, salalmac
Solanum jubae	caduur

Sterculia spp.	qararrro, dharrab
Tephrosia obbiadensis	xolmaar, geed-xajiin
Terminalia orbicularis	bisiq
Terminalia prunioides	hareeri
Terminalia spinosa	xarar, hareeri
Thespesia danis	kabxan
Triumfetta actinocarpa	xajiin, saalaweyneeya
Vernonia cinerascens	hiil
Ziziphus hamur	xamur

Table 4. Common woody species that are in the unhedgeable category. Classes: 1 = unpalatable, 2 = often inaccessible (tall trees), 3 = palatable but never or hardly ever noticeably hedged, 4 = eaten but usually none left, 5 = hedged but reaction variable therefore (at least for now) not recommended as hedging indicators.

Acacia edgeworthii	3	jeerin, gumar jeerin, dheer-dheere
Acacia hamulosa	3	cadaad, cadaad-cad, bilcil-cadaad
Acacia mellifera	3	bilcil
Acacia nilotica	3	maraa, tuugaar
Acacia senegal	3	cadaad, cadaad geri, bilcil, jiiq
Acacia tortilis	3	qurac, qudhac, aqab
Acacia walwalensis	3	

Acacia zizyphispina	3	cadaad-ciddidheer, cadaad-cijigod
Adenia spp.	1	lamagooyan
Adenium obesum	1	obbo, aboobo, omba-nageed
Aerva javanica	1	hambooye, soome
Aloe spp.	1	dacar
Anisotes trisulcus	1	mirdhis, majabe
Aristolochia rigida	4	wees
Asparagus africanus	5	arjeeg
Astripomoea procera	3	balanbal, fiidole
Barleria hildebrandtii	1?	madaxcade, busley
Blepharis edulis	3	yamaarug, xiddig
Blepharis ogadenensis	3	ruqsey, gabogabo
Calotropis procera	1	booc
Caralluma spp.	1	gowracato
Cissus spp.	1	carmo, carmodhagay, dhegoweyn
Commiphora hodai	1	xoday
Commiphora lobatospathulata	1?,5?	dililiqo, fullay, luuqtool, sagaarosal
Commiphora myrrha	3	dhiddin, malmal
Commiphora oddurensis	3	xoday, reymol
Commiphora rostrata	1?	Jinow, subagle
Commiphora samharensis	3?	qaroon, quraar, gumbo weyne
Commiphora sennii	1	xoday, xudi
Cordyla somalensis	1	ontar, ontor

Cucumella kelleri	1?	aneex, aneexo
Cyphostemma spp.	1	carmo
Delonix baccal	2	bakal
Delonix elata	2	lebi
Desmidorchis spp.	1	udaabteys, tugunbarbaar
Entada leptostachya	2	kabaqor
Erythrina melanacantha	1	yooc
Euphorbia cuneata	3	dhirindhir
Euphorbia erlangeri	1	qabo yaro, qabayar
Euphorbia longispina	1	qabo
Euphorbia migiurtinorum	1	qabayar, kabir
Euphorbia robecchii	2	dharkayn
Euphorbia schizacantha	1	qabo yare
Gardenia fiorii	5	yabaarayeel, dhingaras, madax madaal
Glossonema revoilii	1	karuunjo
Gyrocarpus angustifolius	2	yucub
Jatropha dichtar	1	dhiigtaar, dhiiqle
Jatropha pelargoniifolia	1	dhiiqle, deeqlay
Jatropha rivae	1	isqubu, dhiiqle
Kelleronia gillettiae	4,5	geed aboodi
Kleinia spp.	1	wisil, lamax, qodaar
Leucas jamesii	1?,5	rasow
Loewia glutinosa	1	rummasan, balalaq

Melhania spp.	1,4?	Saalaweyneeye, caleemaal, ari jecel, balambal
Momordica spinosa	1	madax bushaar, saarsaar
Moringa borziana	4,5	mawe
Moringa longituba	4,5	mawe
Ocimum jamesii	3	sufur cad, yacay, yacey-cade
Pavonia spp.	1,4?	yabcal, balambal, saalaweyneeye, timofaaxis
Pergularia daemia	1	canoole
Phyllanthus somalensis	1	majabe
Platycelyphium voense	1	sabansabdho, balalag
Sansevieria ehrenbergii	1	dhiti, xaskul
Sarcostemma spp.	1	ciin
Senna truncata	1	jaleelo, hanjaleelo
Senna spp.	1	jaleelo, hanjaleelo
Solanum incanum	1	caduur, mooh, kariir
Solanum somalense	1	hanbalac, caduur, kariir
Tribulocarpus dimorphanthus	5	daacul, kaxar
Triumfetta heterocarpa	5	kabgal
Uvaria denhardtiorum	1	murug, cismaan-dooy
Waltheria indica	5	saalaweyneeye, nagaar
Withania somnifera	1	cabcab, geedduge, gurayafan

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Naylor JN & D Herlocker 1984 Criteria for range condition classification. CRDP Tech. Rep. Ser. No. 6, 26p.

Leslie, AD 1989 ***Tree phenology and seed collection in Somalia***. ODA Brit. For. Proj. Som. Res. Sec. Working Pap. No. 10, 36p.

Seeds belong to 2 broad groups, orthodox (readily dried to c5% moisture content, & can be stored at low temps for long periods) and recalcitrant (difficult to store because they can't be dried below c30% moisture & won't survive below 5C). Reducing moisture content to 12-14% stops fungal damage, & below 8% prevents insect damage. Rules of thumb from lit: every 1% decrease of moisture content below 13% doubles a seed's life, as does every 5C temp reduction from 50 to 0C.

In this study, bruchid beetles were the most important damaging agent of the various woody species. Notable for acacias and *Terminalia*.

Collections from various localities in S Somalia. Noted much variation in form in some species, especially *Acacia oerfota*, *A. horrida* and *A. seyal* [*actually A. zanzibarica*] which exist in 2 forms, arborescent and bush. "This may be phenotypic, genotypic or both."

Shepherd, G 1989 ***The reality of the commons: answering Hardin from Somalia***. Devel. Policy Rev. 7(1): 51-63.

(abst.) Against the background of Hardin' s 'tragedy of the commons', Shepherd reports on work undertaken in the Bay Region of Southern Somalia between January and April 1988. During this time it became clear that the assertion and denial of common property rights to bushland were at the heart of the energy issue which was the original field of study. It also describes the early stages of research aimed at returning common property rights to rural people who have lost them, and thereby ensuring the survival of resources which would otherwise be lost as well. People in the Bay Region survive by the complementarity of the low-risk trees-and-livestock component of their economy practiced on sandy soils, and high-risk sorghum cropping on clay soils. The Region is also the main source of charcoal (300 T per day) for the capital, Mogadishu. Fieldwork indicates intensive conflict over trees, particularly disappearance of species suitable for building materials: *Acacia bussei, A. senegal, A. tortilis* and *Terminalia* spp. Fodder species are also being used as fuel *(Grewia* spp*., Cordia* spp. and *Commiphora* spp*.).* However, communal land rights were as much of an issue as trees. Villagers proposed solutions to the common property rights' problem, including reserving rights of groups to portions of woodland, improved control of use

of trees for poles, legal rights to control charcoal burners, and new land management arrangements. These issues were discussed at a national seminar.

Thulin, M & AM Warfa 1989 ***Cyclamen (Primulaceae) in tropical Africa***. Pl. Syst. Evol. 166: 249-252.

The veg of Al Miskat Mts, Al Madu & the other mts of N Somalia has a strong Mediterranean impression. Juniperus procera, Olea europaea ssp africana, Pistacia falcata, Brassica somalensis, Anemone somaliensis, Teucrium polium, Salvia somalensis, Cheilanthes catanensis, Cyclamen somalense are Medit. elements or have close relatives in the Medit. region. This element is mixed with a tropical element. This disjunct Medit. element is believed to be largely a relic of Tertiary origin that has survived in the Medit.-type climate of dry hot summers and winter rain.

Thurow, Thomas L & Abdullahi J Hussein 1989 ***Observations on vegetation responses to improved grazing systems in Somalia.*** J. Range Manage. 42: 16-19.

"Increasing dry season forage availability is a primary objective of range management programs in Somalia." When rainy seasons are brief but intense, short-lived annual forbs quickly dominate deferred-grazing sites of fair or poor condition. The vine habit of several of the dominant forbs rapidly overtops and outcompetes other cover. Such forbs are of little use for dry-season forage since they die and decompose soon after the rains. Hypothesis: short duration use during growing season facilitates more rapid grass establishment than livestock deferral, by grazing back the initial surge of vines.

Study site S of Afgoi. Shrub cover A. horrida, A. tortilis. Methods: 10 0.25 m^2 plots (quadrats) in each of heavily grazed pasture, moderately grazed, and exclosure, standing herbs clipped, dried, weighed. Also 10 permanent plots in each of 2 stands. Herb layer in Table 1, which gives relative composition by heavily grazed (common pasture), moderately grazed, and exclosure. Much lower grass cover under heavy grazing, also differencess with forbs. Forb standing crop extremely similar under all 3 regimes. Grass biomass much lower in heavily grazed pasture and this included virtually all the species, forbs much higher. I can't believe the graph tracking grass standing crop, and the tracked forb standing crop over 3 yrs was almost identical for all 3 treatments! (But it combined unpalatable and palatable species, which behaved oppositely in open pasture vs. exclosure.) Litter biomass is highest under no grazing, at some periods exceeding 1000 kg/ha. It is much lower, sometimes close to 0, under heavy grazing.

Thurow, TL, DJ Herlocker & AA Elmi 1989 ***Development projects and Somali pastoralism***. Rangelands 11: 35-39.

General info on pastoral system. Important characteristics: mobility, family herd dispersion, female pref, large herds.

Communal access to range with few restrictions on its use. *"Somali pastoralists are loath to restrict use of traditional grazing areas by others, even if there is perceived rangeland degradation, for fear that when rain eventually fails in their own area, they may be excluded*

from neighboring regions." (is this based on anecdotal info, sociological surveys, or what? Can the connection be made so clearly?)

"The historical balance between the environment and production system has been altered over the past several decades, forcing the traditional pastoral system into a state of transition." *(or is this being forced on them by Gov & Aid?)* Two traditional major checks on human & stock growth were water & disease. These have been overturned.

"Brown (1971) [Biol.Conserv.3:83] was among the first to recognize that it is increasing human populations that force overstocking on many pastoral rangelands. Pastoralists are keenly aware that the rangeland is deteriorating, but they are unlikely to respond by decreasing livestock density because that would jeopardize their subsistence livelihood. The range resource itself is shrinking due to pressure for agricultural development of critical dry season pastures."

Boreholes create land-use conflicts between (semi-)settled pastoralists who make large enclosures, & nomads who need forage near the water.

Reduced herd size trend means lower ability of families to subsist on livestock products alone. Shift in diet from c5% to 40-45% grain in 40 yrs.

Historically, camel:shoat value was c15:1 but in recent yrs has dropped to c6:1; various reasons (p.38). Trend toward shoat emphasis has ecological implications: closer browsing & grazing, & sharp hooves on soil.

(Range) development programs have not had as bad an envir. or social impact as feared, because few projects last more than a few yrs. Need integrated (i.e. not sector) approach, with long-term commitment, before devel. programs can hope to succeed. They call it a 'challenge'. (*But what exactly will these projects be doing – will it be the same old things, which have been so severely criticized in recent yrs, as the transplanted U.S. system supposedly does not fit the milieu.)*

Acacia horrida with wide ecological amplitude and one of the commonest plants, absent only on gypsum and scarce on basaltic soil