Perennial Plant Mortality in the Guban Area of Somaliland

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HEINRICH BÖLL STIFTUNG
EAST & HORN OF AFRICA

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This document has been produced with the financial assistance of the European Union and Heinrich Boell Foundation; the Contents of this document are the sole responsibility of Candlelight for Health, Education & Environment and can under no circumstances be regarded as reflecting the position of the EU and HBF.

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Acknowledgements

I would like to acknowledge individuals and institutions that made their contributions to this study. In particular, I thank the Ahmed (Jamal) Ali Jama, regional director of the Department of Environment and Pastoral Development, the Berbera Airport Police and the community representative of the different villages visited during the assignment for their hospitality and for providing information. I would also like to fully acknowledge the staff of Candlelight who participated in the study namely: Lemma Belay, Abdiqani Suleiman, Abdillahi Khalif and not forgetting Khadar Ibrahim and Mohamed Omer for keeping the vehicles in good shape for the arduous desert driving.

Special thanks goes to Haron Ahmed Yusuf, a member of Social Research and Development Institute (SORADI), for proof-reading and giving useful general comments on the text.

Finally, I thank the European Union (EU) and Heinrich Boell Foundation (HBF) for funding this case study.

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Executive Summary

The extraordinary demise of certain perennial plants such as *Acacia tortilis, Balanites orbicularis* and *Suaeda Fruticosa* in the coastal areas of Somaliland, particularly between Berbera and Lughaya districts, has been a subject of discussion and debate among a lot of people, including the direct resource users, pastoralists in particular. Different explanation has been put forward to shed light on the causes of this problem and these include: chemical contamination, pro-longed droughts, climate change and plant diseases.

This study is an attempt to find an answer to the root cause of the unusual mortality of these plants, through discussion and analysis of the above mentioned factors and their relationship to the phenomenon.

The historical meteorological data available for the coastal areas, though not comprehensive just like the data for other parts of the country, shows a trend of a continuous decline in rainfall. The reduction of rainfall has been greatest in semi-arid regions and along the coast (Hemming, 1966).

The effects of the deficits in rainfall can be gleaned from the condition of the vegetation. The plants became adapted to the harsh coastal environment and have developed small leathery leaves and deep roots. Most plants are deciduous but some are evergreen (*Balanites* and *Suaeda fruticosa*) and they protect themselves from water loss by having small "waxy" green leaves. However, a succession of dry seasons may result in the disappearance of perennials and an increase of annual plants. {Malte Sommerlatte and Abdi Umar (2000)}.

The reason why Berbera area has attracted the biggest attention is that the problem is most noticeable in its environs. This is a result of heavy exploitation of plant resource, coupled with prolonged drought periods. Furthermore, while there is growing evidence on the progression of climate change effects in the Horn of Africa, like elsewhere in the world, the semi-arid *Guban* is receiving its share mainly in the form of extended periods of droughts resulting in decline of underground water levels, which is crucial to the survival of perennial trees under investigation.

Therefore, it can be argued that the ensuing water stress is a key factor in the high mortality rate of plants in the coastal area.

In the search for an explanation to the widespread mortality of some perennials in the study area, this study has put more emphasis on climatic and anthropogenic aspects of the subject matter. Therefore, as a follow up to this study, an in-depth investigation of the impact of chemical contamination (even though localized within Berbera environs, the Airport area in particular), resulting from leakage and/or intentional spillage, is essential.

Finally, the continuous trend of the death of vegetation will definitely have a negative impact on the sustainability of the pastoral livelihoods in the future, as this will lead to a decline in browse foliage for livestock herds.

1.0. INTRODUCTION

This study seeks to assess the unusual mortality of some of the perennial plants such as Acacia tortilis, Balanites orbicularis, *Suaeda fruticosa* and Zizyphus hamur in some locations of the coastal areas of Somaliland. The local communities, particularly pastoralists whose livelihoods are heavily dependent on the condition of the rangeland, have been giving different explanations on this disturbing trend, which surfaced in the early 1990's.

The study also aims to identify the possible causes of the accelerated plant death in the target areas and further explore the probable impact on people's livelihoods.

2.0. THE STUDY AREA

The study area is located in the coastal area of Somaliland[1] and the adjacent sub-coastal areas further south towards the Golis Range escarpment. This ecological zone has distinctive features compared to the other eco-zones of the country which include, according to earlier classification[2], the evergreen *montane* (mountainous) forest formation, *Acacia Bussei* Open Woodland, Gypsiferous Areas (Nugaal) and Haud-Type mixed bush.

The maritime plain runs parallel with the Gulf of Aden and varies in width from 60 km in the western part of Somaliland to less than 1 km in the east and is covered with a mantle of stony or sandy alluvium and raised beach deposits[3]. Specifically, the study focused on the following areas:

a) In Berbera area, the locations under investigation were: Berbera Airport, Kurta Kaaraha, the police checkpoint on the Berbera-Hargeisa road and as far as *Jiifto* hill (11.4 km away from Berbera), Suryo Malable on the Berbera-Burao police checkpoint (10 km) and Biyo-guure, an oasis with running stream situated approximately 16 km east of Berbera;
b) Bullaxaar area: Approx. 65 km. west of Berbera;
c) Abdi-Geeddi: Approx 100 km west of Berbera; and
d) Lughaya, 125 km west of Berbera

1 Somaliland, formerly North West Somalia, is located in the Horn of Africa. It borders the Gulf of Aden to the north, Somalia to the east, the Federal Republic of Ethiopia to the south and the Republic of Djibouti to the west. Somaliland was formerly known as the Somaliland Protectorate under the British rule from 1884 until June, 26th 1960 when Somaliland got its independence from Britain. The independence was short-lived as the new republic merged few days later (July 1, 1960) with the former Italian Somalia to form the Somali Republic. The merger did not work according to the aspirations of the people, and the strain led to a civil war which dragged from 1980's to the demise of Somali Republic. In 1991, representatives from the various clans of Somaliland held a congress in which it was decided to withdraw from the Union with Somalia and to reinstate its sovereignty. Since then, Somaliland has been peaceful, stable, with a functioning national government for over a decade, but the country remains unrecognized in the international arena.
2 Hemming, C.F., The Vegetation of Somaliland, 1966, Proceedings of the Linnean Society of London
3 C.F. Hemming, The Vegetation of Somaliland, 1966, Proceedings of the Linnean Society of London

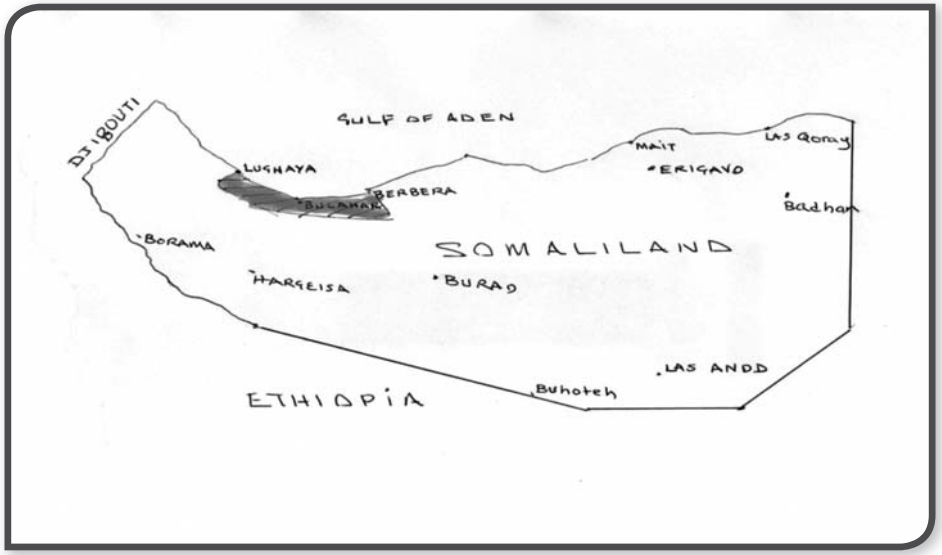

Figure 1: Map of Somaliland with highlighted study area

3.0. CLIMATE AND RAINFALL

The study area is located in the Guban, which means 'burnt' in Somali – an allusion to the high temperature levels during the *Xagga* (summer) and the prevailing desert environment.

The area is characterized by high temperatures and humidity, little rainfall (about 50mm annually) and sparse vegetation. The terrain is bisected by numerous and broad seasonal watercourses, known as *Tog*, which originate from the escarpment. Despite the desert type environmental condition with the archetypal sand dunes, the area affords excellent grazing to goats, camels and sheep, following a succession of good rains.

The occurrence of rainfall in Somaliland is subject to the movement of the sun back and forth across the equator twice a year. The south-west monsoon which blows from May to September brings with it the long rains (known locally as *Gu*) and marks the beginning of the hot summer season, whereas the north-east monsoon which blows from October to April marks the beginning of the short rains (known locally as *Deyr*) and the cool winter season. During the summer and in the absence of rainfall, a strong hot wind with sandstorms blows, which desiccates the land and causes a considerable amount of sand erosion. The Guban, in particular, sometimes receives light showers known as *Hays* during December.

Temperatures are generally high and during the summer months maximum temperatures on the plains are commonly over 400C (1040F). In the winter months, the relative humidity at Berbera during 08:30 in the evenings varies from 70% to 82%, and in August the average is 45% (Hunt, 1951). The relative humidity on the plain appears to be closely related to the proximity of the sea, with lower humidity prevailing inland. The rainfall is highly variable. For example, Hemming (1966) put the long-term rainfall average (43 years) for Berbera at 57 mm; with the driest year 1947 at only 1.8 mm and the wettest years at 178 mm in 1906, and 161 mm in 1910. Recent statistics show even less rainfall. For example, rainfall data from 1973 to 1978 showed 0 mm. No data was available from 1979 to 2007. *(Source: www.faoswalim.org/ Berbera Station Manual Rainfall Data)*

The main limitation in obtain a more comprehensive data on the climate in the study area is the lack of meteorological records. There are no weather stations available at any locality on the coastal plain other than the one in Berbera town.

4.0. VEGETATION

The vegetation in the study area is a combination of low bushes and grass clumps which are adapted to the semi-desert environment. These consist of halophytes such as *Suaeda fruticosa ('Xudhuun'), Zygophyllum album, ('Dinaas'), Halopyrum and Salsola foetida ('Xajiin'), Lasiurus hirsutus ('Darif'), Panicum turgidum ('Dungaare'), Eleusine eragrostis* and *Tragus* in the saline areas bordering the sea. As one moves away little further from the sea, the area is dominated by well-spaced *Balanites orbicularis ('Kulan'), Acacia tortilis ('Qudhac'), Salvadore persica ('Caday'), Acacia edgeworthii ('Jerin'), Dobera glabra ('Garas')* sprinkled with *Cadaba glandulosa ('qalaanqal')* and *Boscia minimifolia ('Maygaag')*. A prominent feature along the seasonal water courses is the presence of *Tamarix nilotica ('Dhuur'), Zizyphus hamur ('Xamudh')* and *Leptadenia spartium ('Moroh')*.

The high variability of rainfall has considerable effects on the regeneration and establishment of perennials. For example, a succession of dry seasons may result in the death of perennials.

Along the banks of the seasonal watercourses *(Tog)*, where trees are usually established, they are able to tap on the underlying water-table. Trees standing on low-lands with good aquifers are also greener than those standing on higher grounds, which are more likely to wither and die after a succession of dry spells.

The scale of deforestation in the study area has been recorded by early foreign travelers in Somaliland. According to the observations made by Major H.G.C. Swayne during the last years of the 19th century:

> *"The plain immediately around Berbera is covered with white pebbles and devoid of bushes; a mile or two inland it becomes sandy and covered with a flat-topped mimosa, which is called Khansa, growing here to a height of about three feet. There are also scattered thorn bushes about twelve feet height. The plain around Berbera has been greatly denuded of bush for firewood since 1885. I have watched this denudation gradually going on year after year, and have attributed*

it to the increased traffic since the British have been at Berbera, and to the fact that town {Berbera} is now well populated all the year round, giving the bush no chance of recovering after the trade season is over [4]".

The three foot high *Khansa*, probably *Khansah* tree *(Acacia misera Vatke)* noted by Major Swayne in the coastal maritime plain is intriguing, as this species is nowhere to be found in that very short distance from Berbera, currently. The study team tried to probe and cross-check this information with some elderly people in the area, by asking them whether they had ever seen or heard of *Khansah* trees in that very area. Their response was in the negative. Upon further investigation, the study team found out that *Khansah* bushes are well established in stands further south in the sub-coastal zone at a distance of 30 – 40 km inland.

Interestingly enough, during a transect walk in an area near Jiifto Hill (12.3 km south of Berbera), the study team came across a lone *Delonix elata ('Lebi')* tree {see fig. 8) towering above the low bushes in the maritime plain. The tree was showing all signs of over-use, with severed branches spread on the ground, most definitely lopped (felled) as a browse for goats. This species is known to produce best timber for carving traditional camel bells *(koor),* but sadly one can rarely encounter saplings (young trees) anymore – a clear indication that it is subject to over-exploitation. The presence of this tree in that area proved a surprise to the study team, as it is known to be dominant in the sub-coastal areas that lie at the foothills of the Golis Range. The existence of this single tree in the relatively unsuitable climatic location could support the assumptions that either over-utilization contributed to its dwindling in that area or climate change have pushed it to the cooler sub-coastal areas that have higher rainfall. Climate warm up often leads to an upward elevational migration of plant species[5]. This is likely to be true for the two species mentioned above (*Khasnah* and *Lebi*), which have been pushed to cooler and higher elevations. Hence, it is logical to raise the following question: *Could similar climatic processes are facing the plant species under investigation?*

5.0. RESOURCE USERS AND NEW GRAZING TRENDS

Unlike the coastal towns, namely Berbera, Bullaxaar and Zeila, which have been in existence for over two millennia as ancient trading posts, the hinterland used to be a vast wilderness containing high diversity of plants and teeming with wildlife. Pastoralists used to roam, as they do today, in the open country, from one place to another with their livestock (sheep, goats, cattle and camels) in search of water and better grazing and in response to changes in climatic

4 Swayne, Seven Trips Through Somaliland, (1890), p.362 Kessinger Publishing's Legacy Reprints.

5 This is confirmed by a recent study carried out in Southern California which "suggests (that) recent (global) warming is behind a massive die-off and rapid migration to higher ground by nine different species where of the plants had moved to elevations 200 feet above their previous growth range (Source: CBSNEWS: Los Angels, August 11, 2008, "Global Warming Linked to Plant Migration".

conditions. During the hot summer *(Xagaa)* season, from June to September, pastoralists used to escape the unbearable heat of the *Guban* eco-zone to the cooler *Golis Mountains* and *Oogo* plateau and further to the *Hawd* wet season grazing areas. The cycle was again reversed in the winter (*Jilaal*) season (November to March) when the *Guban* area is cooler. These yearly 'pulsatory' seasonally managed movements, which were dictated by nature served as a key factor in maintaining the near sustainable utilization of the rangeland resources in the different ecological zones.

However, in the past fifty years or so, the grazing pressure in the different ecological zones has increased dramatically to a level where regeneration of palatable annuals and many perennials have faced significant decline, while at the same time causing the disappearance of some and recruitment (i.e. the successful entry of new species into the breeding plant population[6]) of noxious invasive plants (such as *Prosopis juliflora ('Garanwaa')* and *Parthenium hysterophorus ('keligii noole')*. This is mainly due to the interruption in the age old transhumance of pastoralists and livestock population. Moreover, the establishment of thorn enclosures, particularly in the *Oogo* areas, mostly by sedentarised pastoralists who became disenchanted with the pastoral life, is another major factor contributing to the restriction of the free movement of pastoralists and their herds. These enclosures are marked by unbroken thorn fences which barely allow any significant free and open space between adjacent villages.

The effect of this land grabbing through the establishment of enclosures has contributed to the marginalization of pastoralists as it brought the essential seasonal mobility to almost standstill. The pastoralists in the *Guban* are already encountering difficulties in moving to the plateau during the summer when the coastal belt is unbearably hot. Similarly, those from the waterless *Haud* have little access to the resources of the escarpment and the coastal belt in times of need.

6.0. SOCIO-ECONOMIC AND ECOLOGICAL USES OF THE SOME OF THE AFFECTED PERENNIAL PLANTS

Acacia tortilis ('Qudhac'), also called 'Umbrella Tree' is one of the dominant trees in the study area. It provides vital browse to livestock (particularly camels and goats) and wildlife. In response to the increase of land degradation accompanied by decline in availability of grazing, its pods *(Dhaameel)* are collected, particularly in the *Haud* eco-zone, mainly by women and sold in urban markets as fodder for domestic animals (particularly goats and donkeys). The forage of *Acacia tortilis* is available through most of the dry season when other sources are scarce. Pods, when tender and green are also eaten by humans. Bees use its flowers to produce the best variety of honey, known as

6 This definition was given in "Interpreting Indicators of Rangeland health" Version 3, by Mike Pellant et. al .

acacia honey. In a well-developed tree, the spreading crown affords a good shade – sometimes used as venue for different community functions, such as resolving conflicts *(Garta)* and general meetings. It also provides an ideal environment and shelter for establishing a temporary Qur'anic school *(Dugsi)*. Some trees grow to heights, as tall as, 15 meters and thus turn into important landmarks which guide travelers to their destinations. Unfortunately, due to the combination of thinning of vegetation and increasing wind speeds, as a result of climate change, many trees of this species are vulnerable to uprooting, triggered by the strain of vigorous winds on the umbrella shape of mature trees.

Its wood is second best to *Acacia bussei ('Galool')* in terms of firewood and charcoal quality – a reason why the later is being over-harvested. Cordage is made from its inner bark; it also provides building material for the Somali hut *(Aqal)* and good thorn fencing material.

Balanites orbicularis ('Kulan') is an evergreen tree which grows interspersed in the coastal areas and is often scrambled with *Acacia tortilis* and *A. edgeworthii (Jeerin)*. It has edible fruit, which is bitter, but can be de-shelled before boiling for food. It has also good firewood. The tree is a nitrogen fixing type (i.e. helps conversion of nitrogen gas from the air being turned into a compound in the soil by bacteria that live in the root nodules of certain plants). It is also a source of edible oil, although it is not utilized locally.

Zizyphus hamur ('Xamudh') is one of the three species of *Rhamnaceae* family that are found in Somaliland. The evergreen tree is found in the coastal areas, particularly along the ephemeral water courses. It is palatable and is mainly relished by goats and camels. The other two trees in the same family are *Zizyphus spina Christi ('Gob-yar')* and *Zizyphus mauritiana ('Gob')* which are more numerous in the higher elevations and along seasonal water courses.

Suaeda fruticosa ('Xudhuun') is a halophyte that naturally thrives on saline areas and is a palatable browse material for camels.

7.0. FINDINGS

7.1. Extraordinary vegetation mortality

The high mortality of certain tree species in the study area has been noticed as early as in the year 2000. Malte Sommerlatte and Abdi Umar, in their article *Ecological Assessment of the Coastal Plains of North Western Somalia (Somaliland)*, noted the dying of certain species, such as Sueda fruitcosa, in the coastal areas west of Berbera and attributed the demise of these species to the effects of droughts. A local journalist, Ahmed H. Aden, based in Berbera reported in (2001) that their mortality first started with the *Acacia tortilis ('Qudhac')* and later moved on to *Balanites orbicularis ('Kulan')*. Further observations revealed that the trend was more noticeable on either side of the tarmac road leading to Berbera starting from an area between *Kurta Kaaraha* limestone hill located on the outskirts of Berbera and *Jiifto* hill which lies 12.3 km due south of Berbera. Few years later, some local papers started raising alarm by publishing feature articles on this worrying development. *Haatuf* daily newspaper on its issue number 1497 (dated 6 August 2007) launched a front page expose addressing the seriousness of the problem titled *'Dhimashada Geed-weynta Xeebta Duleedka Berbera waa Mushkilad u baahan in jawaab loo helo"* (The morality of the coastal trees in the vicinity of Berbera is a problem which needs real explanation).

In addition, an official from the then Ministry of Pastoral Development & Environment (MoPD&E)[7] alerted concerned authorities and agencies on the extent of the problem in the area through telephone communications and video clips.

The areas west of Berbera, such as Bullaxaar and Lughaya, have also shown similar trend of plant mortality, but to a lesser extent compared to the surroundings of Berbera. The authors of this study witnessed this phenomenon in Bullaxaar[8] in 2006 when they were investigated and writing about the proliferation of mesquite *(Prosopis juliflora)* in Somaliland. They observed and discovered a large number of trees consisting of *Acacia tortils* and *Balanites* which were either dead or in the process of desiccation.

However, the worst affected area is a stretch of land near Berber town proper; starting from the eastern periphery of the town, drawing a line all the way to Biyo-Guure to the South east, then skirting at the foot of Suryo-Malabe mountain (just behind Berbera cement factory) and moving further west to connect with *Jiifto* hill on the tarmac road to Hargeisa. Outside of this area, the different vegetation species look healthier and almost remain unscathed. In the other affected areas, such as Cabdi Geeddi village, Hadayta, Lughaya, Fuguho, Ceel-Sheekh, Bullaxaar and Geeri, almost the same tree species are afflicted, but not as bad as the situation in Berbera area. (See Table 1).

In all affected areas, the main species that have shown higher proportion of mortality, and in most cases accompanied by limited recruitment of new plants, are *Acacia tortilis, Zizyphus hamur, Suaeda fruticosa* and *Balanites orbicularis*. However, there are variations in the scale of mortality in the different species based on location, as detailed in the following table.

7 Mr. Ahmed Ali Jama, the regional director of the then MoPD&E.

8 Bullaxaar is a coastal town in Somaliland where the mesquite shrub (Prosopis juliflora) was introduced first by a British forester in 1950, as a wind-break for a date palm plantation.

Annex I: Photos

Fig. 1: Dead Acacia tortilis, Jiifto hill (11.4 km south of Berbera)

Fig. 2: Zizyphus hamur near Jiifto Hill, south of Berbera in the process of drying out

Fig. 3: Young dead Zizyphus hamur. Most of trees in the background are also dead, (Jiifto area)

Fig. 4: A dead Balanities in Abdi-Geeddi area, Lughaya District

Fig. 5: Dead Sueada Friticosa in Bulahar area

Fig. 6: Acacia edgeworthii ('Jerin'), South of Jiifto Hill, not much affected

Fig. 7: Leptadenia spartium ('Moroh', north of Xabaalo Tumaalo

Fig. 8: Lone Delonix elata ('Lebi') in the coastal area near Berbera

Table (1) distribution of affected coastal vegetation species by district

#	Location	District	Common vegetation species in the area	Affected Species in the respective areas
1	Cabdi-Geeddi Village	Lughaya	- *Balanites Orbicularis* - *Suaeda fruiticosa* - *Iphiona rodundifolia* - *Chloris virgata* - *Prosopis Julipholara* - *Courbonia virgata* - *Conocarpus lancifolius* - *Indigofera spinosa* - *Cenchrus ciliaris* - *Panicum turgidium* - *Pennisetum discolor* - *Zygophyllum album, ('Dinaas'),*	- *Balanites orbucularis* - *Suaeda Fruticosa*
2	Hadayta Village	Lughaya	- *Suaeda Fruiticosa* - *Salsola foetida* - *Prosopis Juliflora* - *Balanite orbicularis* - *Prosopis Juliflora* - *Zygophyllum album, ('Dinaas'),*	- *Suaeda fruticosa* - *Balanite Orbicularis*
3	Lughaya	Lughaya	- *Balanites Orbicularis* - *Suaeda fruiticosa* - *Iphiona rodundifolia* - *Chloris virgata* - *Prosopis Julipholara* - *Courbonia virgata* - *Conocarpus lancifolius* - *Indigofera spinosa* - *Cenchrus ciliaris* - *Panicum turgidium* - *Pennisetum discolor* - *Zygophyllum album, ('Dinaas'),*	- *Balanites orbucularis* - *Suaeda Fruticosa*
4		Bulahar District	- *Balanites orbicularis* - *Suaeda Fruiticosa* - *Prosopis Juliflora*	- *Balanites orbicularis* - *Suaeda fruiticosa*
5		Bulahar District	- *Suaeda fruiticosa* - *Prosopis Juliflora* - *Balanite Orbicularis* - *Panicum turgadium* - *Zygophyllum album, ('Dinaas'),*	- *Suaeda fruiticosa* - *Balanite rbicularis*
6		Bulahar	- *Balanites orbicularis* - *Suaeda Fruticosa* - *Prosopis Juliflora* - *Pennisetum dischotomum* - *Acacia Tortilis* - *Zygophyllum album, ('Dinaas'),*	- *Suaeda fruticosa* - *Balanites orbicularis*
7		Bulahar District	- *Balanites orbicularis* - *Suaeda Fruticosa* - *Prosopis Juliflora* - *Salsola foetida*	- *Suaeda fruticosa* - *Balanite rbicularis*
8		Berbera District	- *Acacia Tortilis* - *Qansax* - *Balanites orbicularis* - *Suaeda Fruticosa* - *Sizyphus hamud* - *Conocarpus lancifolius* - *Zygophyllum album, ('Dinaas'),*	- *Balanite orbicularis* - *Sizyphus hamur* - *Acacia tortilis*

7.2. Community Perceptions of the Death of the Plant Species

The accelerated scale of the mortality of these perennials is an unprecedented phenomenon. A pastoralist living in the vicinity of Berbera, quoted in the same news article by *Haatuf* (see above) has the following to say.

> *"No matter how severe a drought spell might be, we have not experienced anything like the current massive dying of these trees. A tree that has been green one month ago is now dry and dead. You will see it shriveling up within few days. This is a strange phenomenon and we are wondering what sort of calamity has fallen on them. Even dry trees will not produce firewood. The dry branches crumble under the light pressure of your feet[9]".*

The following symptoms were observed in the affected trees: in the case of *A. tortilis,* the first noticeable symptom is the profuse dark-red gum excreted from the branches and the stem. This is followed by gradual shedding of leaves until the tree becomes completely defoliated, then some dark spots appear on the branches, and finally the tree dies. The drying process, which is a sign of slow death, starts from the top to bottom. In the case of *Balanites orbicularis,* the dark-green leaves turn chloratic (yellow leaves), followed by wilting, desiccation and leaf shedding, then the death of branches. In further incidence, dozens of mature *zizyphus hamur* trees were found completely dry in the same area between *Jiifto* hill and the police check point near Berbera where the mortality of *A. tortilis is the greatest,* followed by *Balanties orbicularis.*

The communities interviewed in the different location of the study area were almost unanimous in confirming the demise of these plant species, a process which has been going on for over ten years now, even though as noted above, there is a degree of variability in the scale of mortality within the different species in different areas.

Another important perception held by some community members in Berbera is the attribution of plant mortality to spillage of toxic waste which leaked or intentionally emptied from surface to air missiles (SAM-2 & SAM-3) left behind (at the Berbera airport area) by the Russians during late 1970's, when the relationship between Somalia and the Soviet Union became strained as a

9 Quoted from an article in 'Environment in Crisis' (2010) a book authored by Ahmed Ibrahim Awale, pp. 162, Redsea-online books, Pisa, Italy

result of the war between Somalia and Ethiopia in 1977.
Drought is another significant factor which communities attribute to the mortality of those species. Although there was a high degree of rainfall variability in the far past, the study areas, particularly Berbera and its environs, have experienced a decline in rainfall during the past 10 years (see Annex III for Berbera station manual rainfall map). This issue will be discussed in detail in a later section.

8.0. DISCUSSIONS

The possible causes of the desiccation and demise of perennial plant species in the coastal areas are discussed below on the basis preceding findings.

8.1. Anthropogenic Causes: Human disturbance: Deforestation and overgrazing

Human disturbance in the form of deforestation and livestock over-grazing has been in the increase in the coastal areas during the past several decades. This is due to the population increase in the coastal towns and the closely related increase in demand for charcoal and firewood. The worst affected area of all the locations covered by the study is Berbera and its surroundings. Incidentally, this is the same area where Major Swayne had reported the massive deforestation that was going on during the last years of the 19th century. In that period of time, firewood was not only collected for use in Berbera town, but was also taken as supply by dhows calling at Berbera port for cooking purposes during their long journeys. Moreover, the British troops and their dependants stationed in Aden (Yemen) used to source from Somaliland, not only their meat supply needs, but most importantly firewood. However, although these shipments had been discontinued long ago, the utilization of biomass resources originating from the environs of Berbera and far inland have dramatically increased with the rise of population in Berbera, who have no reliable/affordable alternative source of energy for cooking other than charcoal and/or firewood, like all the inhabitants of the country. Likewise, the maintenance of the thorn fencing of the traditional livestock holding grounds, prior to their shipment to Arabia, also requires continuous cutting of acacia trees.
The reason why Berbera area is the most affected can be related to the fact that the area is under greater human pressure compared to other areas in Bullaxaar and Lughaya districts. Berbera, as the biggest livestock export outlet in Somalia/Land, also hosts a large numbers of camels which are driven on the hoof from far away inland areas for export. These worn out animals browse hungrily on whatever stunted vegetation they come across before they are penned in the Berbera livestock holding grounds. Obviously, the over-utilization of the mature trees for firewood and fencing material for the huge and numerous livestock pens (Xero) in Berbera, will not allow young saplings to thrive and become mature trees, hence resulting in the impediment of the natural regeneration of trees. Moreover, the few remaining aged trees will progressively lose their resilience allowing a single severe drought to destroy them.
The practice of keeping milch camels in and around Berbera town has also contributed to the denudation of Batalaale area, which contained of tens of thousands of *Suaeda fruticosa ('Xudhuun')* and *Concarpus lancifolius ('Dhamas')* planted under a reforestation programme started in the early 1950's[10].
Another cause of physical disturbance in the area is the effect of vehicle tracks in the southern fringes of Berbera. These numerous and crisscrossing tracks are made by vehicles operated by people involved in quarrying and firewood collection activities.
In comparison, in areas where human disturbance is minimal, the vegetation looks healthier, consisting of trees of all ages, including new plants. A good example is Berbera Airport area, which is less exposed to deforestation compared to other surrounding areas – thanks to the presence of a contingent of police force in the area.
Evidence regarding microclimate changes due to land use changes, such as deforestation, is an emerging fact worldwide. The denudation of the land in a certain area contributes to the increase of average ambient temperatures. This also means that the daily variation in ground temperature is much higher in denuded areas compared to a ground under wooded areas. Curiously, while some of the indigenous plants are dying, *Prosopis juliflora* has been establishing itself in many areas in and around towns, villages and on the banks of *Togga Waaheen*.

8.2. Droughts and Climate Change

Drought conditions have been a persistent phenomenon in the region for a very long period of time and therefore, the plant species became well-adapted to the harsh semi-desert climate of the *Guban* areas. However, severe drought events are becoming more frequent and more hard-hitting than in the past. The rainfall record in Berbera station, which was initiated by the British colonial authorities in 1908, shows a progressive decline of rainfall for most of the years from 1908-2010 (Annex III). The later years show almost zero (0) rainfall, except in 2010. This recorded data is also supported by community informants. The study team met with Omer Salad Geelle, a pastoralist living in the locality, while investigating hundreds of dead acacia trees in an area between Berbera and Biyo-Guure village (16 km east of Berbera). When asked about the last time the area received good rains, he responded; 'it was during *'Sannadkii Munaafaqadda'* (the year of hypocrisy!). Somalis as an oral society, often mark past years with important events. In this case, *'the Year of Hypocrisy'* marks 1994, which was the year an internecine war broke out in Berbera between two

10 Ahmed I. Awale, "Environment in Crisis"(2010), pp. 146-147

major clans in the country. This basically means 16 years of either no rain or below normal rain.

Such severe water deficits lead to an adverse impact on plant growth and may contribute to over-stretching their coping mechanism, thus resulting in high plant mortality.

The desiccation and eventual death of some of the plants in the coastal area was reported by Malte Sommerlatte and Abdi Umar in 2000. Their work is the only comprehensive assessment in the western coastal areas of Somaliland. They noted that shrubs *(Suaeda fruiticosa* and *Salsola foetida)* were particularly affected with between 40% and 55% of all individual shrub plants dying or dead due to drought conditions. They have argued that; "*According to our guide, this was due to drought which had affected many species. Trees on the whole were in healthier conditions with Balanites, Boscia and Acacia having 4%, 14% and 4% respectively dead or dying*"

Similar experiences linked to climate change were noted in many parts of the world, particularly in dry land areas. In Somaliland, the declining precipitation levels coupled with increase in temperatures over the past 30 years, has also resulted in the decline and mortality of the Juniper forests *(Juniperus procera)* found in the higher altitude mist forest areas of the Golis Range, such as Gacan Libaax[11]. The desiccation of Juniper trees starts from the branches, which is an indication of water stress. A healthy tree has a covering of leaves right to the very top.

Whenever temperature levels rise high enough for sufficient period of time and cause irreversible damage to the plant function and development, plants experience stressful conditions. The demand of trees for water increases proportionally with evapo-transpiration processes. Therefore, in the absence of sufficient supply of water to replace the amount released from the leaves, plants will end up in a stressful condition which could have a far-reaching effect on their chemistry and functioning, thus rendering them susceptible to plant diseases and pest infestations. In the end, this leads to the eventual death of the plant (Awale, 2010).

Our investigation of the study area revealed that most of the trees that were found to be either dead or dying were located on higher grounds, while those standing on lower grounds and in areas hosting higher number of trees, particularly in depressions and along ephemeral water courses, were greener and healthier. Likewise, the entry of new plants (recruitment) in the higher grounds was almost non-existent due to the fact that there has not been enough surface moisture for almost a decade which is essential for them to survive.

In general, vegetation types depend on temperature and rainfall, which in turn depend on altitude. Therefore, the most revealing observation which could link the demise of the perennial plant species under study to climate change

11 Ahmed Ibrahim Awale, Climate Change Stole our Mist (2007), Candlelight study. Also, John Miskell's, an Ecological Resource Utilization Assessment of Gacan Libaax, Somaliland, (2000), IUCN report.

and droughts, is that the all the affected areas are almost in the same elevation, which runs east-west parallel with the coast. Therefore, it is more likely those climatic processes, which are able to push some of these affected species to higher elevations (just like the *Khansah* and *Lebi*), are gradually coming into being.

8.3. Pests and diseases

During the period of the study, the different species appeared to be free from pests. However, it is normal for seeds to be attacked and destroyed by beetles, like anywhere else and anytime in the past. During the flowering phase, large numbers of insects feed on plant flowers. This issue requires further investigation, which should also include soil tests, as it was beyond the scope and capacity of the study team to carry out such an investigation.

8.4. Chemical contamination

As noted earlier, some sections of Berbera community attributed the extraordinary death of certain plant species to spillage of toxic waste, which leaked from surface to air missiles (SAM-2 & SAM-3) site left by the Russians during late 1970's when the relationship between the then Somali Republic and the Soviet Union became strained as a result of war between Somalia and Ethiopia in 1977.

The obsolete missile site, which was previously managed and run by the Somali National Air Force, had two underground tanks that are believed to contain Fumicnitric Acid and TONKA fuel[12]. According to John Dingley, a UN Mine Action Chief Technical Advisor, this was the fuel supply for the 92 unarmed SAM-2 Missiles that were stored on the site. Those warheads and the armed missiles that were on the launchers were destroyed by the Danish De-mining Group, but the problem of the fuel still remained. Mr. Dingley believes that; 'this problem is well outside the scope of the Mine Action programme and requires experts on toxic waste disposal. There is potential for massive environmental damage and loss of life should these tanks rupture or be tampered with'[13].

No action has been taken to dispose of these chemicals so far, but the issue was raised in the Somalia Joint Needs Assessment (JNA) which was a prelude to the Reconstruction and Development Programme (RDP) for Somalia. The JNA proposed recommendations include: "investigation of the chemical contamination at the former missile site in Berbera and other sites and if necessary to draw up and implement a plan for decontamination'.

On the basis of the findings and their analysis detailed above, the authors of this report believe that the likelihood of chemical contamination, as the cause of the high mortality of the many perennial species in the study locations spanning a distance of approximately 120 km along the coastal area is far-fetched. This does

12 John Dingley. Briefing Note on Berbera Missile Site Toxic Fuel Tanks, 4th August 2003
13 Ibid. (the same place as above)

not mean that the said chemicals are harmless, but it is compelling to note that the very area where the chemicals are supposed to lying and its surrounding area (within Berbera Airport) is populated by healthy looking *Acacia tortilis* and *Balanites orbicularis* plants as compared to other areas that show a distressing trend of tree mortality. Furthermore, the recruitment of new plants, specifically *Acacia tortilis* and *Balanites orbicularis*, in the airport area has been evidenced by the study team. Had the chemicals been very detrimental to the vegetation species in the airport area, these plants could have been the first to be affected. On the contrary, there is a totally different situation at the Police checkpoint (3 km away from the airport) and beyond. In the discussions the study team conducted with many elderly community informants who have been in the airport for a long time, there was no mention of either pest infestation on plant species or any kind of unusual death. They also mentioned that some steel tanks containing 'liquid chemical' were emptied in the airport area and then transported to Berbera for use as storage for compressed air in tire repair shops.

9.0. Conclusions and Recommendations

The past meteorological data available for the coastal areas, though not comprehensive like the data for other parts of the country, shows a trend of a continuous decline in rainfall. The reduction of rainfall has been greatest in more semi-arid regions and along the coast (Hemming, 1966).

The effects of the deficits in rainfall can be gleaned from the condition of the vegetation. The plants became adapted to the harsh coastal environment and have developed small leathery leaves and deep roots. Most plants are deciduous but some are evergreen *(Balanites* and *Suaeda fruticosa)* and they protect themselves from water loss by having small "waxy" green leaves. However, a succession of dry seasons may result in the disappearance of perennials and an increase of annual plants.

The reason why Berbera area has attracted the biggest attention is that the problem is most noticeable in its environs. This is a result of heavy exploitation of plant resource, coupled with prolonged drought periods. Furthermore, while there is growing evidence on the progression of climate change effects in the Horn of Africa, like elsewhere in the world, the semi-arid *Guban* is receiving its share mainly in the form of extended periods of droughts resulting in decline of underground water levels, which is crucial to the survival of perennial trees under investigation.

In the search for an explanation to the widespread mortality of some perennials in the study area, this study has put more emphasis on climatic and anthropogenic aspects of the subject matter. Therefore, as a follow up to this study, an in-depth investigation of the impact of chemical contamination (even though localized within Berbera environs, the Airport area in particular), resulting from leakage and/or intentional spillage, is essential.

In order to safeguard people from a situation described as 'a potential for massive environmental damage', there is a moral obligation for the Government of Somaliland and the specialized international bodies to carry out a thorough investigation and draw up a plan for its decontamination.

Finally, the continuous trend of the death of vegetation will definitely have a negative impact on the sustainability of the pastoral livelihoods in the future, as this will lead to a decline in browse foliage for livestock herds.

Annex II: List of Common Plants and wildlife in the in the Coastal Areas

Scientific name	Vernacular name (Somali)
Acacia edgeworthii T. Anders	*Jeerin*
Acalypha fruticosa	*Dhikri*
Acacia benadirensis	*Sarmaan*
Balanities orbicularis	*Kulan*
Boscia minimifolia	*Maygaag*
cadaba glandulosa	*Qalaanqal*
Caralluma sp.	*Gowracato*
Cenchrus ciliaris	*Sareen*
Conocarpus lancifolius	*Dhamas*
Courbonia virgata	*Duqow*
Chloris virgata	*Cagaar*
Dobera glabra	*Garas*
Indigofera spinosa	*Xajiin*
Iphiona rodundifolia	*Gebagebood*
Lasiurus hirsutus (Forsk)	*Darif*
Leptadenia spartium	*Moroh*
Panicum turgidum Forsk	*Dungaare*
Prosopis juliflora	*Garanwaa*
Zygophyllum hildebrandtii Engl.	*Mawo*
Zizyphus hamur	*Xamudh*
Tamarix nilotica	*Dhuur*
Suaeda fruiticosa	*Xudhuun*
Salsola foetida	*Xajiin*
Salvadora persica L.	*Caday*

Common wild life in the area

#	Scientific Name	Vernacular Name (Somali)
1.	*Litocranius walleri*	*Gerenuug*
2.	*Gazelle soemmeringi*	*Cawl*
3.	*Struthio molybdophanes*	*Gorayo*
4.	*Secretary bird*	*Salemodhle*
5.	*Gazelle pelens*	*Deero*
6.	*Spotted hyena*	*Waraabe*

Annex III: Berbera Station Manual Rainfall Data

(Source: www.faoswalim.org/)

NB. In the table, (-999) means, no data available.

Berbera Station Manual Rainfall Data												
Year	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1908	16.0	2.5	0.0	0.0	0.0	0.0	9.7	1.3	0.0	0.0	0.0	4.1
1909	3.8	0.0	0.0	33.8	31.8	0.0	0.0	0.0	0.0	0.0	0.0	4.1
1910	0.5	0.0	146.8	0.0	5.1	0.0	1.5	7.6	0.0	0.0	0.0	0.0
1911	11.4	0.0	-999	-999	0.0	0.0	0.0	0.0	0.0	0.0	-999	0.0
1912	0.0	4.1	0.0	62.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7
1913	0.8	26.4	17.8	0.0	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1914	0.0	13.8	0.0	0.0	34.3	0.0	0.0	0.5	1.8	16.1	0.0	0.0
1915	0.0	0.0	0.0	-999	-999	0.0	0.0	0.0	4.1	0.0	2.0	0.0
1916	1.8	46.0	1.3	0.0	0.0	0.0	15.5	6.1	2.3	0.0	0.0	0.5
1917	0.0	0.3	0.0	5.1	1.8	0.5	5.8	0.5	0.0	0.0	0.0	0.0
1918	2.3	0.0	0.0	36.6	3.0	0.0	1.3	0.0	0.0	0.0	5.8	0.0
1919	0.0	0.3	41.1	13.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1920	0.0	0.3	0.0	6.6	0.0	0.0	0.0	0.3	3.0	0.0	47.5	0.5
1921	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	17.3	13.5	1.3	0.0
1922	0.0	0.0	4.8	0.0	8.1	0.0	0.0	1.3	0.0	0.0	0.0	5.8
1923	0.0	4.8	0.0	34.8	0.0	0.0	0.0	0.0	0.0	30.5	0.0	2.5
1924	0.0	0.5	0.0	0.0	0.0	0.0	0.0	19.1	2.5	0.0	1.3	1.5
1925	0.0	2.5	0.0	0.3	0.0	0.0	0.0	0.0	5.6	0.0	5.6	0.3
1926	44.5	3.3	42.9	11.7	55.9	2.5	4.3	0.0	0.5	0.0	0.5	0.0
1927	2.0	2.0	0.0	47.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1928	0.0	1.3	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	18.3	3.8
1929	0.5	0.0	0.0	1.0	0.0	2.8	0.0	0.0	0.0	0.0	0.8	4.3
1930	61.7	0.0	0.3	30.2	0.0	0.0	0.0	0.0	0.0	23.9	0.0	1.5
1931	0.0	0.5	2.5	0.0	21.6	0.0	0.0	0.5	11.2	0.0	0.0	0.0
1932	0.8	0.0	1.8	0.0	14.5	0.0	19.6	2.0	0.0	0.0	0.0	17.3
1933	7.4	0.0	0.0	0.0	5.6	0.0	0.0	8.9	0.0	0.0	0.0	0.0
1934	0.0	0.0	0.0	0.0	2.3	0.0	0.8	1.0	0.0	0.0	39.1	0.0
1935	0.0	4.8	0.0	88.4	47.5	0.0	0.0	0.0	0.0	0.0	0.0	16.8
1936	0.3	57.2	0.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	2.3
1937	7.1	1.8	8.1	11.4	3.3	0.0	0.0	4.3	0.0	0.0	9.4	0.0
1938	0.0	0.0	1.3	0.0	1.3	0.0	14.0	10.9	0.0	0.0	0.0	0.0
1939	0.0	0.0	5.1	4.3	-999	-999	-999	-999	-999	-999	0.0	0.0
1940	0.0	30.7	61.5	0.0	10.2	0.0	0.0	0.0	-999	-999	-999	-999
1942	-999	0.0	1.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	65.3	0.0	0.0	0.0	0.0	5.6	0.0	0.0

1944	0.0	0.0	68.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.7	2.7	1.6	7.7	21.9	0.0	2.3	0.0	0.0	0.0	0.0
1946	1.1	0.0	0.0	20.0	3.3	0.0	0.0	1.9	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.3	0.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	60.5	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	18.5	0.0	0.0	67.8
1950	65.3	0.0	0.0	0.0	0.0	0.0	0.0	16.0	14.7	0.0	0.0	0.0
1967	-999	-999	-999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	-999	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	-999	-999	-999	-999	-999	-999	0.0	0.0	0.0	2.5	0.0
1970	0.0	0.0	-999	0.0	-999	0.0	10.0	0.0	0.0	0.0	0.0	0.0
1971	-999	3.0	0.0	0.0	0.0	0.0	-999	0.0	-999	0.0	5.0	-999
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
1976	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-999	-999	-999	-999
2007	-999	-999	-999	71.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0
2008	0.0	0.0	0.0	0.0	6.5	0.0	0.0	0.0	0.0	0.5	1.0	0.0
2009	10.0	0.0	10.0	6.5	0.0	0.0	0.0	70.0	0.0	0.0	0.0	0.0
2010	0.0	13.0	9.0	10.5	0.0	0.0	4.2	7.5	0.0	0.0	-999	-999

Annex IV: Bibliography

Ahmed Ibrahim Awale & Sugulle, A. Jama, *Proliferation of Prosopis Juliflora in Somaliland,* (2006), Candlelight

Ahmed Ibrahim Awale, *Environment in Crisis, Selected Essays with Focus on Somali Environment,* (2010), Redseaonline Books, Pisa, Italy

Ahmed Ibrahim Awale, *Climate Change Stole our Mist,* (2007), Candlelight Hargeisa

Awale, et. Al: *Impact of Civil War on the Natural Resources: A Case Study for Somaliland* (2006), Candlelight

Awale, Ahmed & Killeh, Mohamed Eggeh: *Case Study: Integrated Community–based Resource Management in the Grazing lands of Ga'an libah, Somaliland* (2004), Candlelight

Duale,Omer H. & Magan, Abdillahi H.: *Case Study: Alternative Source of Energy and Reduction of Dependence on Charcoal in Somaliland,* (2005), Candlelight.

Hemming, C.F., *The Vegetation of Somaliland,* 1966, Proceedings of the Linnean Society of London

Ingrid Hartman, A.J. Sugulle and Ahmed I. Awale, *The Impact of Climate Change on Pastoralism in Salahley and Balli-Gubadle Districts, Somaliland,* (2010), Candlelight, Hargeisa

Malte Sommerlatte and Abdi Umar, *An Ecological Assessment of the Coastal Plains of North Western Somalia (Somaliland)*, (2000), IUCN Eastern Africa Programme

Pellant, *"Interpreting Indicators of Rangeland health"* Version 3, Technical Reference (2000), *et. al.* United States Department of the Interior, Department of Land Management and National Science and Technology Centre Information and Communications Group, Denver, Colorado.

Swayne, *Seven Trips through Somaliland,* (1890), Kessinger Publishing's Legacy Reprints.

Miskell, John. *An Ecological and Resource Utilization Assessment of Gacan Libaah, Somaliland,* (2000), IUCN Eastern Africa Programme, Nairobi.