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Framework Paper

Proposal for Priority Actions in the Reconstruction and Development Process of Somalia

Contribution on Agro-Pastoralism & Forestry

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Summary

This document proposes elements of strategy and priority actions to be integrated in the National Action Plan of Somalia regarding the agro-pastoralism and forestry sector. This list of possible interventions was made to support decision - making in the field of post-war development. As the experts were not able to go to Somalia, the identification of potential interventions was mainly made through bibliographic evaluation. The document is structured as follow: After a brief presentation of the sector review and the problems to be addressed, the objectives/goals and intervention strategies are described. Priority actions are finally presented.

Sustainable management of natural resources will drive Somalia's productive capacity but current massive degradation of natural resources results in a serious threat to livelihoods and future development. Pastoralism has a large impact on the environment and, hence, it needs to be considered in conjunction with natural resource management.

In order to stop degradation of rangelands, the current trend of tree over-cutting needs to be reversed. The charcoal export ban must be enforced and the development of alternative energies (gas, kerosene, fuel) in towns should be supported.

Livestock production and management strategies will also need to be aligned with seasonal fodder availability. Changes in flock management, production and marketing strategies by selling animals at younger ages should increase the rentability of livestock husbandry. A trend towards lowering stocking rates during the drier period of the year will also contribute to the long term rehabilitation of rangelands. On the other hand, livestock nutrition needs to be improved in order to increase milk and meat production for local consumption and export. For that purpose, strategies for increasing fodder production and quality during the dry season on rangeland as well as on irrigated land were identified.

Strategies for wide use of multipurpose trees were identified to increase production of wood, fodder, food, gum and resins. Crop and pasture protection and soil fertility conservation and amelioration are important services that trees can provide while diversifying production and generating income revenues. For tree exports such as Frankincense and Gum Arabic, sustainable improvement of supply chain networks is a prerequisite to guarantee the stability of economic returns to producers and collectors.

A general agro-ecological zoning should be carried out throughout the country in order to identify homogeneous land use systems and related constraints and development needs. The public sector will need to address specific environmental issues such as fuel-wood conservation and land-use planning in the context of extensive natural resource use by the private sector. Training adequate professional and technical staff and extension agents in the areas of pastoralism, horticulture and forestry is a necessity. Regarding rangeland, livestock and agroforestry management, priorities to the different intervention strategies listed in the present document need to be defined in relation to the different stakeholders and target beneficiary groups in the different regions.

2.3. Agro-pastoralism and forestry

2.3.1. Sector review

Physical conditions of Somalia

Somalia covers an area of 637 539 km² between latitudes 12°N and 1°35'S and longitude 41°E and 51°W. Most of the country consists of plains, with a high mountain escarpment in the North, facing the coast (the Goolis Mountains). The highest peak in this range reaches 2,400 m. Only two permanent rivers, the Jubba and the Shabelle, water this dry land. Both originate in the Ethiopian highlands, but only the Jubba flows into the Indian Ocean, the Shabelle loosing itself in a swampy terrain. The climate is hot with a low rainfall (see Map3), exceeding 500 mm only in the most favorable region (the South). Annual average rainfall throughout most of the country is between 200-300 mm. The mean annual temperature varies according to the location between 25°C and 28°C. In the North, 45°C can be recorded during the hot summer days, while the temperature can drop to just above 0°C in the mountain range during the winter. Different general maps (topography, temperature, rainfall, soils) are available in Bowen (1990).

Map 3: Somali rainfall isohyets (Leslie, 1989)



Vegetation of Somalia

In such an arid country, for the most part, the vegetation is xerophytic in character. Common genera such as *Euphorbia*, *Commiphora*, and *Acacia* all show classic adaptation to growth in a dry environment. The natural vegetation of Somalia has come under only limited investigation by plant taxonomists and ecologists. Studies on the main vegetation formations are needed to assist the development of the country's resources and a significant proportion of the species have still to be elucidated (Bowen, 1990).

Table 4: Vegetation types of Somalia, by area, from White (1983) reported by Bowen (1990)

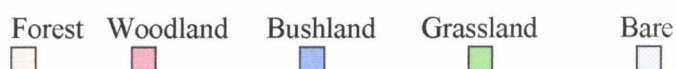
Vegetation type	Area ('000 ha)
Acacia Commiphora deciduous bushland and thicket	42,400
Semi-desert grassland and shrubland	17,600
East African coastal mosaic	2,400
Evergreen / semi-evergreen bushland and thicket	900
Absolute desert	200
Undifferentiated mountain vegetation	100
Coastal desert	100
Total	63,700

The *Acacia Commiphora* formation is a dense bushland (3-5 m tall with scattered emergent trees up to a height of 9 m). It is at its most well developed in the relatively high rainfall areas of the Bay region where *Acacia bussei* is predominant.

The second most widespread vegetation type is a semi-desert grassland and shrubland which is true rangeland. Occurring in areas with an annual rainfall of less than 200 mm, the vegetation is low-lying with species of *Aloe* and *Euphorbia*.

The East African coastal mosaic refers to a small area of open woodland centered on the Holowajir depression in the far south of the country. This vegetation type appears to have come under no recent botanical investigation, perhaps as a result of difficult access into the area. Two remaining vegetation types are true high forests which occupy less than 2% of the country area. The first of these forest types is the riverine forest on the Jubba and Shabelle rivers. Confined to the rivers' edges, these forests are subjected to periodic flooding. A large part of these gallery forests has been eliminated. The other example of high forest occurring in Somalia is the juniper forest found in a few localities within the Goolis Mountains in the northern hills. But this forest has also been largely destroyed by over-cutting and over-grazing.

Map 4: Vegetation Map (UNESCO *et al.*, 2004)



Land use systems of Somalia

According to UNDP's Annual Development Report for 1987 (United Nations Development Programme), only 13% of Somalia is considered suitable for permanent cultivation. Pastoralism is judged possible on a further 55% of the land area, whilst the remaining 32% is classified as non-agricultural.

Somalia can be divided into three land use zones:

- (1) The North, where pastoralism with camels, goats and sheep is the predominant form of land use. Only small areas can be cultivated.
- (2) The central rangelands, where pastoralism is also the dominant land use but with a higher proportion of cattle in herds.
- (3) The South, where there are the Jubba and Shabelle rivers, a generally higher rainfall and more fertile soils allow large scale settled agriculture. Livestock husbandry and particularly cattle remains an important activity.

The important soils for settled agriculture are generally those having higher clay content. These include vertisols, fluvisols, cambisols, luvisols and the nitisols, and account for 20% of the total land area mostly in the interriverine areas. Elsewhere, nutrient deficient soils and saline soils predominate.

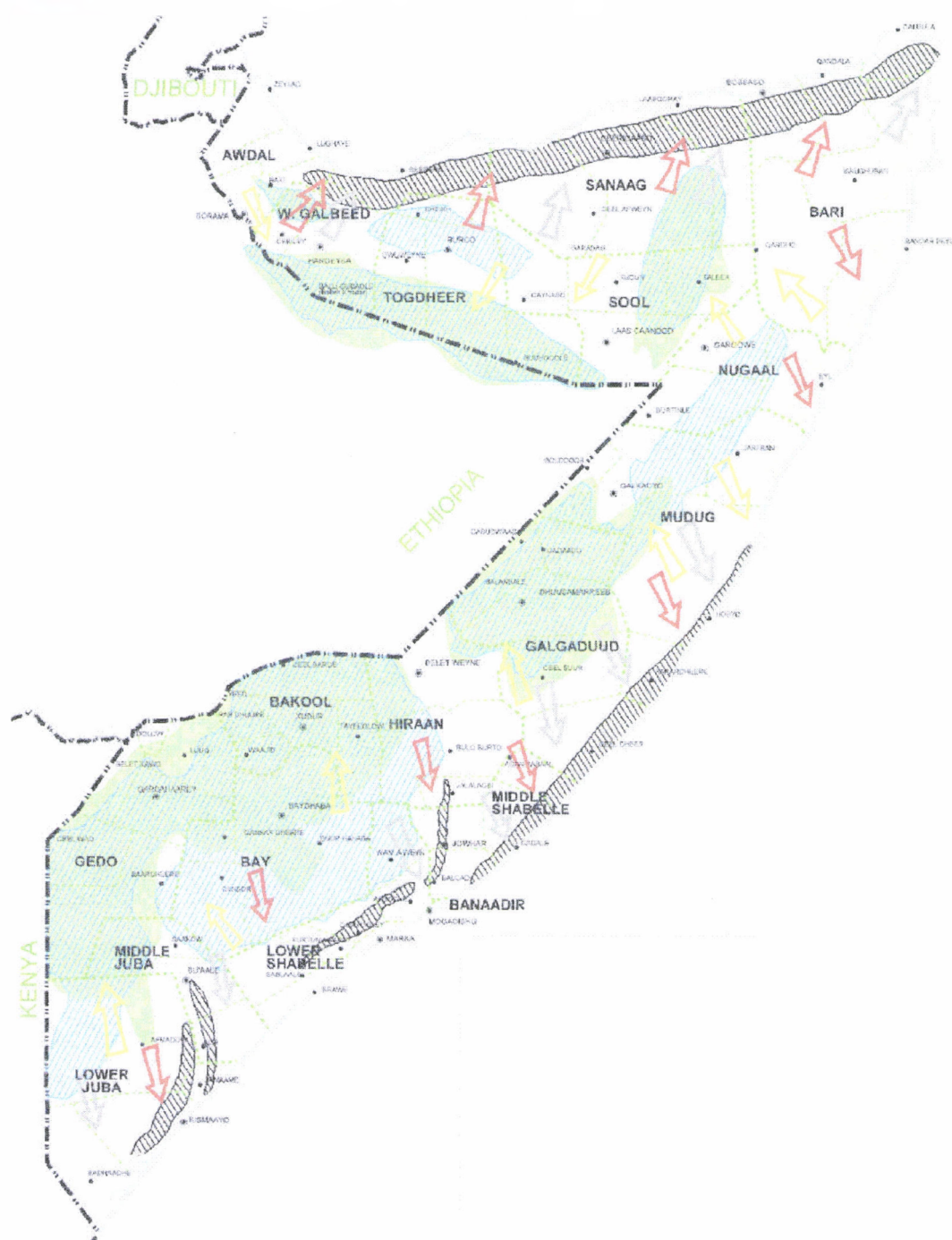
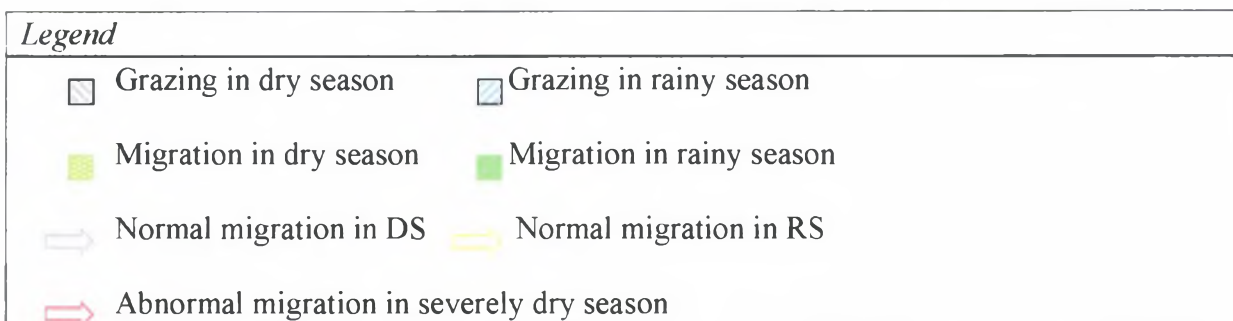
Livestock husbandry is the main export activity. Bananas are cultivated on prime irrigated land. It was the 2nd export product before the civil war. Presently, banana production is very

low. Mangoes were also exported. Four main crops are grown (maize, sorghum, sesame and cowpeas). Sesame is an important cash crop. On irrigated land, vegetables and fruits are grown throughout the year. There is no great land scarcity but crop production is limited by water supply. Due to the bimodal rainfall and the different timing in seasons across the country, the crop calendar is variable and complex. During the 15 year civil war, the agricultural sector in the South was greatly damaged and the productive infrastructure destroyed.

Pastoralism

The majority of people in all Somali areas mainly depend upon livestock for their livelihood (milk from camels and cattle, meat from cattle, sheep and goats). Traditionally, the pastoralist system provided the population with mechanisms for coping with changes in the natural environment. Pastoralism was therefore characterized by a high mobility of herds looking for drought reserves during the dry season - as long as pastures supplied sufficient fodder for the animals. However some drastic changes have occurred. Grazing areas demarcated for rotation purposes were abandoned after the collapse of the Siad Barre regime. These reserves were turned into private pasture land by individual clans resulting in the decline of the communal areas available for grazing. Parallel to this development, an increasing semi-sedentarisation of the pastoralists has been observed following the construction of a large number of wells and boreholes. Both factors resulted in a severe degradation of pastures. In the North and North-East, the semi-nomadic population often has a farm where some cows and milk-lambs are kept – while the herds are moving during the dry season.

Map 5: Grazing Areas (UNESCO *et al.*, 2004)



Forestry sector

Trees and shrubs play an important role in Somalia's economy. The natural bushland provides fodder, fuelwood, charcoal, construction materials and other necessary products for humans. Forests and Savannah woodlands contribute to protecting the very fragile Somali ecological conditions that are inherent. Wildlife is being nurtured in a forest and woodland environment. As a result, Somali fauna is unique in a spatially and ecological point of view. Forest resources are strongly being depleted. Huge areas, previously covered by trees, have been deforested. This has led to wildlife extinction and soil erosion.

Charcoal is still exported despite the existence for many years of an export ban. Today charcoal is the second largest foreign currency export earner after livestock. The preferred species for charcoal production are *Acacia bussei* and *Acacia nilotica*, although a lot of other species are also used such as *Acacia tortilis*, *Acacia melifera*, *Terminalia polycarpa*, etc. The "earthen -clamp" method used around Mogadishu and in the Bay region, was highly efficient and has approached the theoretical maximum of 40 percent of charcoal production. In the far North and in the South, a "light and quench" method has only 10-15 percent of efficiency (Bowen, 1989).

About 85% to 95% of the domestic energy requirements in Somalia are dependant upon wood and charcoal fuel sources. Demand was reported at approximately 4 Mm³ of wood annually (Warsane & Hassan, 1987).

In addition to the demand for fuelwood, there is also a growing demand for construction poles. This market was estimated at 144,000 m³ in 1980 (Bowen, 1990).

Frankincense obtained from tapping *Boswellia* species growing in the North-East, myrrh from *Commiphora*, in the South and the North-East, Arabic gum from *Acacia* spp., and yicib nuts from *Cordeauxia edulis* (thought to be endangered) in central regions, are also important wood products.

Frankincense used to be Somalia's fourth largest foreign currency export earner with an annual production of 12,000 tons. *Boswellia* are highly prized trees with tree tenure systems. Although they are not cut for charcoal or other uses, their natural regeneration is threatened by over-grazing (EC/IUCN, 1997). Today, this sector is in a state of neglect. Now, since production and export is no longer regulated, there are concerns about the scale at which trees are being "tapped". Somali trade in myrrh is small compared to the frankincense market. *Acacia senegal* is common in Somalia although no organized industry exists. Gum-arabic from this species is collected in the South and exported to Kenya.

Timber production is of little importance in Somalia. Before the civil war only one sawmill existed in the North-West, which used to process wood from natural *Juniperus excelsa* forests. Almost all timber for construction, joinery and carpentry industries is imported. Imports' figures were reported to around 16,000 m³ of sawn timber and 7,000 tons of paper per year by Bowen (1990).

In conclusion, the forestry sector has contributed a lot to the national economy although it has been strongly neglected. Current overexploitation of the vegetation will plainly result in disaster for Somalia.

Traditional agroforestry practices

Live fencing is extensively used in Somalia, mainly to restrict livestock movement. It occurs around the huts and lining tracks through agricultural land. On rain-fed agricultural land, scattered trees are retained. These provide limited dry season browse, fruits, nuts and poles and are mainly used as shade for farmers and livestock. Natural bush fallow is often used to restore soil fertility. Tree planting is mostly for protection of agricultural land, stabilization of sand dunes, fruit production and amenity. Wind breaks have been established for the purpose of increasing agricultural production near the two main rivers. On irrigated land, agricultural crops are commonly grown alongside young fruit trees until shade becomes too great (Leslie, 1989).

2.3.2. Identification of problems

Pastoralism at the crossroad

Pastoralism has a large impact on the environment and, hence, it needs to be considered in conjunction with natural resource management. Vice versa, the use and improvement of natural resources have large implications for pastoralism and concomitant livestock production.

Environmental degradation

In 1989, there was already a widespread belief that woodland over large areas of the country was declining both in terms of area and species richness. The more pressing causes were over-cutting and overgrazing. During the last 15-years of civil war, the agricultural productive sector was greatly damaged and natural resources were put under more pressure. Bushland was cleared for charcoal production and fence enclosures. Tree destruction has increased wind and water erosion, and has eliminated valuable dry season fodder for livestock, and has naturally led to conflicts. Furthermore, in arid zones, trees generally provide favorable microclimatic and soil conditions for the growth of the herbaceous stratum. On the treeless and windswept rangelands, the herbaceous fodder production is now more susceptible to the effects of drought. The recent 4-year drought (which ended in 2004) resulted also in overgrazing and destruction of trees. Massive degradation of natural resources resulted in a serious threat to livelihoods and future development.

Pastoralism problem

Both factors – enclosures and “semi-sedentarisation” due to water points’ creation – have contributed to deterioration of the areas and lowering of the range’s quality, which apparently exceed their carrying capacity. The disappearance of traditional adaptive management strategies has increased production risks for herds’ owners. Land enclosure has also created conflicts amongst communities. Reduced livestock mobility leads to a less effective livestock production and contributes to a destruction of the natural resources.

Institutional aspects

Legal and institutional responsibilities are unclear. Institutional capacity for addressing environmental problems and enforcing regulation at federal, regional and local levels is weak to non-existent. Both problems call for immediate clarification of legal responsibilities. The key issue of charcoal production and export must be addressed as soon as possible. Export is no longer regulated for most tree products traditionally exported as well as for livestock.

2.3.3. Objectives

General topics

Sustainable management of natural resources will drive Somalia's productive capacity. So the public sector will need to address specific environmental issues such as fuel-wood conservation and land-use planning in the context of extensive natural resource use by the private sector.

In order to stop degradation of rangelands, the current trend of tree over-cutting needs to be reversed. The charcoal export ban must be enforced and the development of alternative energies (gas, kerosene, fuel) in towns should be supported.

Livestock production and management strategies will also need to be aligned with seasonal fodder availability. Changes in flock management, production and marketing strategies by selling animals at younger ages should increase the rentability of livestock husbandry. A trend towards lowering stocking rates during the drier period of the year will also contribute to the long term rehabilitation of rangelands. On the other hand, livestock nutrition needs to be improved in order to increase milk and meat production for local consumption and export. For that purpose, strategies for increasing fodder production and quality during dry season on rangeland as well as on irrigated land will be identified.

Strategies for wide use of multipurpose trees will be identified to increase production of wood, fodder, food, gum and resins. Crop and pasture protection and soil fertility conservation and amelioration are important services that trees can provide while diversifying production and generating income revenues.

Harvesting, processing and marketing of forest products

Harvesting, processing and marketing of forest products should ideally conform to a forest strategy and be in accordance with forest management plans. These plans should accommodate the realities of the needs of the users or industry without violating the principles of good forest management practices. For any tree product, employed marketing systems should provide fair return to the grower thereby encouraging production and subsequent renewal of the resource base. For tree exports such as Frankincense and Gum Arabic, sustainable improvement of supply chain networks is a prerequisite to guarantee the stability of economic returns to producers and collectors. Higher prices for these products would give incentive to the collectors and could be achieved through better contractual arrangements between chain partners (producers/collectors, traders, processors and exporters) and through better access to existing foreign markets.

Potential of increased rangeland resources

While “semi-sedentarisation” and range enclosure can have various negative environmental impacts, they may also offer opportunities for improved land management, permanent investments in land productivity and the application of innovative technologies. Small favored areas in the range -such as drainage areas- may be used for pasture (fodder trees, grass) and food crop production (vegetables). These spontaneous closures may be exploitable to develop some conventional “ranching” concepts. Temporary protection against livestock will lead to natural regeneration of tree and grass species and increase the rangeland’s biomass production. In these reserves, pasture can also be improved by sowing local grass (*Cenchrus ciliaris*). Production and protection of fences could supply fodder during dry seasons.

Livestock management and nutrition

The key issue of rangeland stocking levels must be addressed as soon as possible as it seems to negate development efforts. Management of the different categories of herds (camels, sheep, goats and cattle) would be improved by selling old and less productive animals and shortening the development cycle of the animals. Lowering the age of the first dropping, shortening the interval between droppings and improving the nutrition of the animals would result in selling animals at a younger age with a higher price. Supplementing the feeding ration with agricultural and/or industrial by-products or tree forage, would increase the overall protein, vitamin and mineral content and thereby increase meat and milk production.

The potential for Agroforestry in Somalia

Incorporation of multipurpose trees and agroforestry techniques into farming systems will diversify agriculture, enhance income generation and contribute to land improvement and biodiversity preservation. It is in the higher rainfall areas and irrigated ones that there is a potential for agroforestry based on widespread tree planting.

Agroforestry can benefit small and large farmers. Small farmers require a large number of products from their land (food, fodder, fuel-wood, and lumber). They are also likely to adopt a diverse farming system to minimize risks. Large farmers have capital to invest in expensive systems such as shelterbelts.

Extension efforts

Traditional nomads are not planting grass and trees because it is not in their interest to do so. The concept of extension may be difficult to apply except in a context of sedentarisation with closures establishment. Educating communities on the advantages of range closure and land management is something of paramount importance. As forestry activities are attractive in rural development, they need to be included in a global extension program to avoid conflicting advice from diverse disciplines concerning use of limited resources. Farmers can be encouraged to adopt agropastoralism and agroforestry practices through demonstrations and possibly free seedlings eventually.

Alternative activities to pastoralism

Literature currently reports that the human support capacity of Eastern Africa and particularly Somalia has been exceeded. *Since neither primary productivity (pasture) nor secondary productivity (livestock) can be easily improved, it should be of the highest importance to*

develop alternative means of livelihood in the non-pastoralist sector of the economy: agriculture or others (GFA Terra System, 2005).

2.3.4. Intervention Strategies / Logical Framework

Lessons from the past and use of traditional knowledge

Generally, the literature outlines a lack of documents about past activities of research and development projects in forestry and pastoralism. To avoid duplication of past mistakes by new incoming projects, it is necessary to have access to these documents. In order to minimize the necessity for behavioral changes in the target population, it is recommended to use indigenous knowledge as well as to use and support traditional coping mechanisms. Moreover, existing organizations that prove themselves adequate should be used in order to avoid too many innovations that might not be fully accepted by the beneficiaries. Experiences and support from neighbor countries would be beneficial.

Institutional aspects and organization management

It is of a high importance to facilitate establishment and strengthening of agropastoralist and pastoralist organizations and associations at local district, regional and national levels that can manage land resources in a sustainable manner, and that can defend their interests. Development agents would be trained in order to be capable to work with these organizations and associations.

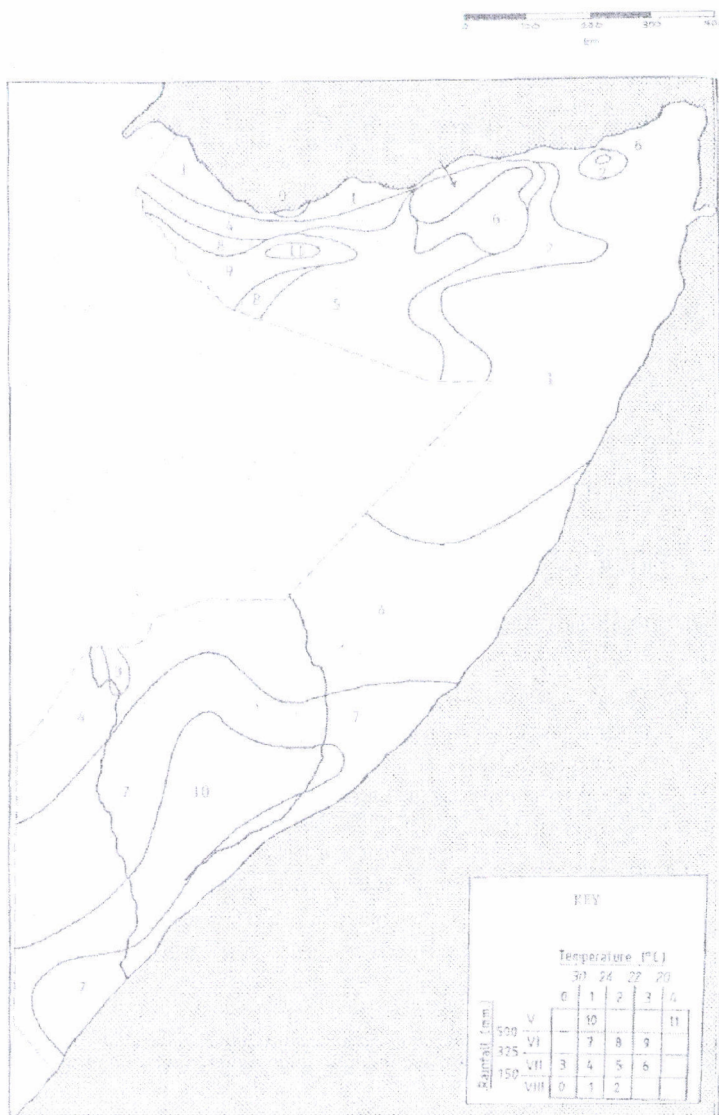
Limitations for agroforestry and tree plantations in Somalia

- **Physical limitations for tree plantations**

Most of Somalia is characterized by an arid or semi-arid climate with a bimodal yearly rainfall pattern. Hutchinson (1989) has classified Somalia into “agroforestry zones” based on a simplified version of Teel’s agro-climatic classification. This gives a good general view where certain crops and trees will grow successfully. It is based on rainfall and temperature data only and ignores the importance of irrigation (see Map 6). There are 12 zones ranging from 0 (the hottest and driest) to 11 (the wettest and coolest). Growth rates in arid areas are so low that there is little incentive for wide-scale tree planting. In these areas, which cover much of Somalia, trees could be best established by promoting natural regeneration. Techniques include reducing browsing, scarification, and using a mulch of dead branches.

In the Southern regions and Northern mountain areas, higher rainfall allows growth rates that make tree planting worthwhile. This corresponds to zones 7 through 11 with rainfall generally higher than 300 mm a year. Also, irrigated areas outside these zones or rain-fed zones with a high water table may be suitable. Rainfall in most of the country averages less than 450 mm a year. Any tree planting can therefore only take place at the very start of the main rainy season (late April – early May).

Map 6: Agroforestry zones of Somalia (Hutchinson, 1987)



- **Land tenure and tree ownership**

In Somalia, a complex system of clan/feudal ownership exists for land, trees and use rights. Clan members have the right to the land as long as it is cultivated. Land can be handed down from one generation to another. When the land is no longer cultivated, it falls under the control of the clan. Excess land is either rented for cash or for part of the crop. Rental is usually for a year only which gives little incentive for a tenant farmer to plant trees; so tree plantation must be at the initiative of the owner. Long living trees (coconut, mango) are often handed down from generation to generation.

- **Education**

Manuals, films and posters have been published on tree planting and on benefits from trees and in order to discourage activities leading to land degradation. But these activities were most prominent in towns and not in rural areas. There is a little tradition of tree planting, although the Government has encouraged it in the past through providing free seedlings.

Enrichment of existing agroforestry parklands through natural regeneration

An evaluation with farmers is needed to find the best strategies to improve existing parklands. Given the high cost of projects, focusing on tree planting, protection and stimulation of natural tree regeneration should be encouraged. In most areas of Somalia, naturally regenerating trees are retained in agricultural land. These provide shade, fodder (evergreen species), fruit and building materials. Farmers tend young seedlings of useful tree species. Often a shelter of dead thorny branches is built around the seedlings to protect them from browsing. The most common species retained on cultivated land in Southern Somalia are *Dobera glabra*, *Balanites aegyptiaca* and *Salvadora persica* and *Ziziphus spinachristii*. On the lower Jubba, some species (*Hyphaene thebaica*, *Adansonia digitata*, *Ficus spp.*, *Garcinia livingstonei*, *Tamarindus indica*) are often left in farmers' fields and they provide edible fruits.

Example of tree parkland potentially useful for Somalia and to be developed in the long term: The *Faidherbia albida* parkland

Farmers actively regenerate tree species when the benefit of their investment is guaranteed. *Faidherbia albida* is a multipurpose tree, widely distributed in agroforestry parklands in semi-arid Africa and is considered as an excellent agroforestry species. It develops complementary and facilitation relationships with associated annual crops for resource use. This N₂ fixing tree has a reverse phenology. As a phreatophyte species, the tree is in leaf, growing and fruiting during the dry season. It shades its leaves during the rainy season, limiting the competition for light with the crops. Its pods and leaves provide valuable dry season fodder and the soil under the tree is enriched by the decomposition of tree litter and by the dung of animals browsing in the field. That results in an increase in crop yield in the vicinity of the trees especially in nutrient depleted soils. In the semi-arid zone, 30 to 40 mature trees per ha are recommended to give high cereal yields. *Faidherbia albida* parklands are generally associated with continuous cropping systems and cattle breeding (Les parcs à *Faidherbia albida*, Cirad, 1996).

Although *Faidherbia albida* occurs naturally in the North-West of Somalia, it is only in the last 20 years, with the encouragement of aid organizations, that intercropping with this tree has been attempted in the South. As initial growth of planted trees is rather low (less than 80 cm in the first year), it may be difficult to persuade farmers, to adopt such a practice. *Faidherbia albida* usually shows high potential of growth and natural regeneration on sites with high water table and these sites must be chosen in priority. If a tree resource occurs in some spots after the action of previous projects, conservation of naturally regenerated *Faidherbia* can easily be encouraged through incentives.

Establishment of block plantations

In order to renew the resource base, block plantations could be eventually developed to supply different products (e.g. wood for construction and fuel, fodder, gum-arabic) and service functions (e.g. land rehabilitation, soil fertility restoration). They should only be tried where the determination of the implementing organization to protect and manage the plantation is adequate. Massive reforestation seems to be unrealistic. In rain-fed areas, because of low and highly variable rainfall, any exotic species will either fail or production will be so low and would be uneconomic on most sites.

- **Acacia plantations in agricultural rain-fed area**

Fallow system is practiced on rain-fed agricultural land. The period the land is cropped and the period it is under fallow depend upon soil fertility, labor availability and land tenure. On fertile clays, there are areas that have been under continuous cultivation for 50 years. On the less fertile sand of the central rangelands, the land is cropped for two to ten years (usually 6 or 7) and then left under fallow for a minimum of 15 years (Leslie, 1989). However, it is commonly accepted that in the arid and semi-arid regions of Africa, shortened fallow periods and intensive harvests of fallow biomass undermine the ability of the fallow to restore soil fertility. So there is some potential for introducing planted tree fallows in rain-fed agricultural areas where site conditions make tree planting worthwhile. One potential solution is to promote the plantation of native, under-utilized legume tree: *Acacia senegal*, the world-wide main species for producing the internationally traded gum-Arabic. This species has potential for a wider use: fodder and wood production and service function such as soil fertility restoration (Deans *et al.*, 1999). Considering the time span between the tree planting and the gum harvesting (6-7 years) as well as the long term rotation of the plantation (20-30 years), only farmers with stable ownership will be able to adopt this agroforestry system (citation).

- **Irrigated block plantations**

Irrigated block plantations in the inter-riverine area is expected to compete with agricultural needs in terms of land and water use unless farmers can find financial justification for the establishment of trees as a crop. The concept of harvesting and selling timber trees (e.g. *Eucalyptus camaldulensis*) in order to increase cash flow in the difficult financial period before regular crop harvesting, can generate funds in the interests of individuals. Fodder bank based on irrigated tree plantations with *Leucaena leucocephala*, *Calliandra calothyrsus* or other species can also be established. Trees can be planted at rather low spacing and regularly pruned at medium height (1 to 2m) for fodder production. High value timber crops for building materials, joinery and carpentry may offer a better of economic return than fuelwood for such plantations.

Live fencing

The use of live fences is widespread providing shelter for the crops and acts as boundary markers between fields. *Euphorbia* and *Commiphora* are the two most commonly used genera. *Commiphora* is established through cuttings taken in the dry season and directly planted into the ground. Establishment is successful. A wide range of *Commiphora* species are used. The wood is used for milk containers, stools and water troughs. Somali trade in myrrh, obtained from tapping *Commiphora* species, is small compared to the frankincense market. Nevertheless, production of myrrh from *Commiphora* sp. might be an incentive for a widespread establishment of live fences based on this species.

Concerning Euphorbiaceae, *Euphorbia tirucalli* is the most commonly used species. It is not browsed by cattle and can produce a very effective live fence. *Euphorbia* edges are also established using cuttings planted during the dry season. Other species used for live fencing include *Opuntia* sp., *Solanum* sp. and *Erythrina* sp. *Opuntia* sp. is so heavily armed that it is an effective fence even when fairly low. Other species can be used such as *Parkinsonia aculeata*, *Leucaena leucocephala*, *Caesalpinia pulcherrima*, *Acacia letta* and *Acacia mellifera*, to provide shelter as well as fodder. Live fences can be supplemented with dead branches of Acacias.

Windbreaks

Wind erosion is particularly important in Southern and Central Somalia where there is little relief to provide natural shelter. A well designed shelterbelt or windbreak will significantly increase yields of some crops, mainly through reducing water loss by transpiration but also by decreasing mechanical damage by the wind. In a study from Northern Nigeria, millet and groundnut yields were increased by 88% and 148% respectively, thanks to windbreaks, but cowpea yields were diminished by 70% (Leslie, 1989). In citrus orchards, fruit drop, defoliation and breakage of branches are important forms of wind damage.

The shelterbelt or windbreak can be productive; thinning can provide poles and fodder. On the flat riverine plains, there is extensive use of shelterbelts (Leslie, 1989). These are of simple design consisting of one or two lines of trees -usually the same species- protecting banana plantations. The most used tree species on the Southern riverine areas are *Casuarina equisetifolia*, *Conocarpus lancifolius*, *Azadirachta indica*, *Eucalyptus camaldulensis*, *Thevetia peruviana*, *Cassia* sp. and *Leucaena leucocephala*. Species like *Dalbergia sisso*, *Albizia lebbek*, *Eucalyptus camaldulensis* and *Leucaena leucocephala* showed a high growth within shelterbelts established around irrigated crops in the Gedo region (Kassimani, 1987). *Leucaena leucocephala*, which provided good poles and fodder, got more attention.

Plantation grazing

On the Shabelle, livestock, mainly cattle, is often allowed to graze under fruit trees such as mango and coconut (Leslie, 1989). This practice is based on a complementary relationship for resource use between farmers and pastoralists. It keeps the grass down and gives the cattle dry season grazing. This practice may be extended concomitantly with improving fodder production in plantation systems.

Rangeland management

Experiences from the North (Somaliland) have shown that a sustainable range and pasture management can occur if stakeholders from the immediate vicinity of the range establish pastoral associations in order to promote high livestock productivity and fodder production in conjunction with water and soil conservation measures.

Dry season rangeland improvement can be increased by planting fodder trees and grasses in the drainage zones, also in the oases and around barrages in North and Central Somalia.

Fodder production for different purposes

Animal nutrition needs to be improved, especially for dairy (camel and cattle) and meat production (sheep and cattle). Furthermore, there is a need to increase the potentialities of fodder production in certain areas (e.g. high concentration of livestock near the ports for slaughterhouse and quarantine, possible development of a milk industry in the north of Mogadishu?). In this context, food-crop residues and agro-industrial by-products are often important but not sufficient to feed livestock. Market-oriented pasture reserves (natural grass or fodder crops) should be favored. On irrigated and rain-fed areas, local grass species (*Cenchrus ciliaris*, *Sporobolus robustus*) or exotic legume and grass species (*Stylosanthes* spp, *Vigna unguiculata*, *Chloris gayana*, *Atriplex* sp, *Andropogon gayanus*, etc.) could be sown. Also, on irrigated land and to a lesser extend on rain-fed land, fodder shrubs (*Cajanus cajan*, *Sesbania sesban*) and trees (*Calliandra calothyrsus*, *Leucaena* spp.) can be cultivated

along internal boundaries, external field boundaries, along contours or around the homestead. About 500 *Calliandra* shrubs are sufficient to supplement the fodder of one dairy cow with 6 kg fodder every day over a lactation period of 10 months. Due to its good fodder traits, over 100 000 farmers in East and Central Africa now grow *Calliandra* (Jama, 2004). While producing fodder, it also provides firewood, fencing, boundary planting, soil erosion control, and stakes for climbing beans.

Doum palm (*Hyphaena coriacea* and *H. benadirensis*) were formerly found in moderately extensive, pure stands along the Jubba River. Chemical analysis of the fruits showed the milled pericarp to be rich in sugar, fats and minerals, and also to be a valuable source of supplementary feed for livestock (Bowen, 1989).

Sand dunes fixation

Large moving sand dunes are a major problem along the Eastern Somalia coastline and central rangeland. Sand dune fixation received enhanced political support in the past. The techniques of sand dune fixation seem to be reasonably well understood in the context of Somalia (Fagotto, 1987). Panels woven from palm leaves, lines of *Commiphora* cuttings, dead branches inserted in the sand, provide protection to the newly planted tree seedlings (*Casuarina equisetifolia*, *Prosopis juliflora*). Isolated cashew trees planted in the sand, dune slacks have grown well too. But stabilization is achieved at a high cost and hasn't materially reduced the areas of active sand dunes (TFAP, 1989). It seems that more effort could be done to manage the currently stabilized sand dunes in order to prevent them from becoming active again. Self regenerated trees such as *Acacia tortilis*, *Dobera glabra*, *Terminalia polycarpa* are left from the natural bush land by settled pastoralists on sand dunes near Mogadishu. The prickly pear *Opuntia* is commonly grown on the dunes around Mogadishu. When sand dunes threaten developed infrastructure or agricultural land, and not only low value land, meaningful management with or by local populations should be achieved more easily.

Soil stabilization around dams, wells, irrigation infrastructure

In the North-West of Somalia, *Conocarpus lancifolia* is planted along irrigation canals to reduce erosion. Grass often develops underneath and is harvested as fodder. In the same area, *Prosopis chilensis* is grown on the edge of terraces to stabilize them. When mixed with other vegetable matter, the pods are fed to livestock. Other species can be introduced for different uses.

Forest trees for food supply

In the oasis gardens in the North-East, indigenous fruit trees *Ziziphus spinachristi* and *Grewia tenax* are left when the natural vegetation is cleared. Different trees and shrubs can be cultivated in gardens to produce edible leaves (*Adansonia digitata*), seeds (*Cajanus cajan*), and young shoots (*Borassus aethiupium*).

Intervention methodology to develop tree plantations

In order to successfully establish live fences, windbreaks, small-scale woodlots and fodder banks, tree plantations will require efforts from different stakeholders. Any intervention would have to provide long term technical advice to tree farmers and nursery managers. The main tasks of the technical advisor would be as follows:

- Training and technical help for nursery managers in:
 - Seed germination and seedling cultivation
 - Installation of appropriate irrigation systems and in the sheltering of plants
 - Grafting methods
 - Plant marketing
- Technical training to tree farmers in:
 - Planting techniques
 - Tree maintenance and protection
 - Harvesting methods of tree products
 - Marketing of tree products (wood or non wood products)

Regular meetings with all participants about failures, successes and problems occurring in projects should be held to assist the exchange of information and experience.

2.3.5. Priorities

- A general agro-ecological zoning must be carried out throughout the country in order to identify homogeneous land use systems and related constraints and development needs.
- Training adequate professional and technical staff and extension agents in the areas of pastoralism, horticulture and forestry. For that purpose a manpower requirement survey is required.
- Looking for conciliation between farmers and pastoralists for land use;
- Facilitating the establishment and strengthening of pastoralist organizations and associations based on traditional authorities;
- Addressing the problem of charcoal production which is a major cause of land degradation (Re-enforcing the charcoal export ban);
- Developing alternative energies as charcoal (gas, fuel, kerosene, solar energy);
- Identifying alternative opportunities of employment in the non-pastoralism sector;
- Creating new nurseries and supporting already established ones with different objectives according to the area (tree seedling production, shrub and grass seed production, establishment of species trials and demonstration plots).
- Regarding rangeland, livestock and agroforestry management, priorities to the different intervention strategies listed before need to be defined in relation to the different stakeholders and target beneficiary groups in the different regions.
- A State of the Environment should be assessed regarding vegetation, wildlife as well as soil and water resource dynamics. An inventory and an evaluation of the management of different water points are needed. Vegetation studies using remote sensing and field inventories are also required. Little is known about the standing woody biomass per ha in the various classes of woodland and less is known about the annual increment. Does annual wood increment exceed off-take for domestic consumption? Considerably more detailed inventory work and studies on vegetation and rehabilitation potential are needed before specific recommendations for rangeland management can be made.

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