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The place of agroforestry in the rehabilitation and utilisation of semi-desert environments of northern Kenya

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Abstract

Increasing destruction and degradation of the natural resource base in the sand-duned landscapes of North Horr, Marsabit District, northern Kenya, are jeopardising efforts towards sustainable economic development. The Gabbra nomads of the area live under severe poverty conditions. Efforts to assess and apply agroforestry practices towards the rehabilitation and utilisation of the area's vast rangelands are at a formative stage. To this end silvopastoral systems have been formulated designed to ensure continued provision of fodder for livestock, improved soil fertility, provision of fuelwood, conservation of water resources and land rehabilitation. Suitable technologies including semi-desert plants such as *Hyphaene coriacea* for basketry and thatching of dwellings and *Suaeda monoica* for dry season browsing by camel are possible candidates for further development. The potential to domesticate wild plants for conservation purposes exists. Unfortunately direct planting of trees on communal lands within the study area is low. This paper examines the dual utilisation of agroforestry practices for land rehabilitation and enhancement of economic production systems in North Horr dry lands. Some of the factors that have hindered the effective application of agroforestry practices in the rehabilitation of the semi-desert environment of North Horr are also discussed. It is concluded that by addressing some of these factors and issues through community education programmes it would be possible to provide an effective framework for increased community participation for sustainable land-use management using suitable agroforestry techniques in semi-desert environments.

Key words: agroforestry, land rehabilitation, semi-desert environments, utilisation

Introduction

The dry lands cover nearly 88% of the total land mass of the Republic of Kenya (Gatheru and Shaw 1998). They are characterised by adverse conditions yet they provide livelihoods to over 25% of the human population of Kenya and support over 50% of the country's livestock population, besides hosting a diversity of wildlife. Due to climatic, environmental, technological, infrastructural and socioeconomic constraints that this region faces, land degradation is moderate or high (Darkoh 1994). In addition, the effects of drought and increasing demographic pressure have made the traditional livelihood systems based on pastoralism inadequate and unsustainable (UN 1993). Land degradation exacerbates poverty, which in turn accelerates desertification. The nomadic peoples of these dry lands are forced to intensify over-utilisation of their land just to survive (Darkoh 1993). Thus in areas prone to desertification, current livelihood and resource-use systems are not able to maintain people's living standards. A major challenge is to

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effectively arrest the process of land degradation and restore biodiversity and productivity. This must be accompanied by actions to rehabilitate and improve the agropastoral and pastoral systems for sustainable management of rangelands.

Fragile ecosystems of the dry lands of northern Kenya have unique features. In order to safeguard these ecosystems optimal use should be made of their natural resources, more to enhance fertility and productivity and prevent soil degradation, nutrient depletion, water waste or pollution, waterlogging and salinisation. North Horr is a classic example of how interactions between climate and anthropogenic pressures can lead to land degradation. Decreased precipitation and vegetation cover, coupled with anthropogenic pressures resulting from sedentarisation, characterise a dramatic increase in wind erosion on pastoral lands. This has led to a reactivation of the once stable sand dunes, leading to sand encroachment in the centre of the North Horr settlement. The consequences include submerging of the existing seedbanks of dwarf shrubs and grasses, burying of houses and roads, health hazards, and nuisance to the inhabitants. Together with the recurrent droughts, these problems have adversely affected the natural processes of regeneration of plant species. A rational response to the emerging harsh conditions is difficult to set in motion. Hence, the loss of key grazing areas has led to severe land degradation (Omar and Abdal 1994).

Plant resources in North Horr perform both economic and ecological functions of providing fodder for livestock and sand dune stabilisation, respectively. However, increasing destruction of the indigenous plant resource base has jeopardised efforts towards sustainable development and effectively fighting poverty.

The study area

North Horr settlement is located in North Horr Division within Marsabit District at the northern-western edge of the Chalbi desert in northern Kenya (Figure 1). Most of the area is classified as agroclimatic zone VI (Sombroek et al. 1982; Jätzold 1991) with a climate that is characterised by high input of solar radiation through generally clear skies, high heat losses at night, low precipitation supply, high moisture losses (evapotranspiration), and prolonged water deficits. It receives a mean annual rainfall of 157 mm with a median of 200 mm (Schwartz et al. 1991) characterised by high spatial and temporal variability. Figure 2 shows the total annual rainfall distribution in North Horr between 1977 and 2000. Over that period the highest rainfall received was 281 mm in 1977 and the lowest was 18 mm in 1984, with 1985 registering no rainfall. Drought risk occurs in four out of ten years.

The major landforms and geology of North Horr have been described by Touber (1991). Lacustrine plains characterize the landform around North Horr settlement, with predominant geology and parent material being lake-bed deposits in the Chalbi desert with an undulating almost flat relief (< 2%). Soils are sandy loam in texture, saline, sodic and calcareous, shallow to moderately deep and pale brown. The parent material is sand mixed with some volcanic ashes. According to FAO-UNESCO classification the soils are classified as cambic Arenosols (Aridosols or Solonchaks). The high salt concentration causes surface sealing and reduces water infiltration, leading to flush floods.

The study area has low natural vegetation cover (Van Bremen and Kinyanjui 1992). Presently, large areas in North Horr are completely bare and covered with desert pavement ('serir' desert type) underlined by fine- to middle-grained sand, which is an indicator of prolonged exposure to strong wind erosion. Dune fields of 'nebkha' type surround the

Figure 1: Location of North Horr in Kenya

settlement. Hummocks grown mostly with *Suaeda monoica* (a salty shrub palatable to camels), *Euphorbia cuneata, Indigofera spinosa, Heliotropium* spp. and *Sporobolus spicatus* form a perimeter around settlements. There are also scattered trees of mainly *Acacia tortilis, Boscia* spp., *Balanite* spp. and *Salvadora persica*. Colonies of *Hyphaena coriacea* (doum palms) are found growing in areas associated with relatively high ground water table, especially around water springs.

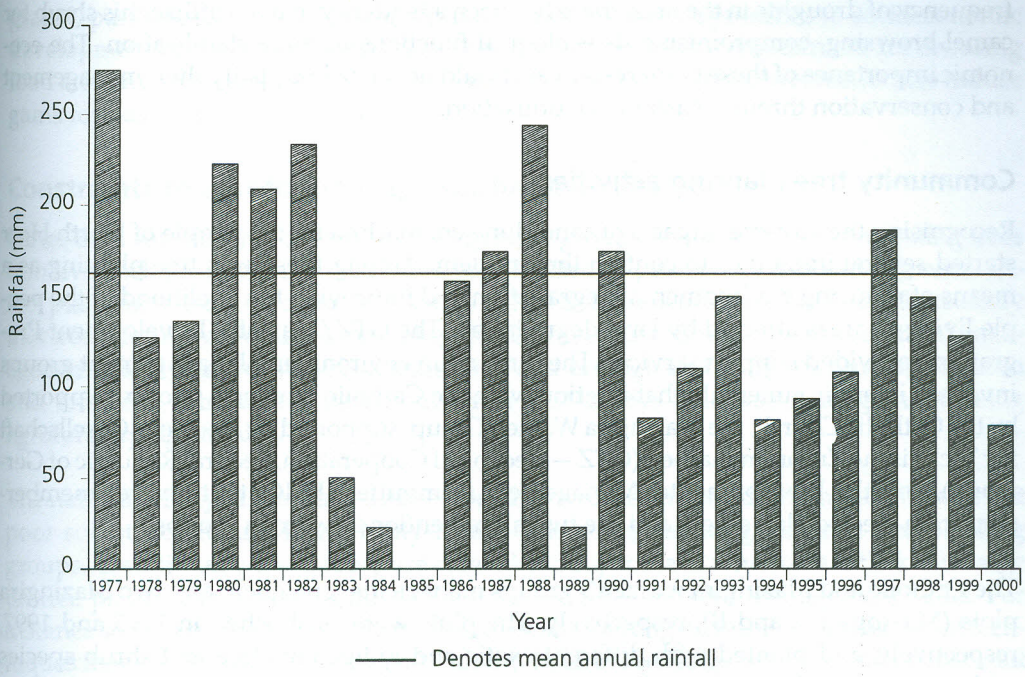

Figure 2: Total annual rainfall in North Horr between 1977 and 2000

North Horr is inhabited by the Gabbra nomads, who predominantly depend on camel husbandry for their livelihood though they also keep sizable flocks of sheep and goats for subsistence needs in times of drought and for celebrations and ceremonial purposes.

Important agroforestry tree and shrub species for ecological and economic functions

Notable agroforestry tree and shrub species in the study area include *Hyphaene coriacea* (doum palm), *S. monoica*, A. *tortilis*, *S. persica* and *Commiphora africana*. The Gabbra use *A. tortilis* for firewood, building of bomas, fencing and fodder (pods are fed to goats). They prefer *Salvadora persica* for camel fodder. However, the abundance of *S. persica* has reduced over the years, making *S. monoica* the predominant camel browse.

H. coriacea is a multipurpose tree species. Women make table mats and baskets from its buds (unopened leaves). These products are sold to generate income to supplement earnings from livestock husbandry. The *H. coriacea* stands around North Horr settlement have greatly diminished following the sedentarisation of the Gabbra (Olukoye et al. 2000; Olukoye et al. 2003). The increased demand for materials for building and for mat and basket production continues to lead to heavy cutting of trees and unopened *Hyphaene coriacea* leaves. The heavy utilisation of this plant species has jeopardised its ecological role in sand dune stabilisation and general environmental rehabilitation.

S. monoica is an important dune stabilizer. It is also extensively used for fuelwood, with 77% of the Gabbra women preferring it as a source of fuelwood (Milimo et al. 1999). It is also an important dry season browse for camels and thus ensures sustained milk production for the Gabbra in periods of drought (Olukoye et al. 2002). Due to increased

frequency of droughts in the area, there has been a tendency to over-utilize this shrub for camel browsing, compromising its ecological functions of dune stabilisation. The economic importance of these plant resources should nevertheless justify their management and conservation through sustainable utilisation.

Community tree planting activities

Recognising the adverse impacts of sand dune encroachment, the people of North Horr started several initiatives to contain the problem. Among these was tree planting as a means of reducing environmental degradation and improving the livelihood of the people living in areas affected by land degradation. The GTZ/Marsabit Development Programme provided support services. The three main environmental management groups involved in environmental rehabilitation were the Catholic Women's Group, supported by the Catholic Church, the Mazingira Women Group, supported by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ — Technical Cooperation, Federal Republic of Germany), and the Environmental Management Committee (EMC) that derives membership from elected clan elders and the two aforementioned women groups.

The Catholic and Mazingira women's groups manage the 'greenbelt' and two Mazingira plots (Mazingira A and B), respectively. The plots were established in 1995 and 1997, respectively, and planted with different exotic and indigenous tree and shrub species with the aim of rehabilitating the environment. Notable indigenous species include *A. tortilis*, *C. africana*, *H. coriacea* and *S. monoica*, while *A. indica* (neem) is the main exotic species planted by the Mazingira Women's Group. However, neem is gaining popularity among the whole community and is currently being planted around the homesteads.

EMC is not an active tree planting group but it performs a regulatory role in general resource management. It, however, fenced and established a plot — the natural regeneration plot — to encourage natural regeneration of indigenous shrub species, mainly *S. monoica*, for environmental restoration. Several planting trials showed that camels facilitate the natural regeneration of *S. monoica* through their dung deposits (Milimo et al. 2002; Olukoye 2003). Indeed, the local EMC is popularising the grazing rotation of camels to enhance the regeneration of the species. This strategy is compatible with the traditional nomadic land-use system. It is expected to ensure that the shrub effectively performs both its economic and ecological functions.

The assessment of the performance of indigenous and exotic tree and shrub species for rehabilitating North Horr's desert environment has been reported in Olukoye et al. (2003). But generally, compared with indigenous species, the exotic tree species (not naturally growing in Marsabit natural ecosystems) fail to sustain improved growth performance in the saline soils of North Horr. This explains why the survival rates of indigenous plants in the area are higher than those of exotic ones. In order to rehabilitate saline soils and stabilise sand dunes, use of indigenous tree and shrub species adapted to such saline conditions should be encouraged.

The implementation of the described community forestry practices that include the participation of the local people is essential if trees and shrubs are to effectively address people's needs in terms of food security and the overall socioeconomic development. The adoption of these agroforestry techniques enhances the productivity of dry land grasslands and livestock management. Further, sustainable development through inte-

grated, participatory and information-based agroforestry approaches to socioeconomic development and environmental management is a necessary requirement for ensuring food and environmental security for future generations. Such improvements also induce gains for pastoral communities.

Constraints to agroforestry approaches in North Horr

Other than for the environmental management groups the tradition of integrating trees into livestock production systems has been limited to preservation of existing ones. Direct planting of trees on communal lands of North Horr is uncommon. It is only recently that tree planting around homesteads gained momentum. Environmental, cultural, management, land and tree tenure, institutional and ecological constraints hinder increased and effective community participation in sustainable land use management using agroforestry techniques.

The natural aridity of the study area — together with strong winds, high sand movement poor soil structure and low fertility levels — is a demotivating factor in tree planting groups. Traditionally the Gabbra are camel keeping nomads who have little knowledge on tree planting and management. They do not have nursery management skills. For instance some locals who have received only scant training on nursery management techniques manage the local government nursery. Lack of seedlings is thus a major constraint to tree planting activities in the area.

Lack of seeds of most indigenous tree and shrub species — their best propagation method — is another constraint to tree planting. High soil and water salinity levels that lead to low seedling growth and survival rates further compound this problem. In most cases, this leads to seedling demand outstripping supply, especially for the two women groups involved in tree planting. The fact that earlier tree planting activities were supported by food for work programmes has also created a dependency syndrome, which has negatively affected people's participation in such activities. In addition, despite the abundance of manure, cultural taboos have prevented its use in tree planting. Such cultural taboos have also hindered large-scale use of camel dung in natural regeneration of *S. monoica*.

Communal land tenure systems that are predominant in the area have created a tricky problem in regard to tree tenure. Tree tenure, as is the case for land, is communal. This might be an impediment to the distribution of future benefits accruing from high value trees such as neem, now being planted on communal plots. However, GTZ, through its Marsabit Development Programme, tried to introduce the concept of tree ownership. It is hoped that EMC will spearhead further community discussions on tree tenure systems.

There is also a changing scenario in pastoral lands where communities have problems in managing and sustaining agroforestry practices because they do not have inadequate incomes. There is need for communities to link economic development with increased benefits from improved silvopastoral systems. In retrospect, poor institutional linkages, as manifested in the inordinate time taken by EMC and the provincial administration to convene public meetings for awareness creation, hinders the implementation of agroforestry practices (Milimo et al. 2002). This has led to delays in decision-making, negatively affecting natural resource management strategies.

There is also the need to ensure better complementarity of the roles and responsibilities of men and women. Currently tree planting activities in North Horr are mainly carried out by women, who are also involved in other demanding domestic chores.

Role of community education programmes

Participation of local communities is intended to strengthen the capacity of rural people to acquire responsibility for and authority over local resources. This concerns all decisions on how resources are used (Barrow 1996; Saxena 1998). It should be a voluntary process by which people influence or control decisions that affect them (Milimo et al. 2002). This way, decision-making is decentralised from the agency to the community and the field office. The strategy can be enhanced through community education programmes that strive to improve on the local capacity and institutions in environmental management. The result would be a reverse of the negative attitudes and cultural taboos that hinder tree planting for land rehabilitation in pastoral ecosystems. In addition, strengthened local institutions would facilitate more flexible and sustainable ways of managing natural resources such as rotation of grazing camels for natural regeneration of *S. monoica*.

Creation and strengthening of community-based management committees like the North Horr EMC to take full responsibility for managing tree and shrub resources is the basis for an effective framework for increased community participation for sustainable land use management. Such indigenous management authorities could be the entry point for training on participatory processes of seed collection, storage and conservation and planting techniques. This would enable the local communities, especially the two women groups, to develop their own seed and biodiversity data banks. This would also facilitate the collation and recovery of considerable investments in relevant data on the production and management systems of indigenous tree species.

Community education programmes facilitate training, articulation of lessons learnt and sharing of experiences. The approach should be to give direction and specialised training to all community-based natural resource management committees operating in the study area. The lack of such an approach has seen the EMC settling disputes over conflicting perceptions by different resource-use groups such as camel owners versus non-owners, town dwellers versus mobile nomads, and even one local authority against another. For all these competing interest groups to contribute to and benefit from community agroforestry programmes the existing differences among them must be taken into account in formulating education programmes. These competing interest groups have to be considered in any designed education programme. EMC views its role as purely to impose fines on environmental offenders (Milimo et al. 2002), thus its advisory capacity, training and even information dissemination roles based on the legal provisions of the Environmental Management and Coordination Act (Republic of Kenya 1999) have to be clearly defined so that from the outset user groups avoid conflicts and have a clear mandate.

In order to successfully implement education programmes that emphasise user involvement, planners and managers of agroforestry in semi-desert environments must understand the social fabric in which change will be embedded, the human dimension affecting community acceptance and use, and how management of facilities is organised. A participatory agroforestry planning and monitoring process responds to this changed role by offering a medium through which agencies can understand this social fabric as op-

posed to the conventional blueprints, and communities can be empowered to take over the management of agroforestry programmes and to work in partnership with government agencies and other partners. These other partners would also be able to learn from the local communities.

Conclusion

Collaborative efforts involving pastoralists, researchers and development workers are essential in developing innovative agroforestry approaches for more ecologically sound natural resource utilisation and management of arid ecosystems. Further, although agroforestry techniques have a place in the rehabilitation and utilisation of semi-desert environments of northern Kenya, the removal of the various constraints discussed in this paper through community education programmes would provide an effective framework for increased community participation in tree planting activities. This is more so in cases where pastoralists are becoming increasingly settled, as is the case in the North Horr settlement.

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