DRYLAND ZONE CASE STUDY 3

Enclosures as a Tool for Rehabilitating Degraded Woodlands of Ethiopia[1]

BACKGROUND

Deforestation has been a major national problem in Ethiopia for many years. At the close of the twentieth century, the country found itself experiencing very rapid deforestation through forest clearance for crop cultivation, unsustainable wood exploitation for lumber and wood-fuel, overgrazing and also wars and civil unrest. The severely degraded lands are typically characterised by heavily eroded or nutrient deficient soils, hydrological instability, reduced primary productivity and low biological diversity (Verma et al., 1999) and these are common phenomena in the dry areas of Ethiopia. Most of these degraded areas have been under great pressure for a long time, to the extent that they have been changed into wastelands. Thus, at present, remnant forests, woodlands or shrub lands have become restricted to inaccessible areas such as hillsides, mountain tops and around churches, monasteries, mosques or graveyards, particularly in the northern parts of the country (EFAP, 1994).

Past reforestation and afforestation programs in the degraded areas have often been unsuccessful with no or very low survival of the planted trees. Factors such as unavailability or low availability of propagules, low soil nutrient availability, absence of fungal and/or bacterial root symbionts or unsuitability of the microhabitats for plant establishment in general and seasonal drought have been identified as major reasons for program failures (Verma et al., 1999).

As part of their fight against land degradation, communities have started establishing enclosures, with the hope of preventing further degradation and promoting their re-vegetation. The main objective of establishing such enclosures is to improve the overall ecological conditions of degraded areas so that they can provide better socio-economic benefits and environmental services to the local communities. In this regard, it has become a common phenomenon to observe increase of plant as well as animal biodiversity with time after the establishment of enclosures. In areas where they have been established, particularly in the northern parts of the country, enclosures are among the green spots with considerable species diversity (Tefera et al., 2003; Tesfaye, 2002; Emiru, 2002; Kidane, 2002).

Establishing enclosures is considered advantageous since it is a quick, cheap and lenient method for the rehabilitation of degraded lands (Bendz, 1986). Despite the fact that enclosures have proved instrumental in the re-vegetation and rehabilitation of degraded lands, knowledge on the diversity, sources of propagules and status of regeneration of the developing flora as well as the actual and potential socio-economic benefits that can be derived from such enclosures is lacking. Hence before a nationwide action plan use of enclosures as a tool of rehabilitation of dry areas was adopted, investigation on their viabilities and potential was urged.

This project was conducted in *'Aynalem Tabia'* within Wukro Woreda situated 30 km north of Mekelle, in the Eastern Zone of the Tigray National Regional State (TNRS), north-eastern Ethiopia. Aynalem Tabia is a

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dry area with an average annual rainfall ranging from 390 to 410 mm, although variability of rainfall from year to year is very considerable. The rainy season is mainly between June and September. The average annual temperature at the study site ranges from 15 to 18° C. The area has an altitude that ranges from 1900 to 2200 m and slope that ranges between 05-20%.

The study area has a very interesting history. Key informants of the area reported that the area was covered with a forest, mainly of big *Acacia etbaica* trees, until the invasion of Ethiopia by Italy in 1935. The area is known by the name *'Ziban Serawat'*, which refers to an area covered with *A. etbaica* trees. After the invasion, the Italian soldiers are reported to have cut the big trees and transported them on big lorries to Wukro town for fuel to process lime. According to the local people, most of the trees were uprooted, but those that were not uprooted coppiced vigorously. The coppice was devastated again after the First Tigray Peoples Liberation Front Movement failed in 1948. After the proclamation of land by the Socialist Government of Ethiopia in 1975, the area was converted into farmland. It was also reported that the area had been put under different land uses since 1993 when the 58 ha of land was enclosed for protection while the other 52 ha of land was left aside to serve as grazing land.

The livelihood of the local people depends on subsistence farming, in which livestock husbandry and crop production play a major role. Almost all the population in Aynalem Tabia depends on agriculture and the dominant farming system is highland mixed farming. Land degradation combined with high population pressure and large livestock populations is a severe constraint to the farming system and livestock productivity is very low.

OBJECTIVES

The general objective of this study was "to investigate the role of enclosures in the rehabilitation of degraded drylands focusing on their potential socio-economic and environmental benefits to the society".

Specific objectives included:

- Studying the diversity, i.e., species richness and evenness, of woody plants;
- Investigating the soil seed bank as a possible indicator of actual or potential source of propagules for the developing flora;
- Assessing the regeneration status of some selected woody species;
- Investigating perceptions of the adjacent communities on the actual and potential socio-economic and environmental benefits of degraded lands rehabilitation;
- Formulating recommendations that would assist in the further development, management and sustainable utilization of enclosures.

APPROACH

The project was carried out by the government of Ethiopia (through the Ethiopian Agricultural Research Organization), the Swedish International Development Agency (for partial funding) and the local community. The site covered a total area of 7,133 ha. The study site had 1,800 households, of which 500 inhabited the actual study area known as 'Hawza Kushet'. The total population in the study area was 3,000. In Hawza Kushet two sites of similar characteristics were selected for the study at a locality known as 'Ziban Serawat'. One of the sites, covering a total area of 58 ha, had been enclosed for eight years while the other site, covering a total area of 52 ha, had been used for grazing.

The following vegetation parameters were assessed:

- Species richness, abundance, density and diversity;
- Regeneration status and ground cover;
- Soil seed banks;
- Socio-economic survey based on 50 households from a list of 500.

RESULTS

Species Richness, Abundance, Density and Diversity

The total number of woody plant species recorded in the study area, in both the enclosure and open grazing area, was 39, among which 31 were naturally growing species and eight were planted. In the enclosure 27 plant species representing 18 families were recorded. Out of the total woody species encountered in the study quadrants, 37% were trees and 52% shrubs. In the open grazing area, 14 species were recorded representing 12 families. Here, trees constituted 50% of the total woody species and shrubs 50%.

In both land uses, more than half of the density, i.e. 64% in the enclosure and 60% in the open area, was contributed by only one species, namely *A. etbaica*, which had also the highest (100%) frequency. The species is four times more abundant in the enclosure than in the open area. The importance value index, basal area (BA) and density are also higher for this species in both land uses and is greater by all factors in the enclosure than the open area. The BA of all woody plants with their diameter greater than 2.5 cm was 21.96 m^2/ha for the enclosure and 9.6 m^2/ha for the open area. The BA in the enclosure exhibited a sort of normal distribution while in the open area most of the BA was concentrated around the higher diameter classes. Most of the woody species had a BA of less than 5 m^2/ha both in the enclosure and open area. *Acacia etbaica, Euclea schimperi*, *Aloe berhana, Lucas oligocephala*, *Carissa edulis* and *Oncoba spinosa* were the first six most important dominant woody species in the enclosure reflected by their Importance Value Indices. Similarly, in the open area, *Acacia etbaica, Euclea schimperi,* and *Lucas oligocephala* were the most important dominant woody species.

The difference between the enclosure and open area in terms of their number of species and ground cover could be attributed to the high level of interference both by humans and animals in the open area. The open area is used to collect wood and non-wood products for household consumption, to dig out stone for

construction and for grazing by domestic animals. There was a higher proportion of shrubs in the enclosure than in the open area, which was rather dominated by trees, suggesting that there is also an active succession taking place in the enclosure, i.e., high woody plant recruitment.

Regeneration Status and Ground Cover

When the diameter classes of all woody species were analysed together, the enclosure showed a more or less inverted J - shaped frequency distribution with abundant individuals at the lower diameter classes but declining numbers of individuals as the diameter classes increased, suggesting good regeneration status. The proportions of seedlings, saplings and trees were 59.8%, 20.7% and 19%, respectively. At the species level, the most abundant species, namely *A. etbaica*, exhibited an inverted J - shaped frequency distribution of its diameter classes with about 50% of its individuals less than 5 cm in diameter. Conversely, *Euclea racemosa* showed a relatively hampered regeneration.

In the open area, although the diameter classes exhibited a more or less inverted J - shaped frequency distribution, *Acacia etbaica, Euclea racemosa* and *Maytenus senegalensis* showed hampered regeneration. The proportion of seedlings, saplings and trees were 27%, 58% and 15%, respectively indicating lower numbers of individuals both at the lower and higher diameter classes.

The high proportion of seedlings in the enclosure, which is an indicator of recruitment of the plants through germination, implies the existence of a good potential for the restoration of woody communities. However, the same species exhibited lower proportions of seedlings in the open area than the enclosure indicating the impact from human and animal interference on their regeneration.

Soil Seed Bank

About 29 and 23 herbaceous species were recovered from the top nine centimetres of soil samples collected in the enclosure and open area, respectively. The total numbers of viable seeds recovered both from sieving and incubation of the soil samples were 1663 and 924, corresponding to densities of about 1479 and 1354 seeds/ m^2 in the enclosure and the open area, respectively. Both the number of species and densities of seeds decreased with increasing depth in both land uses.

Socio-economic Settings

The male and female individuals accounted for 92 and 8%, respectively. The family size of the households in the study area ranged between 3-7 people. There is a high level of illiteracy, which is attributed to the prevalent subsistence farming. About 90% of the respondents had land ranging between 0.5 and 1 ha, and the remaining landless people, most of whom are married, live with and depend on their parents.

Attitude, Perception and Awareness of the Local People

Most of the informants in the study area had positive attitudes towards enclosures. All respondents in the village regarded the enclosure as a source of feed for their cattle and gave higher aesthetic value to the enclosure. About 71% of the residents near the enclosure supported further conservation of the enclosure while 29% of them preferred to use the enclosure for their immediate needs. The major reasons given for the need to use the enclosure were inability of the people to afford other forms of energy and shortage of grazing land since 78% of the respondents owned livestock for farming, draught, dung, milk and social

security. The majority of respondents did not have any other source of feed in bad seasons except the enclosure.

All respondents agreed on the need for the bylaws and guarding, especially to protect the enclosures from damage by straying domestic animals. However, all the respondents expressed their strong desire for the amendment of the operational bylaws, which they felt should include provisions for carefully planned utilization of enclosures, e.g. through controlled livestock grazing in drought periods, as was done in 1996 and the collection of dead and live wood, etc.

REASONS FOR SUCCESS AND LESSONS LEARNT

Reasons for success and lessons learnt include:

- Integration of indigenous knowledge in the implementation of the project;
- Low funding requirement to carry out and complete the project;
- Involvement of local communities and extension service in determining the solutions on enclosures and the way forward;
- The highly scientific manner followed in carrying out the study has led to generation of valuable quantitative data on enclosures.

RECOMMENDATIONS

Policy

Full involvement of the local community during planning and initial support to community members is necessary for the success of enclosures as a rehabilitation strategy.

Management

Since participation of the local communities is the key to success in any community-based development and conservation effort, it is recommended that identification and delineation of areas for establishing enclosures together with their subsequent management, conservation and sustainable utilization; formulation, development and implementation of bylaws should be undertaken in close consultation and active participation of the communities concerned. It is particularly important that there should be equitable sharing mechanisms of both costs and benefits among members of the communities. Other factors to be taken into account include a balanced focus on protection and utilization of the enclosures as well as decisions on the level of punishment fines; and the identification, development and implementation of appropriate and viable management options for the actively developing or already rehabilitated enclosures.

Research and Training

Exploration and introduction of affordable alternative sources of household energy and construction material are recommended to relieve the pressure from the local people on the enclosures.

Formal and informal training for the local people is still needed on the ecological and socio-economic importance of enclosures. This has the ultimate aim of enhancing their awareness, which, in turn, is vital in ensuring the long term desired management, conservation and sustainable utilization of enclosures.