Invasive Plants and Food Security: the case of in the Afar region of Ethiopia

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1. Introduction

Invasive plant species, introduced deliberately or accidentally to different parts of the world (), can cause important economic, environmental and social losses (Anderson, 2005).

This case study reflects on the invasion of in the Afar region of Ethiopia, revealing the serious potential impacts of invasive plant species on people's food security and livelihoods. It discusses the lessons learnt from subsequent management interventions by FARM-Africa in collaboration with local partners. These lessons may serve to alert other communities, practitioners and decision-makers in

Over 700,000 hectares of prime grazing land and cultivable land following the Awash River is currently either invaded or at risk of invasion from prosopis in the Afar Region (US FS, 2006). This accounts for 15% of the region's productive land (4,670,316 hectares), excluding wetlands, water bodies, sandy and rocky areas (4,856,251 hectares). Refer table 1**.**

Table 1: Afar National Regional State land use cover

Land use type	**Hectares**	**% coverage**
Cultivated land	51,919	0.5
Grass land	1,409,426	14.8
Shrub land	3,005,719	31.6
Woodland	164,152	1.7
Natural forest	10,379	0.1
Reverine forest	28,721	0.3
Water	82,140	0.9
Wetland	48,860	0.5
Exposed soil, sand or rock	4,725,251	49.6
Total area	**9,526,567**	

According to local communities, the prosopis invasion has resulted in multiple negative effects on their food security, livelihoods and the region's environment (Dubale, 2006). The invasion of prosopis has caused considerable declines in livestock production and productivity due to the loss of dry season grazing areas to prosopis plants. Palatable indigenous pasture species such as and have all reduced. Indigenous trees such as and have also declined in the rangelands due to the invasion. Pods and branches of these trees are the main dry season feed sources for livestock. Zelalem (2007) reported that camel ownership has reduced almost by one-third over the last five years alone while the mean number of calves and heifers was reduced by five fold. He also noted a higher rate of decrease in numbers of sheep and goats compared to camels, perhaps due to the relative advantage of camel to browse tall woody plants.

Feeding livestock exclusively on prosopis pods for extended periods, due to lack of pasture in the invaded areas, has resulted in health problems to animals such as constipation, dental disfiguration and reduced overall productivity. Local people call the diseases in cattle Harmeko. According to their observations cattle manifesting Harmeko will die after prolonged loss of body condition.

People and livestock suffer from injuries from the sharp and poisonous prosopis thorns. Local people also say that predators (hyena, jackal, lion and leopard) attacks on livestock have increased since the prosopis invasion. In agro-pastoral areas, damage to the crop fields from wild herbivores such as warthog and bushpig has increased due to more hiding places in the prosopis thickets.

The increased cost of land clearance became

Local people also [redacted]ed that malaria cases increased since invasion of prosopis. According to their observa[redacted]he moist microclimate in invaded areas provided a favourable environment for m[redacted]'s multiplication. This observation was similar to reports from Kenya also experiencing [redacted]sion of prosopis. (Mwangi and Swallow, 2005)

With the decline o[redacted]g and cultivable land, coupled with recurrent droughts, people in the Afar region becam[redacted]y food insecure and dependent on government food aid for their survival. In highly i[redacted]areas people are now reliant on food aid on average for 5-6 months in good years and [redacted]o 10 months in drought times (PCDP, 2005).

With these consi[redacted]impacts in local productivity, the majority of the pastoralists were forced to diversify[redacted]velihoods to include crop farming, daily labour, charcoal production and trade or com[redacted]ns of these. In a 2006 survey conducted in Gewane and Amibara districts (Dubale, [redacted] was recorded that 77% of the interviewed pastoralists diversified their means of li[redacted] selling labour for private and government state farms, involved themselves in cha[redacted]oduction and trade and carried out shared cropping with emigrant labourers. Similarl[redacted]of the interviewed agro-pastoralists engaged in other activities such as selling labour, c[redacted]production and trade (Table 3).

Table 3 Impact [redacted] on local livelihoods

Occupation	None	[redacted]on	Selling labour	Crop farming	Selling labour & farming	Selling labour & charcoal	Farming & charcoal production	Total
Pastoralist	23%		59%	5%	0%	9%	0%	100%
Agro-pastoralist	0%		5%	14%	77%	0%	5%	100%
			32%	**9%**	**39%**	**5%**	**2%**	**100%**

iii) reducing the dispersal of seeds by livestock and wild animals that feed on the pods of the prosopis and are unable to fully digest the seeds. To reduce this effect, pod collection, crushing (to kill the seeds) and sales for livestock feeding were demonstrated.

At the same time as seeking means to eradicate or control the invasion of prosopis, efforts were made to identify potential livelihood benefits from the plants, as incentives to better manage the invasion. Because prosopis tends to establish itself so well, including in arid lands where other tress fail to survive, it is known to provide various socioeconomic benefits (Mwangi and Swallow, 2005). These include wood products (firewood, fuelwood, charcoal, fence posts, poles, sawn timber, furniture, flooring and craft items), as well as non-wood products (flour for cakes, biscuit and bread, pod syrup, coffee substitutes, animal fee, honey, wax and exudates gum).

In the Afar region, charcoal production and pod crushing was introduced in areas where prosopis was established well and had mature trees that had started setting pods. To pilot the interventions four cooperatives were established in Gewane and Amibara districts and were granted official licences by the government to implement the identified activities.

Cooperative members were trained and technically supported in how to manage their interventions which included: prosopis tree harvesting techniques to prevent coppicing; utilization of time and labour efficient charcoal production techniques using metal kilns (Plate2); pod collection, drying, and crushing using small hammer mills and normal flour mills (Plate 3) and cooperative leadership and financial management.

Plate 3: Prosopis pod ready for crushing, small hammer mill and normal flour mills were introduced

A market survey was carried out to better understand the charcoal trade in cities such as Adama (Nazareth) and Addis Ababa. The local cooperatives were then linked with the wholesale merchants in the surveyed areas. The cooperatives were given hand tools, sample metal kilns, sample pod crushing mills and "seed money" to initiate charcoal trade. The Ethiopian Rural Energy Promotion Centre (which has done research on improved charcoal production techniques) and private companies

with interests in the export of charcoal to the Middle East supported the introduction of improved charcoal production techniques.

pods are highly nutritive and consumed by domestic and wild animals. Collecting and crushing the pods was assumed to contribute to the reduction of seed load to the soil and so minimize further spread of the invasion to new areas. In the beginning, four small hammer milLs (11kg of pod /hr crushing capacity) and later normal flour millS of higher capacity (25HP crushing 400kg/hr) were introduced to handle the large volumes of pods available. The cooperatives are also linked to feed processing factories in Adama and Mojo to sell prosopis pods, crushed or fresh.

In areas where there is better access to irrigation water, communities were supported with farm inputs and training to manage cleared land for pasture and crop production to prevent re-invasion. This activity was carried out in collaboration with the Ethiopian Institute for Agricultural Research Gewane Agricultural Technical Vocational College for technical support.

4.2 What major changes occurred?

a. Benefits from prosopis pod sales

Pod collection, drying, crushing and sales activities showed a substantial demand for the crushed pods by livestock keepers and feed processing factories. The activity benefited both local people and the cooperative that engaged in selling the

Plate 5 : Feeding goats crushed pods

b. Prosopis pod feeding trial

A crushed prosopis pod feeding trial was conducted by FARM-Africa over a three month period (18 May - 16 August 2008). The objective of the trial was to raise awareness amongst local communities of the benefits of supplementing livestock pasture with crushed pod and to measure the productive benefits of supplementation. The local agriculture office and staff participated in the design and implementation of the demonstration.

The overall performance of goats supplemented only with prosopis in addition to normal pasture was low. This could be due to the fact that the feeding was done during unexpected drought period when there was severe pasture shortage. However, goats fed a mixture of 50% prosopis – 50% concentrate corn feed, showed considerably better performance as compared to the control groups on normal pasture grazing (see figure 2). The trial needs to be conducted throughout the year to avoid seasonal biases and better understand contribution of prosopis pod supplementation.

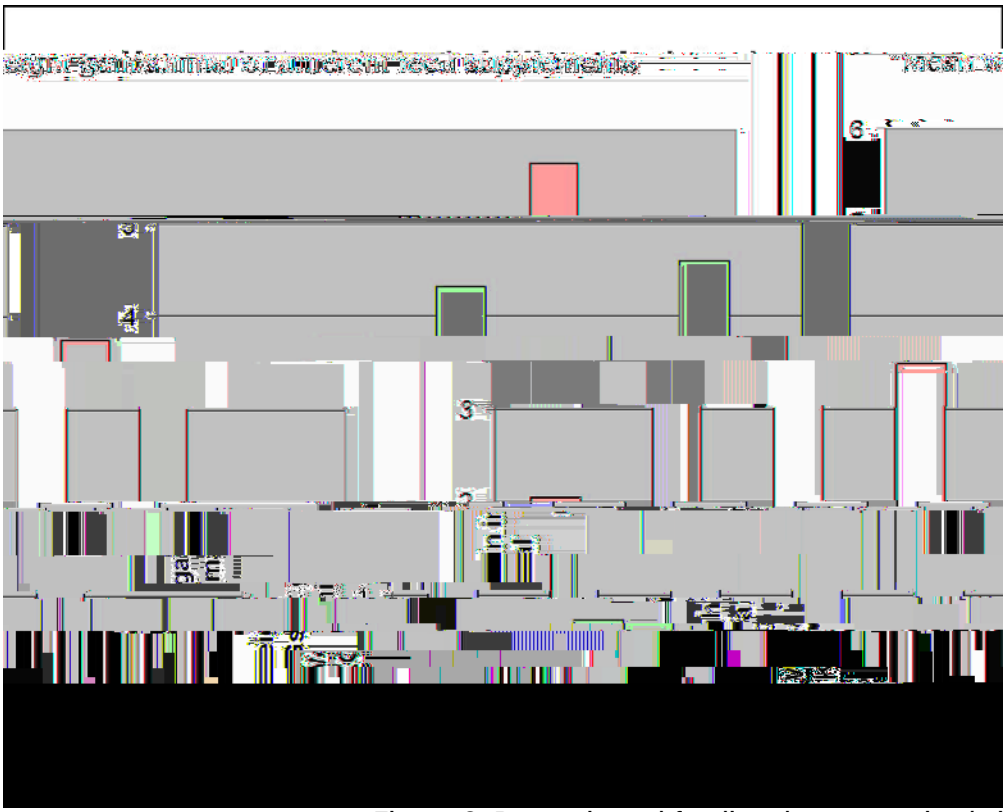

Figure 2: Prosopis pod feeding demonstration/trial results

c. Benefits from charcoal trade

Households involved in charcoal production and sales obtained good income and diversified their livelihood base to better cope with food insecurity. Within one year (Oct 2004-Sep 2005) three cooperatives (Serkamo, Sedhafagae and Gelaladura) with a total membership of 179, bought and sold 188,246 bags of charcoal and earned a net profit of 1,131,758 ETB or 113,176 USD. From the operation, cooperative members were getting up to 750 ETB every month. On top of the monthly income two of the cooperatives (Serkamo and Sedhafagae) were able to give annual dividend payments to their members' amounting 1,500 ETB and 1,257 ETB, respectively. With the income local people were able to cover their household expenses (clothes, medical services and food) and build their asset base by purchasing livestock (Dubale, 2006).

In a one year working period (Oct 2004-Sep 2005) three of the four pilot cooperatives (Serkamo, Sedhafage, and Gelaladura) were able to create over 233,509 man-days of labour opportunities for daily labourers. With 10 ETB or 1 USD minimum daily wages, the job created by the four cooperatives was equivalent to 2,335,090 ETB or 233,509 USD.

d. Benefits from managing cleared land

Cooperatives were able to clear prosopis thicket from over 396 hectares of land, in one year, and availed pasture as well as cultivable land to local communities depending on the potential of the land. In Gelaladura Kebele, where there is better access for irrigation water, local people cultivated all the cleared land (46 hectares) and obtained good harvests. They grew sesame, maize, fodder crops and vegetables (onion and tomatoes) both for household use and income from cash crops (Plate 7).

Plate 7. Maize crop cultivation and harvest from land cleared of prosopis

Crop by-products, weeds under the crop and fodder (Plate 8), provided additional feed sources during the dry season for sheep and goats, as well as lactating cows and calves which could not migrate to traditional dry season grazing areas. From the field observations it was shown that cultivation of land cleared of prosopis reduced the chance of re-invasion. People were able to improve food and income opportunities from the food and cash crops they cultivated in the cleared areas which helped them to better cope with recurrent drought.

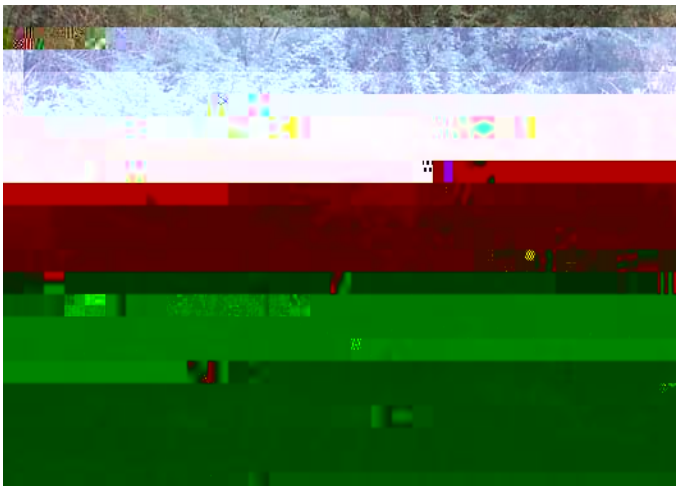

Plate 8. Pasture cultivated on land cleared of prosopis

In addition, indigenous trees, shrubs and grass which were lost due to the prosopis invasion, gradually recovered when the prosopis trees and shrubs were removed and emerging seedlings were uprooted.

e. Change in policy

The control of has come to the attention of Afar Regional and Federal

cleared from prosopis were reinvaded by seedlings emerged from seeds in the soil bank or re-infestation from animals grazing in the cleared areas coming from infested areas or from coppices. Community members were not mobilized and technically supported to sustainably manage such cleared pastureland. The problem is complicated due to free mobility of livestock. Rangeland users need to come together and agree on potential solutions.

Appropriate forums should be established to regularly share experiences among the different institutions and community members involved in management within the country. Opportunities should be also explored for networking and experience sharing with other countries facing similar problems.

Possible management options with technical supports from professionals to protect re-invasion of cleared pasturelands.

- Pod crushing by machine proved that it was possible to crush seeds and so reduce the dispersal rate and provide high-value, protein-rich feed for livestock in invaded areas.
- Introduced metal kilns for charcoal production (despite the reduced labour demand and time for charcoal burning) could not get acceptance due to low volume of charcoal produced per cycle as compared to the traditional system. The metal kilns need to be modified to improve the amount of charcoal produced for better acceptance.
- There was almost no involvement of wo

demonstrated to government partners and local people to prevent further invasion of new areas and to restore invaded areas in ways that benefit local communities. Technical and management capacities of communities as well as government institutions need to be enhanced to carry out research and facilitate management of invasive species.

An enabling policy environment, including appropriate legal framework, needs to be in place for the eradication, control and management of invasive species at sub-national and national levels.

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