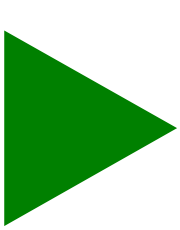
Rural livelihoods and soil conservation in Eastern Tigray

A Rapid Diagnostic Appraisal Report for Gobo Deguat and Teghane

G.W. Meijerink

Working Paper 2002-06



Policies for Sustainable Land Management in the Ethiopian Highlands

IFPRI-WUR project *Policies for Sustainable Land management in the Ethiopian Highlands*

Land degradation problems--including soil nutrient depletion, soil erosion, deforestation and other concerns--are severe in the Ethiopian highlands. These problems are contributing to low and declining agricultural productivity, poverty and food insecurity. The proximate causes of these problems are relatively well known. Underlying these proximate causes are many more fundamental causes. These more fundamental causes are affected by many aspects of government policy. Assessing the impact of different causal factors and identifying effective policy strategies to improve land management is a critical research challenge that has not yet been solved. In part, this is due to the complexity of factors influencing the problem. "One-size-fits-all" policy or program approaches are unlikely to be broadly successful. There is thus a general need and desire for more effective targeting of policy strategies towards specific regions and groups, although this depends on improved information about the potential impacts of alternative strategies.

The long-term goal, immediate purpose and specific objectives of the project are as follows:

Long-Term Goal:
To contribute to improved land management in the Ethiopian highlands, in order to increase agricultural productivity, reduce poverty and ensure sustainable use of natural resources.

Immediate Purpose:
To help policy makers in Ethiopia identify and assess strategies, including technology development policies, to achieve that goal.

Specific Objectives:

- To identify the key factors influencing land management in the Ethiopian highlands and their implications for agricultural productivity, sustainability and poverty;
- To identify and assess policy, institutional and technological strategies to promote more productive, sustainable, and poverty reducing land management;
- To strengthen the capacity of collaborators in the Ethiopian highlands to develop and implement such strategies, based upon policy research; and
- To increase awareness of the underlying causes of land degradation problems in the Ethiopian highlands and promising strategies for solving the problems.

The research takes place in Tigray, Northern Ethiopia. The project started in January 2001 and will continue until December 2003.

The WUR component of the project is funded by the Dutch Ministry of Foreign Affairs, Cultural Cooperation, Education and Research Department, Research and Communication Division (WW132171), Wageningen University (RESPONSE programme) and the Netherlands Ministry of Agriculture, Nature Management and Fisheries (North-South Programme). Their support is gratefully acknowledged.

More information can be found at the project web site:
www.sls.wau.nl/oe/pimea

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Rural livelihoods and soil conservation in Eastern Tigray. A Rapid Diagnostic Appraisal Report for Gobo Deguat and Teghane

List of *Policies for Sustainable Land Management in the Ethiopian Highlands* working papers:

2002-01	Kruseman, G., J.Pender, G.Tesfay and B.Gebremedhin *Village stratification for policy analysis: multiple development domains in the Ethiopian Highlands.*
2002-02	Kinfe Abraha Weldemichael *Public and private labour investments and institutions for soil and water conservation in Tigray, Northern Ethiopia.*
2002-03	Boetekees, S. *Rural credit and soil and water conservation: a case study in Tigray, Northern Ethiopia.*
2002-04	Kruseman, G., R.Ruben, G. Tesfay *Diversity and Development Domains in the Ethiopian Highlands*
2002-05	Meijerink, G.W. *Alternative cropping practices in Ethiopia: A literature review*
2002-06	Meijerink, G.W. *Rural livelihoods and soil conservation in Eastern Tigray. A Rapid Diagnostic Appraisal Report for Gobo Deguat and Teghane*

PIMEA WORKING PAPER 2002-0

Rural livelihoods and soil conservation in Eastern Tigray. A Rapid Diagnostic Appraisal Report for Gobo Deguat and Teghane

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Wageningen, December 2002

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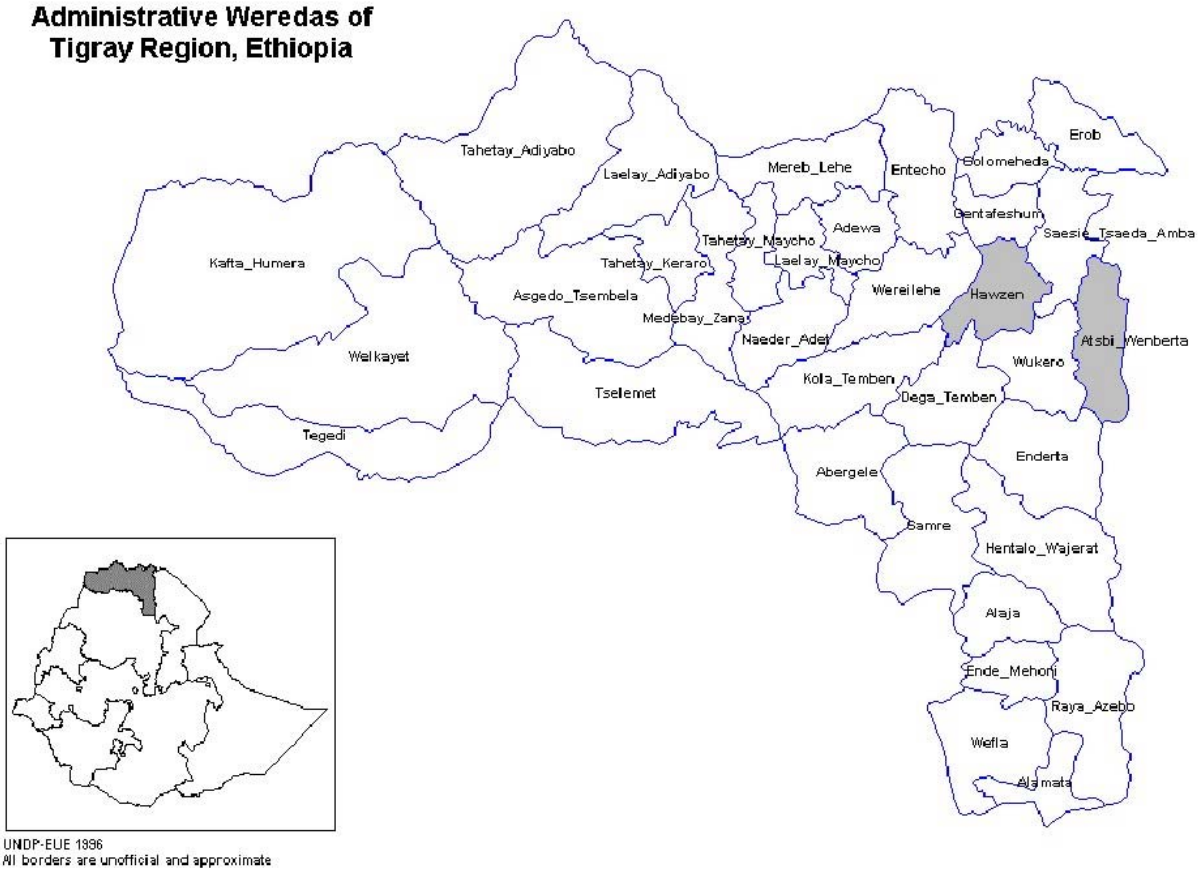
Introduction

A Rapid Diagnostic Appraisal (RDA) was done in two small villages (kushets) in Eastern Tigray, in the provinces (weredas) of Hawzen and Atsbi (see figure 1) within the project "Policies for Sustainable Land management in the Ethiopian Highlands". The main objective of this appraisal was to gather base-line information to be used in a follow-up research study. A secondary objective was to acquaint the villagers to the overall project, and specifically to the research activities that would follow in the field (consisting of measurements and interviews). The participatory nature of the appraisal facilitated the subsequent participation in follow-up research. During a meeting, which was held to invite farmers to participate in follow-up research, many farmers expressed their approval of the process and were keen to be involved.

Figure 1 Figure 1 Map of Tigray



Source UNDP-EUE 1996. The weredas of the research sites (Hawzen and Atsbi-Wenberta) have been shaded.

Tigray is a poor region, where rainfall is erratic and soils are poor. Many authors have pointed out that soil nutrient depletion is particularly severe in this region, with soil erosion a major proximate cause (see e.g. Stoorvogel and Smaling 1990). To what extent this is related to farmers' practices is still the subject of research, and there are few studies that have quantified nutrient balances related to farmers' practices. This will be the subject of follow-up research

within the project "Policies for sustainable land management in the Highlands of Ethiopia Phase II". Soil nutrient balances will be calculated on plot level, using the NUTMON (NUTrient MONitoring) tool. Because soil fertility decline is a complex problem, local adaptation strategies are complex, comprising of judicious manipulation of nutrient stocks and flows to attain sustained production. Nutrient monitoring is a method that quantifies a system's nutrient inflows and outflows, resulting in nutrient balances (Vlaming et al., 2001). Before monitoring these flows, a sound knowledge of the local conditions is needed. This basic information was provided by the RDA. The RDA and literature review provided background information that is crucial for better understanding the farming practices and the resulting soil nutrient balances.

Tigray lies in Northern Ethiopia, extending from 12 to 15 north latitude and 36 30" to 41 50" longitude, with an area of approximately 80.000 km^2 (see map). The altitude varies from 500 m to 4000 m above sea level. The Highlands are defined as area above 1500 m. Rainfall is seasonal, sparse and highly unevenly distributed. Average rainfall varies from about 200 mm (in the Northeast lowlands) to over 1000 mm. Only in the central part of the region (near Axum) and in South-western Tigray average rainfall approaches 1000 mm. In the Highlands close to the eastern escarpment, (where the two research sites are), the average rainfall is 450 mm.

Two research sites were selected to represent in effect two different types of rural communities (kushets) of Tigray. The first, Teghane in Golgol Nae'le represents a community with relatively more opportunities. It has a micro dam for irrigation and is better connected to markets: there is a road leading to a nearby major town (Atsbi). It also has regular contacts with NGOs and research organisations. The landscape is characterised by gentle sloping hills, although it is located at a high altitude. The second community or kushet, Gobo Deguat in Debre Bizen is relatively more constrained in its opportunities. It has no micro dam and is very remote in terms of distance to other cities. Hawzen is the nearest major town, but there are no roads leading from Hawzen to the kushet itself. The landscape is characterised by steep slopes, high plateaux and a small fertile valley bottom.

Methodology

An RDA (Rapid Diagnostic Appraisal) consists if several participatory tools. RDA methodology is part of a large family most commonly named Participatory Rural Appraisal (PRA). An RDA is a shorter version of a PRA, and consists of several processes and methods for learning about rural life and conditions from, with and by rural people. It is a flexible, informal and effective way of gaining insight into complex situation. It does not use long pre-determined questionnaires that can be rather tedious for the farmers involved, thus avoiding loss of interest by farmers and "quick and easy" answers. It builds on the knowledge and expertise of farmers themselves. An RDA includes triangulation. Triangulation means that different informants are used to crosscheck information.

RDA tries to strike a balance between thoroughness and briefness it aims for "Optimal ignorance" and "appropriate imprecision". It does not attempt to find out more than is needed, measure more accurately than is required, nor be excessively rigorous. Scientists are trained to make absolute measurements, but often trends, scores and ranking are all that needed.

An important characteristic is that the principal investigators are in the field, face-to-face with the people, working in multi-disciplinary teams. The most difficult aspect of a successful RDA is probably that it demands critical self-awareness and behaviour; investigators question their

own values or biases, and embrace error. This can be facilitated by valuing information given by the informants at face-value, careful probing and triangulation. (Van Wijk and Thompson, 2002 unpubl.)

Prior to the RDA, the heads of the kushets (and in the case of Teghane also the Wereda head) were visited. The kushet heads would then make appointments with farmers. We made sure that different participants were invited, to represent a cross-section of the community.

During a RDA exercise, we would explain to the farmers why and for how many days they were doing research in the area. The farmers were asked whether they needed more clarification, or had any questions to the researchers. A time for the RDA exercise was agreed on. At the end of the exercise, the researchers promised that all results would be presented back to the farmers on the last day, and that a report would be handed to the village leader.

For each RDA exercise, a list of key topics was prepared by the researchers, and these were introduced to the farmers by the facilitators. The facilitators kept track of the discussions, and asking questions for clarification if necessary. At intervals, the gist of the discussion was translated to the (foreign) researchers, who could then probe deeper into the issues.

When possible, different tools were used so that farmers could visualise the issues being discussed. Visualisation techniques are important tools in understanding and describing concepts (Adeyemo, 1990). They can range from very simple tools such as stones to represent quantities, to drawings to represent spatial elements (e.g. maps). It is not always necessary to use visual aids such as stones, but they are powerful tools because they make the numerical values visible to all present, and they lend themselves more for discussions than just giving numbers.

Farmers were encouraged to use the tools themselves. However, several farmers felt uncomfortable to use pen and paper, and were inhibited by their lack of literacy. Especially women were restrained. Even when they did not have to write, but draw symbols, they often felt extremely uneasy. In this case, we would leave left out pens and paper. On the other hand, in interviewing children who were going to school, we did not use stones to visualise numeric values, as they were able to give these values easily. Numerical values were visualised by using a certain amount of stones or Eucalyptus seeds. This gave no difficulties and worked very well.

On several occasions “semi-structures interviews” SSIs were held. This technique is important when issues are discussed with key informants, such as the kushet leader or elderly priests. Key informants usually are people with specialist knowledge and experience. They can be used to get a more in-depth, better understanding on certain topics. Rather than following a set questionnaire, SSI relies on checklists of issues to be discussed (or information to be collected). The interview is allowed to follow the course of a natural conversation, and the interviewer refers periodically and casually to the checklist to remind him/herself about issues to be addressed. This requires that the interviewers have a good understanding of the information desired. It also tends to work much better if done with pairs of two interviewers, one who interviews the informant and the other who simply writes down the information.

A group of five to ten people were usually involved in the RDA exercises. As part of the triangulation, we discussed the same issues with men and women at separate exercises. Men and women often have different roles and responsibilities and might therefore have different perspectives, which is important to capture. Because women in Tigray often feel inhibited

speaking up when men are present (see ICRA, 1997) we decided to have separate groups. The schedule, key topics and groups involved are shown in table 1.

Table 1 Schedule, key topics and groups involved in the RDA

Day	Activity	Action by:
Day 1	Visit the kushet leader, make appointments with farmers	RDA team
Day 2	Wealth ranking Coping strategies	Men's group Women's group
Day 3	Resource mapping Reconnaissance of the site and comparing the resource maps	Men's group Women's group Children's group (young boys) RDA team
Day 4	Production and soil fertility strategies Organisations Key informant interview on soil conservation strategies Key informant about changes in the area using the resource map	Men's group Women's group Kushet leader Old priest
Day 5	Seasonal calendar Rain calendar Key informant about livestock	Men's group Women's group Herds boys
Day 6	Presentation of results to villagers and discussion of results.	Men and women's groups
Day 7-10	Analysing the results and translating the report for the village leader of kushets into tigrigna	RDA team

Background

Historical overview[1]

To understand the rural sector of Tigray, knowledge about Ethiopia's history is crucial, as it has had a profound impact on land use, land tenure and institutions and its effects are still manifest. The Abyssinian empire of the 19th century, of which Tigray was part has had a profound impact on Tigray's agricultural sector. The Abyssinians were largely members of the Amhara and Tigray ethnic groups. The empire was enlarged in the late 19th century under the rule of Menelik II. Feudal rule was imposed on the conquered areas, but the system was different from that in the northern homeland. It is for this reason that the northern tenures differed for a long time from those in the south. During Menelik's reign, the feudal land tenure system in Ethiopia became firmly established Ethiopia's history.

A second factor that has shaped land tenure in Ethiopia is its long isolation from the rest of the world. The terrain made invasion difficult and the three dominant components of the country - emperor, church and nobility reinforced the Ethiopian unity and identity. The brief Italian colonial rule did not affect the fundamental socio-economic system. The three dominant powers held much of the agricultural lands. The Ethiopian Orthodox Church held large areas of land in complex feudal tenures, and the traditional elites serving under the emperor were allowed to use land to their economic advantage, social status and reward. The priorities of the emperor, church or the nobility did not lie in innovating or commercialising agriculture - but more in instilling into the rural population the importance of the trinity of emperor, church and nobility. A major share of the agricultural production produced by farmers who farmed under a complex set of tenure rights, was paid to landlords, feudal lords or the crown as rent, tribute or tax.

After the death of Menelik II in 1913, Haile Selassie I took over, whose strategy was to transform Ethiopia from a traditional society to a modern system. To do so he assured control over both the central and provincial government. The brief Italian occupation had left a vacuum, which the emperor used to create a central army, abolish regional armies, create a new tax system and reorganise the provincial administration. Those who supported the emperor in his centralisation effort were rewarded with lucrative local posts as well as land. Most of these land grants were in the newly acquired territories in the south. As the north already had long established patterns of land tenure, those who were loyal to the emperor could increase their land holdings. The result of this policy created vested interests in serving the centralised state while maintaining traditional agrarian institutions. So the emperor centralised the nation, under the pretence of modernisation, but did not change the land tenure system or traditional agrarian institutions in any major way.

Although under Haile Selassie I, the focus was mainly on commercialisation of the agricultural sector, rural Ethiopia remained largely feudal with little to no attention to small-scale agriculture. After a series of demonstrations and strikes in the towns and land seizures in the countryside, the monarchy of Haile Selassie I was overthrown in 1974. The military under the leadership of Mengistu Hailemariam seized power and established 17 years of Derg regime. Under the Derg regime the focus shifted to co-operatives and state farms, but again little

[1] Much of this part has been taken from Cohen & Weintraub, 1975.

attention was given to small-holders. Resistance against the repressive regime resulted in civil wars throughout Ethiopia and in Eritrea with disruptive effects, resources were being drawn away from agriculture to military operations and farmers were enforced to enlist into the army. These years were characterised by repression, war and famine. The worst famines of this period were in 1984 and 1986.

Of the resistance movements within Ethiopia, the most successful was the Tigreyan People's Liberation Front (TPLF), which in 1989 joined with other forces to form the Ethiopian People's Revolutionary Democratic Front (EPRDF). By May 1991, EPRDF forces had succeeded in toppling the dictatorship. A Transitional Government was set up, to prepare the country for national elections, which took place in May 1995. Before the elections, a new constitution was drawn up and submitted to more than 26,000 local councils for discussion and ratification. Under the new constitution, Ethiopia is a federal republic, consisting of 14 Regions, essentially based on ethnicity. The Ethiopian People's Revolutionary Democratic Front (EPRDF) won most of the seats in the National Parliament, while member or allied parties won control of regional assemblies. In its program for government, the EPRDF has placed emphasis on agricultural development, particularly on the small-scale farm sector. The policies are based on Agricultural Development-Led Industrialisation (ADLI). In Tigray the programme has been renamed CADLI - Conservation-based ADLI. The specific policies under this programme are the following:

◊ Development and promotion of improved agricultural technologies (though agricultural research, extension, input supply and credit schemes)
◊ Development of small-scale irrigation schemes
◊ Development of livestock resources
◊ Conservation of natural resources
◊ Implementation of enabling land policy
◊ Expansion of marketing services
◊ Enabling incentives for the private sector
◊ Expanding economic and social infrastructure
◊ Ensuring activities are centred around farmers' organisations and their decisions

(Source: BOPED, 1995)

Given the country's agriculture-centred economy, this focus on (small-scale) agriculture is probably long overdue. Agriculture is the main economic activity, accounting for half of GDP, 85% of exports, and 80% of total employment. The major crops are grains: mostly teff (a grain native to Ethiopia), wheat, barley, sorghum, millet, and maize. Manufacturing forms only a minor part of the Ethiopian economy. The country has one of the lowest exports per capita in the world; coffee accounts for a large portion of merchandise exports. Coffee is critical to the Ethiopian economy with exports of some $260 million in 2000. Other important exports include qat, live animals, hides, and gold. Ethiopia is particularly vulnerable to the adverse effects of fluctuations in commodity prices (especially coffee), and drought, which is frequent (World Bank, 2001).

According to the World Bank (ibid.), Ethiopia's economic growth is increasing as it makes the transition from a command to a market-based economy. Its extensive system of price controls has been almost entirely dismantled, tax rates have been lowered, and some restrictions on the private sector have been removed. Ethiopia's GDP grew by 5.3 percent in 2000, and growth was projected at 7.5 percent in 2001. Military expenditures are declining and the country is moving rapidly to demobilise large numbers of soldiers. Almost 400,000 people were displaced by the

conflict with Eritrea, with many unable to return to their homes owing to the presence of landmines and/or lack of community infrastructure.

Agricultural sector[2]

Ethiopia's population was some 64.5 million in 2001, of which 84% lived in the rural area. The agricultural population has slowly declined from 93% in the 1960s to 82% in 2001. Annual population growth is around 3%. Although the average population pressure in 2000 is almost 0.6 per ha, it is around 2.1 persons/ha agricultural land (FAO, 2001). Most of Ethiopia's agricultural land consists of pasture (see table 2). Around a third consists of arable land and only a minor share consists of permanent crops.

Table 2 Types of agricultural land in Ethiopia

Type of agricultural land[1]	Share	1000 ha
Total agricultural area	0,31	30 728
Of which:		
Arable land	0,33	10 000
Permanent crops	0,02	728
Pasture	0,65	20 000
Irrigated	0,01	190

Source: FAO, 2001

[1] Arable land: land under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years)

Studies have shown that around 300 000 ha of land is suitable for irrigation from surface water resources. However, according to FAO (see table 1), only 190 000 ha are currently irrigated. Micro dams are used for irrigation. However, the development of micro dams has resulted in a higher incidence of diseases such as malaria, schistosomiasis and intestinal helminths in Tigray (Alemayehu et al., 1998; Ghebreyesus et al., 1999). The potential of groundwater is considered to be ample, although this has not been intensively studied.

The infrastructure in the rural areas is rather poor. In most of Tigray, virtually no rural household has access to electricity. The main energy sources are fuel wood (66%), dung (12%) and crop residues (9%). The use of these energy sources has a major impact on the environment. Transport infrastructure is poor in Tigray. In total there is 975 km of gravel all weather roads and 1400 km of rural roads. 80-85% of the gravel roads is in need of maintenance and most rural roads are not fit for motor vehicles. However, the government is investing in road development.

Due to the extent of environmental risk (variable and sparse rainfall) and socio-economic uncertainties (civil war, changes in tenure, lack of infra-structure etc) farmers in Ethiopia have faced during the past centuries, they have adopted several coping strategies. On the one hand farmers had to find ways to manage scarce resources to ensure a sustained production. There is much evidence that Ethiopian farmers keen to find news ways to improve their farming practices, that they are innovative and have shown a remarkable tendency to respond to

[2] Much of this is based on Fitsum Hagos et al., 1999

changes. This is for instance reported by REST (1984 cited in Nyssen et al., 2000a) when introducing soil conservation programmes.

On the other hand, farmers find themselves in circumstances that include unpredictable rainfall, which increases the risks of crop failure, unpredictable political conditions, low levels of public investments in rural infrastructure, market imperfections and high transaction costs for input purchase and market exchange. This has made them to adopt risk-averse strategies such as avoiding to rely too much on cash crops (specialisation), or making high investments in external inputs (improved seeds and fertiliser), and not using credit because of the risk of not being able to repay the loan in case the harvests fail. With Cohen and Weintraub (1975) we can therefore conclude that it seems that the apparent "primitive" farming practices of Ethiopian farmers are not so much due to the farmers' traditionalist attitudes and their unwillingness to change, but more to the circumstances in which they find themselves. Farmers in Tigray can be typified as being open to innovations, but risk-averse.

Because land holdings are small in Tigray and yields are low, there is low labour productivity. Off farm income would be able to improve rural lives substantially. However, the industrial and service sectors have not developed sufficiently in cities in Tigray to provide rural migrant workers adequate employment opportunities. So with hardly any off farm wage opportunities, the rural people have few other options than making a living off their land. In fact, our findings show that many rural households often cannot, and depend for a large share on Food for work and Free Food Aid programmes. According to Clay et al. (1999), food aid distributions (direct food aid and food-for-work programmes) are highly concentrated in Tigray. Tigray received approximately eight times the national average food aid distribution per head in 1995-1996, as the region is historically food deficit[3].

Land policies

Land policies and the land tenure system have changed considerably over the past 25 years. At the time of the Haile Selassi I (until mid-seventies) there were three main tenure systems: *Risti*, which was the prevalent system for Tigray, *Gulti* (where tenants paid *Gulti* landlords) and church land. Under the *Risti* system individuals have usufruct rights to land, which cannot be transferred to other (e.g. by sale or mortgage), but land can be leased (out). The right does not include a specific parcel and periodically redistribution is undertaken to ensure that every family member is granted access. Land is divided into sections according to quality and allocated through a lottery system. Usufruct rights are up to 7 years.

After Haile Selassi's reign, the military Derg government took over and embarked on large-scale land reform. Land was made the collective property of the Ethiopian people and was redistributed to farmers, where no land tenancy (such as under the *Gulti* system) was possible. Maximum land holding size was restricted to 10 ha. Large holdings were confiscated and converted into state farms, settlement schemes and co-operatives. Land transfer (e.g. through mortgage, sale, bequest) was prohibited, as was hiring of labour. Grazing lands were made collective areas or redistributed. There were no regulations on forest areas and woodlots, which made these areas to have unclear user rights - often leading to an open access regime.

[3] Another reason may be that the government may favour Tigray over other regions, because of the strong links of the government to the Tigreyan People's Liberation Front (TPLF)

After the rule of the Derg, the TPLF (Tigray People's Liberation Front), embarked on land reform on again, now based on two guiding principles. First, the farmer needs to reside as a farmer in a *tabia* (delineated community) to get land from the *tabia*, and secondly, land is allocated to individuals, not households. Before 1991, much land was redistributed to accommodate young families and returnees from settlement areas, but after 1991 land redistribution stopped in Tigray and further land redistribution is formally prohibited, except for public works. Land leasing is possible, up to 10 years if 'modern' technologies are used and 2 years if 'traditional' technologies are used. Planting of Eucalyptus and cactus trees has been prohibited on cultivable land. The government has also recently started undertaking land inventory surveys and issuing land registration certificates.

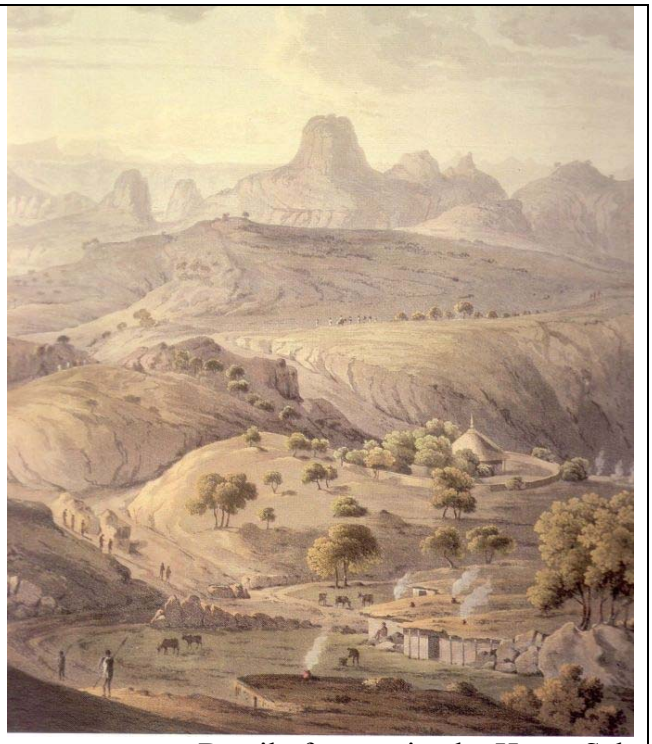
Hence, land reform and redistribution have frequently occurred in the past decades. The latest land redistribution was in the early 1990s when land was allocated according to the size and composition of the household. The different characteristics of the land are taken into account and this results in each household getting plots in different locations. Allocation is through a lottery system. This should, in theory, mean that all households have similar wealth in terms of land. However, at the time of land allocation, no account was taken of people who had migrated (refugees, soldiers etc) due to the war, but who came back at a later time (MARENA, undated). Another land redistribution took place in 1997 to allow the returnees to have access to land as well.

Land degradation

Although land degradation and deforestation is cited by many authors as the major trend characterising Tigray in the past decades, it is certainly not a recent development. According to Hamilton (1977, cited in Esser et al., 2002) deforestation started already some 2000 years ago. When we compare the landscape of Tigray today with engravings made by Henry Salt in the early 19th century, it is striking how little the landscape has changed in terms of vegetation cover (see plates 1 and 2). McCann (1999) describes that narratives of “naked plains” in Ethiopia existed already in the 19th century. He also describes how the open fields of cultivation in the Southern highlands have been turned into broadleafed forests since the late 19th century. This suggests that claims that the process of degradation and deforestation in Ethiopia stems from the past few decades and is increasing should be taken with some caution. Beyene et al. (2001) and Leach & Mearns (1997) have shown that such claims are often made by extrapolating data from limited, locally specific data sets.

G. Meijerink

Plate 1 Landscape in East Tigray in 2002



Detail of engraving by Henry Salt

Plate 2 Landscape in Tigray in the early 19th century

The landscape of Ethiopia and its subsequent degradation should be viewed in a dynamic sense, and not in a linear one of continuing increasing degradation. This is not to say that in many places in Tigray, soil (nutrient) degradation is not a problem. Estimates of soil erosion rates vary substantially but are high for many areas. Quantitative soil loss estimates are rare in Tigray. There have been several studies in the 1980s and a few in the 1990s (e.g. Hurni & Preich, 1992; REST & NORAGRIC, 1995). According to Nyssen et al. (2001), rainfall intensity is very high and has major repercussions on erosion processes such as soil erosion, runoff and landslide risk. A recent study (by REST & NORAGRIC, 1995) in the Central zone of Tigray indicated that about 46% of the currently cultivable land is exposed to severe soil erosion.

Use of organic inputs such as manure or crop residues is constrained by two factors. Due to a lack of woodlands, there is a lack of fuel wood, and rural households instead use dried manure as fuel. Secondly, there is a shortage of livestock feeds, and all crop residues are fed to livestock.

Farmers have invested in conservation structures such as stone or soil bunds, and in area enclosures, in which trees and shrubs are allowed to regenerate. Certain areas are allowed for grazing or for fuel wood collection (Gebremedhin et al., 2000). Most of these investments have been made possible through so called ‘mass actions’, including Food for work programmes. Farmers also have made private investments on their lands. However, they are constrained by the lack of land (some conservation structures occupy land) and lack of physical energy, needed for construction of SWC measures, which usually includes physically demanding work.

Moisture stress is inherent in the semi-arid environment. The amount of rainfall is usually not sufficient to sustain normal crop growth in most parts of Tigray. The low and erratic rainfall is an important constraint in Tigray Ethiopia (see also ICRA, 1997). It not only affects crop production but also livestock forage.

Institutions

The administrative structure has hierarchical units from the largest unit of *wereda* (region) to *tabia* (community) to the smallest unit of *kushet* (village). The development of this *baito* system was a main institutional innovation. It is essentially a system of local democracy, developed by the TPLF during the civil war, based on direct election of representatives at village (*kushet*) and inter-village (*tabia* or *kebele*) level. *Tabia* representatives make up the *wereda* council, which has major responsibilities for planning and implementation of local development. In general, *baitos* are responsible for administrative and socio-economic functions within the community jurisdiction, They play a major role in NRM, tax collection, credit schemes, minor legal issues etc. In essence the *baito* system, partly building on traditional community-based institutions, has enabled the region to mobilise significant social capital to resolve natural resource problems, in a way that was impossible during the Derg regime (Chisholm, 1998).

Tabias and *kushets* play a large role in conservation issues. At *tabia* level social courts have been established which amongst others, deal with conflicts over sharing of natural resources. Many *tabias* and *kushets* have recently established area enclosures, where grazing is restricted. The leadership for this is usually provided by the TBANR (Tigray Bureau of Agriculture and Natural Resources) or by REST, but the decision on establishment and management of such areas is in the hands of the local tabias. The TBANR and *tabias* also play a role in large-scale conservation measures. In the 1970s there were already terracing and reforestation efforts through USAID (and later UN/FAO) sponsored Food for work programmes, which by many accounts were not very successful due to unclear land policies for forested areas. Since the 1980s, there have been mass-mobilisation campaigns, in which households were expected to contribute labour during the dry season, often in Food for work or Cash for Work programmes, which mostly focused on soil and water conservation construction. Since 1992 the amount of mandays requested from households has been decreased from 90-180 to 20 mandays.

The church is another important institution in Tigray with 97% of the rural people being Orthodox Christians and subject to the norms and rules of the Ethiopian Orthodox Church. The Church prohibits manual labour during religious holidays. There are on average 8 religious holidays per month, which means that religion has a clear effect on labour availability.

Many agricultural organisations have been affected by the civil wars in the 1990s. The Bureau of Agriculture in Mekelle, for instance, lost all their laboratory equipment and research results. There are initiatives underway to rebuild the agricultural research system. See table 2 for an overview of the main organisations.

Table 3 Overview of the main agricultural support organisations

	Main body
Extension	The extension service is based on Sasakawa-Global 2000, a project initiated in 1993 by Sasakawa Africa Association, Global 2000 Programme and the Ethiopian Government.
Research	Tigray Bureau of Agriculture and Natural Resources (TBANR)
Inputs	TBANR, REST and the Agricultural Inputs Supply Corporation (AISCO).
Credit (to farmers)	Dedebit Rural Credit and Savings Scheme, which was established in 1994 as an affiliate of REST. The credit is mostly in kind, and 60% is targeted for women.
Irrigation	Sustainable Agricultural and Environmental Rehabilitation of Tigray (SAERT).

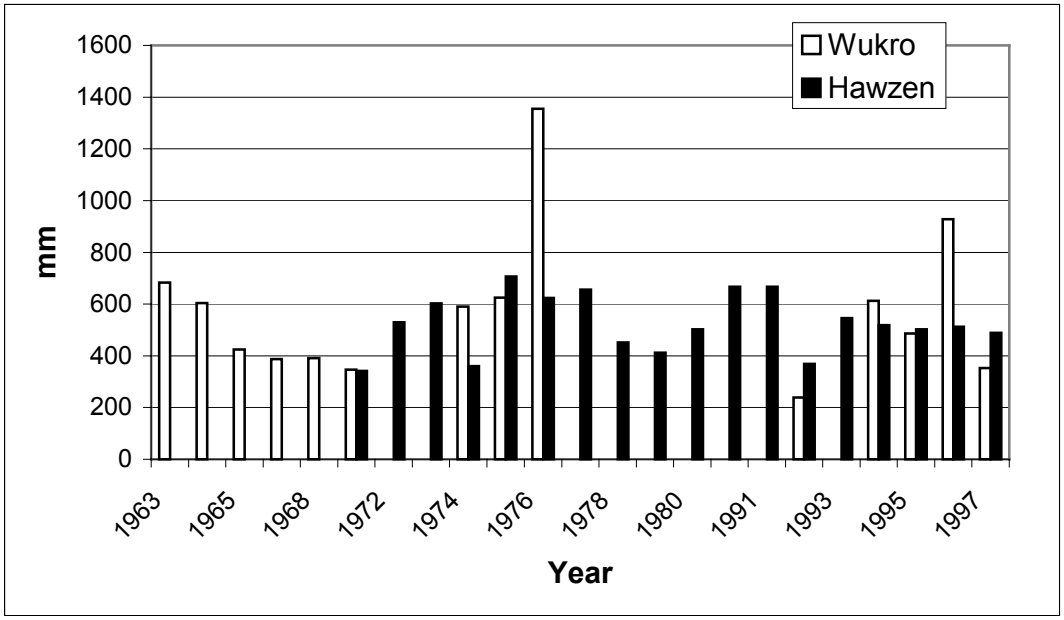
Source: Fitsum Hagos et al., 1999

Rainfall

Rainfall in Tigray is divided into two main rainfall season—the Belg and Meher rains. Belg rains are normally expected from March to May and they are used for the production of short cycle crops (barley, wheat, etc.) in high altitude areas. In lowland areas, Belg rains are used for the production of short cycle crops such as teff and the planting of long cycle crops (maize, sorghum, millet, etc.) that attain maturity during the main Meher season, which usually starts around July. Meher (main) season rainfall is used for the production of long cycle crops planted during the Belg season. Both Belg and Meher rains are important for the replenishment of pasture and water resources (Sewonet et al., 2002).

Due to a distinct variation in topography and altitude there are different agro-ecological niches and micro-climates within short distances. Rainfall is highly variable, temporally as well as spatially (see figure 2).

Figure 2 Average annual rainfall 1963-1997 in Wukro and Hawzen (in mm)



NB Not all data is available
Source: Bureau of Agriculture

Recent rainfall data was difficult to obtain, especially at tabia level. Because weather conditions may vary considerably between regions, and even between tabias, we asked the farmers to give an indication of the rainfall by giving weights and an explanation for the years 1997-2002. Besides this we used literature sources to obtain additional information for 1997-2002 and rainfall data for 2001-2002 for Hawzen and Atsbi (see tables 17 and 18 in Annex 1).

Gobo Deguat

In Gobo Deguat the women scored the drought years (i.e. dry years received a higher score than wet years). The score for rainfall was calculated by subtracting from 20 the number of weight for drought to translate it to scoring for rainfall. This corresponded well with the scores the men gave to the rainfall in each year. Also in Gobo Deguat farmers use different criteria to evaluate rainfall, except in this case, the assessments made by men and women farmers corresponded closely (see tables 22 and 23 in Annex 1) In Gobo Deguat, 1997 and 2001 were the best years (see table 4).

Table 4 Combined responses for start of rainfall in Gobo Deguat

Year	General conclusion
1997	Good year, rains started early
1998	Abrupt end of rains, but overall reasonable year
1999	Rains erratic, but reasonable in GD
2000	Failure of Belg rains and late start to the Meher, but overall reasonable year
2001	Timely rains, reasonable year
2002	Late Meher rains – dry year

Teghane

The evaluation of rainfall by men and women differs quite a bit (see tables 19 and 20 in Annex 1). This suggests that farmers appraise rainfall on different criteria, both quantitative and qualitative. Criteria include amount of rainfall, starting and ending time, overall distribution and effect on crop production. For instance, the high ranking (18 stones out of 60) men in Teghane gave for the rainfall in 2001 reflects the high value they place on good distribution. The rainfall in this year was very good for production. The women rated the rainfall for 2001 lower (7 out of 60) because the rain stopped early.

We asked the village leader and the DA to also give their view on rainfall, for an extra crosscheck of the information given by men and women farmers. Their evaluation differs again from that given by men and women farmers, which confirms the fact that different criteria are used to evaluate rainfall (see table 21 in Annex 1). Bringing together all the different data, we were able to construct the following table:

Table 5 Combined responses for start of rainfall in Teghane

Year	General conclusion
1997	Good year
1998	Belg rains were poor, but Meher rains were excessive
1999	Meher rains were erratic, with heavy showers
2000	Good year
2001	Very good year in terms of quantity, but problems of waterlogging
2002	Good Belg rains, but Meher rains (which started after our interviews) were reportedly poor

Resource inventory

Prior to the RDA, GIS maps had been made by researchers from Mekelle University College. These were used in combination with the resource maps villagers made during the RDA. We asked three groups to make maps: women, men and children (which usually consisted of young boys), see figure 3 for Teghane. We differentiated between these groups because of their different perceptions about their surroundings, that stem from their different activities and responsibilities (see also the section on activities). What struck us was that women usually drew very small resource maps and often started with a circle. This indicated partly their hesitance in taking up a pen and draw. The children, who usually had some schooling typically used the whole sheet and many colours. The resource maps were used afterwards in our discussions pertaining to the resource history of the area (see next section).

In the GIS maps (see figure 6), local names for soil types have been used. It is important to understand the terminology that farmers use because their perceptions of soil fertility is not limited to the soil's nutrient status only. The description of local terminology is given in table 6, which was copied from Corbeels et al., 2000. Figure 4 and 5 show the maps of Teghane and Gobo Deguat in which local soil names have been used.

Table 6 Local terminology of soils

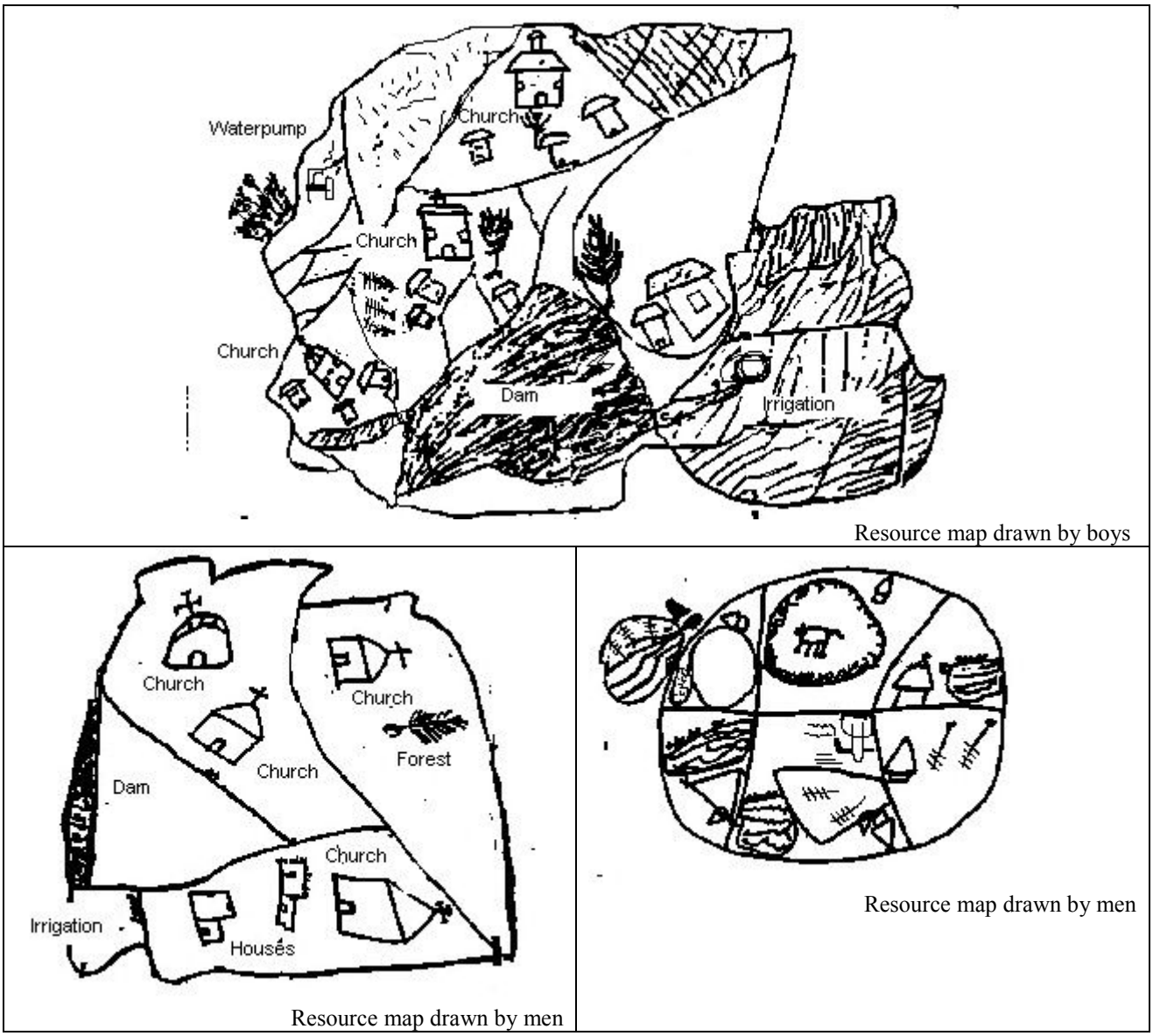
Characteristics	Reguid (or regid)	Mehakelay (makhelai)	Rekik
Fertility status	Most fertile	Moderately fertile	Least fertile
Local soil type	Keyih and andeleway	Andeleway	Behakel (or bakhel) and walka
Colour	Red and brown	Brown	White and black
Texture	Heavy	Medium	Light
Workability	Difficult	Average	Easy
Stoniness	Slight	Moderate	High
Degree of erosion	Slight	Moderate	High
Topography	Level (valley bottom)	Gentle slope	Steep
Yield	Maximum and most reliable	Medium, with slight risk of crop failure	Low, with high risk of crop failure
Description	During rainy season, grasses emerge, slowly and generally survive. Supports a wide range of crops	During rainy season, grasses emerge and dry slowly. Production is limited to certain crops	During rainy season, grasses emerge fast and die quickly, Crop choice is very limited.
Agricultural use	Intensively cultivated arable land.	Some cultivation, also used for pasture	Not cultivated

Source: Corbeels et al., 2000

Teghane

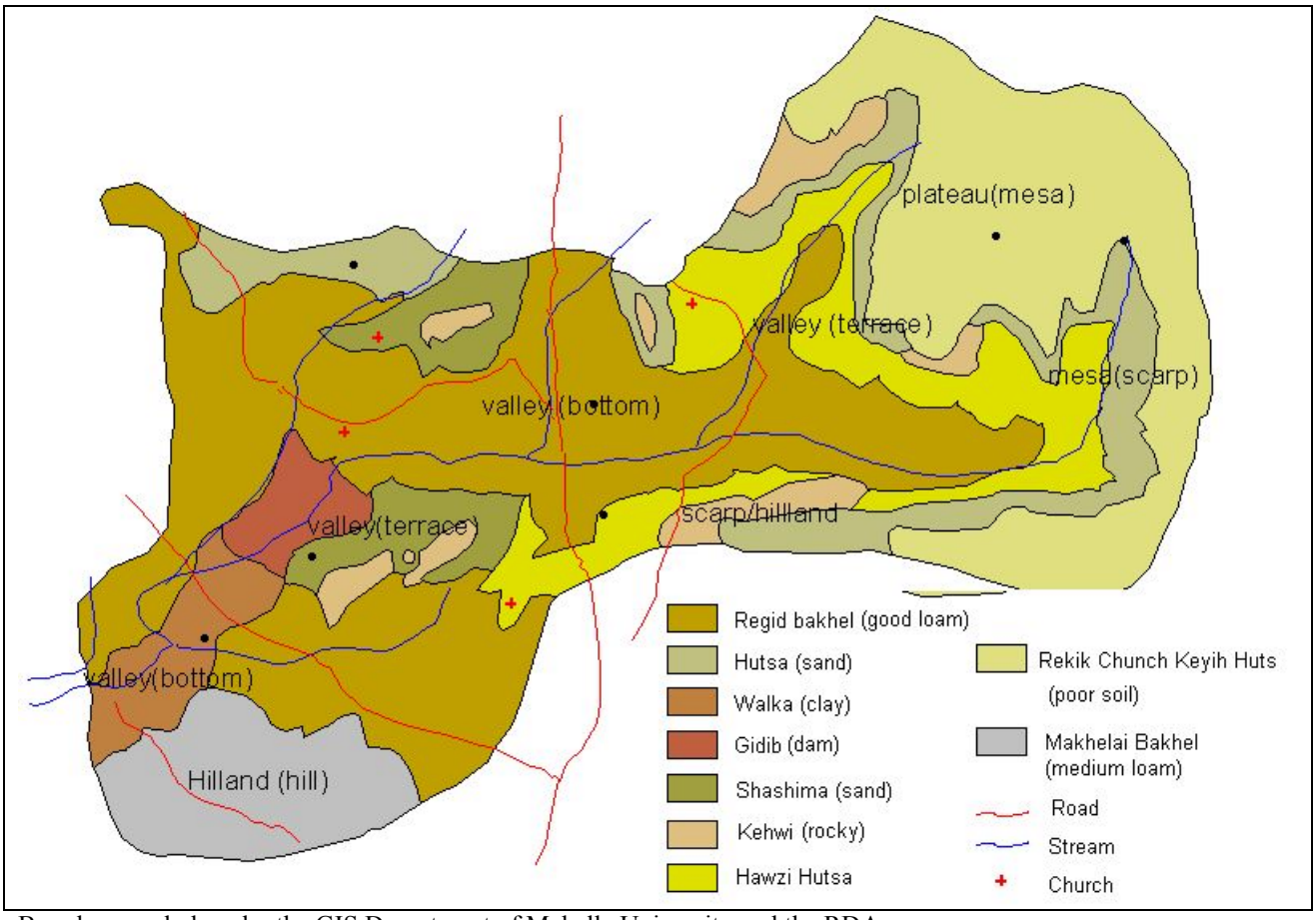
The resource maps drawn in Teghane are shown in figure 3. The map drawn by the boys shows the dam prominently, around it are the churches and several of the houses. There is one big tree that also features in the map drawn by the men. The boys have clearly identified the land uses and this is why this map was used in the discussion on land history. The women and children both marked the water pump. The resource map of the men mostly indicated the different churches and the dam.. The resource map drawn by the women was more complete, although geographically not correct. It is more of an analytical map than a geographical one. It identifies the dam and irrigation area (above left), the grazing area (above centre), the water pump and cropping fields (centre below). The churches are indicated, but are less prominent than those on the men's resource map. All three maps do show how important the churches are in the lives of the farmers in Teghane.

Figure 3 Resource maps drawn by children, men and women in Teghane



The most important feature in Teghane is the dam (see figure 3 and 4). On the northern side of the dam, there is a green area but which is not very suitable for grazing. On the other (valley bottom), is the irrigated area. Only part of this is for the farmers in Teghane. Most of the farmland in Teghane is *regid* or good (fertile) loam. On the outer edges the soil becomes less fertile and rockier and go from *makhelai* to *rekik*. In the north-east, the hills have been terraced up to the escarpment. Woodlots have been established on these terraces.

Figure 4 Resource map of Teghane



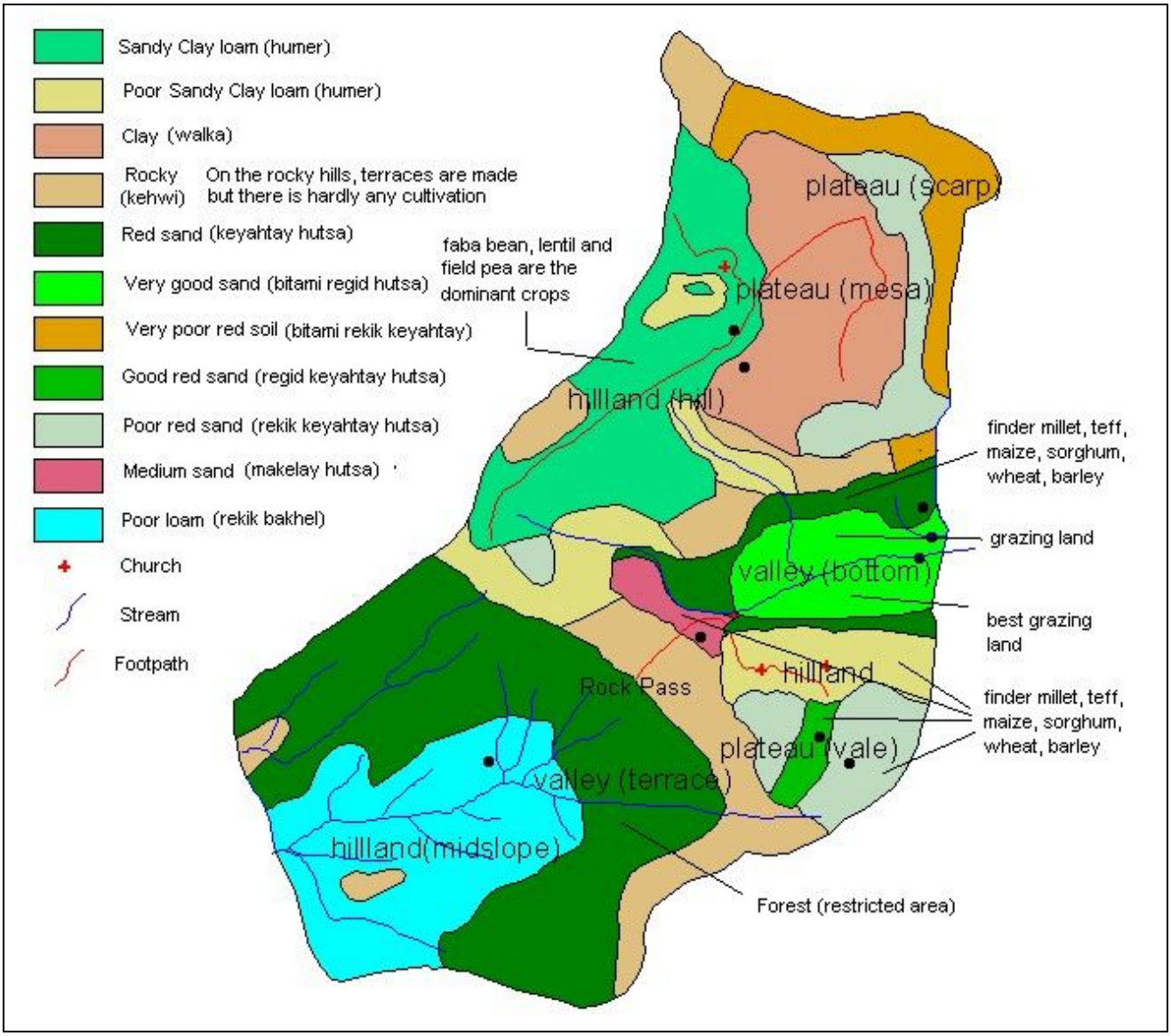
Based on work done by the GIS Department of Mekelle University and the RDA

Gobo Deguat

In Gobo Deguat also three resource maps were made (men women and children), but are not shown in this report. However, the main information from these maps was incorporated into the GIS map (see figure 5).

The most important feature of Gobo Deguat are the two escarpments that enclose the valley bottom on the North-east and East. On the Northern side there is a large plateau, which is also cropped. The Southern part is in fact part of a different catchment, which can be reached through a narrow rock pass. The main area is the valley bottom (bright green area in figure 5). It is the most fertile (*regid*), but is also the most severely affected area in terms of gully erosion. This is the area identified by the farmers as the main problem area. There is a steep escarpment surrounding this area. On the other side (through the rock pass) most of the area has been forested. There is cultivation on the poor loam soil. On the plateau, (labelled as hill land and plateau), the farmers also cultivate. The area is less fertile and not used as grazing. Mostly faba bean, lentils and field peas are cultivated in this area.

Figure 5 Map of Gobo Deguat using local soil names



Based on work done by the GIS Department of Mekelle University and the RDA

Resource history

To understand better the dynamics of the two kushets, we attempted to establish a "resource history". For this we interviewed old and knowledgeable villagers, by using the resource map that was made by villagers on a previous day. The results were later compared with the GIS data that was obtained from Mekelle University and Alterra (WUR).

Gobo Deguat

In Gobo Deguat we interviewed an old priest, who had been mentioned by the villagers as being very knowledgeable. He has lived in the kushet all his life. According to him, many resources have been degraded in the past few decades. He told us that 30 years ago (1970s), there was a big and deep river with water all year round. There was long grazing grass growing around it. These now have been destroyed by the gullies. There were several types of tree species, with the species called *kuiha* dominating up till 1972. Nowadays they have become extinct. In addition to that, a variety of different trees grew here, such as juniper tree and olive tree. There was a larger diversity of plant species, up till about 1987. Due to the decrease of groundwater and increasing droughts they have largely disappeared. A large acacia tree (*seraw*) dominated the valley bottom until 1979. Different kinds of wild animals (antelopes, wild cats) lived in the region some 30 years ago. Groundwater was abundant, there were underground aquifers up till 1982, which have now dried up. Some areas that were cultivated have now disappeared through gully erosion. Several households have migrated to a different area, or to the city.

During the presentation of results to the villagers, the women added that when the trees were cut, the roots were also dug out, which contributed to gully erosion. The men mentioned that monkeys were still around and presented quite a threat to the villagers, biting a 12-year old some time ago. They also confirmed what the priest said about the households that had left. They explained that land was becoming more and more scarce and that people were leaving because of this.

Grepperud (1996) in a study on population pressure and land degradation in Ethiopia has found that as pressure from people and livestock exceeds some threshold, a rapid degradation of land may take place. Although various studies have found that with "more people there will be less erosion" (see e.g. Boserup, 1981, or Tiffen et al., 1994). Grepperud (ibid) finds that this holds as long as population and livestock are far below the supporting capacity of the region. Only when they exceed the carrying capacity of land, a more rapid degradation is identified. This has important implications for the situation in Gobo Deguat. From what the farmers have told us, there seems to be a rapid degradation in terms of gully erosion, but it remains to be seen whether this is a result of some threshold being exceeded.

Teghane

In Teghane we interviewed an old priest, who is responsible for the churches in the kushets. He told us that the village Teghane was established in the 18th century at the time of King Gebre Meskel, and the church near the dam is believed to be a holy place. The village has strong links to the Orthodox religion. According to the priest, Teghane is blessed and a home for holy saints. Teghane originally comes from the word for "hard workers". It is believed that 138 saints arrived nearby the church, inspiring the people to be hard workers.

Teghane includes three sub-kushets. The three sub-kushets of Teghane are Teghane itself, Leke and Kenchebet. Sixty years ago, kushet Leke (A on the map) was one of the largest forest areas in the kushet. Livestock from all the sub-kushets were going there to graze. At that time, this was the communal grazing area for the kushet area.

The cultivated area (at A) is not good because it is water logged and rocky. The forest land has since been deforested, mainly for house construction materials, fuel wood and occasionally for farm implements. Currently, there are restrictions for cutting trees. There were no such restriction 60 years ago.

Since long ago Teghane was covered with grass which has been used for animal feed. One type of grass, called *syrdi* was used by women to make baskets. At that time, cattle were grazing and spending the night in the grazing area.

Long ago there were several cereal types which have become extinct. Examples are *Rie*, *Demeteta*, *Tselimekli* ("black cereal"), *Demhay* (variety of barley), *Desaley*, *Adimoy*, *Kinkina* (types of wheat). These cereal types were cultivated by all the sub-villages.

The third sub-village called Kenchebet was a productive area when there is shortage of rain, because it is prone to waterlogging.

Erosion has always been present in the village, but it has never been considered as a major problem. Rather the problem of waterlogging has been the main concern. According to the priest, the conservation structures on the slope and on the lower farmlands are solving the problem of soil erosion.

Socio-economic stratification - characterisation of the villages

Socio-economic stratification of groups within the two villages was done by categorising households according to levels of means or "wealth". Traditional approaches to measure wealth have included standardised household interview surveys, with predetermined factors that assess household wealth such as land ownership, expenditures, income or education. Wealth ranking within the RDA framework, however, relies on criteria that farmers use to assess household wealth, and on their ability to sort households into different wealth categories. This means that the socio-economic stratification is based on wealth indicators that farmers use to distinguish between different socio-economic groups. This method is a valid means of stratifying rural households according to socio-economic status, particularly because it combines the multiple dimensions of wealth in a culturally appropriate manner (Adams et al, 1997). However, Adams et al (ibid) do point out the sensitivity of the methods to the number, age and gender of the key informants, as well as the competence of the facilitators.

With the last remark in mind, the wealth ranking was done with a mixed group of participants. To account for gender differences, men and women did the wealth ranking in separate groups. These groups were of mixed ages. However, because of the cultural status of older people, their opinion often overshadowed those of younger ones.

In wealth ranking, there may be a bias towards classifying households as poor because farmers tend to classify themselves as poorer than they are in reality. With the history of food and medical aid that followed droughts and wars, farmers are keen to continue or revive this flow of aid. One female farmer asked us for instance when the Red Cross was coming back, because they needed the health care it had provided. However, through probing further and cross-checking, we tried to minimise this bias. Our results correspond with those found by Amede et al. (2001) for a village south west of Addis Ababa.

Land is an important factor in household wealth. Although land was redistributed in 1990 and in 1997 with the aim to equally divide land, the wealth ranking shows that not all farmers have equal amounts of land. Various factors play a role. The size of redistributed land was based on household size. The age of children was not taken into account. In case of a family with almost adult children, when the adult children set up their own farm, the land holding of each of them decreased considerably. A rich household can hire land and thus increase its wealth even more, and can eventually own or hire more land. Wealth is also closely linked to the number of livestock (especially oxen to plough the land). The wealth indicators identified by the men and women in both Gobo Deguat and Teghane are quite similar, as can be seen in tables 7 and 8. Three categories of wealth were distinguished: poor, average and rich households.

With respect to off farm employment, it is important to distinguish between two types. Woldenhanna and Oskam (2001) distinguish between off farm *wage* employment (paid development work, manual non-farm work and skilled non-farm work) and off farm *self* employment (petty trade, stone mining, pottery and handicraft). They found for Southern Tigray that households' participation in off farm wage employment (mostly in food-for-work programmes) is driven by the availability of surplus family labour, lower farm size and low farm and non-labour incomes. Off farm self employment is determined by the capacity to overcome liquidity and credit constraints. They also found that there are entry barriers to the non-farm labour market. As a result, wealthier farm households are able to dominate the most lucrative form of non-farm activity such as masonry, carpentry and trading.

Gobo Deguat

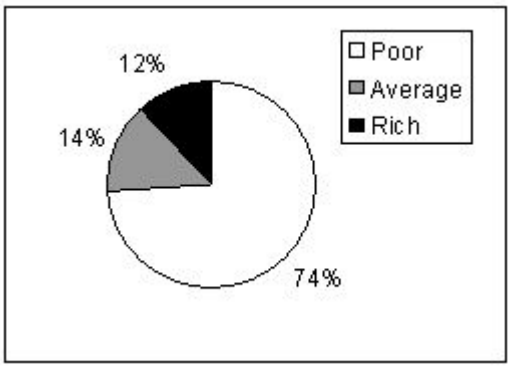
Table 7 Wealth indicators in Gobo Deguat

Gobo Deguat	Women (N=10)	Men (N=10)
Poor households	○ No livestock ○ Small size of farm or no farm ○ Having not enough cereals to feed the household ○ Sharecrop out their land due to lack of oxen	○ No oxen and no livestock ○ A few of the households are landless ○ Low yields each cropping season
Average households	○ One heifer ○ Owning farmland ○ Own crop production which can feed the household for at least 2 months	○ One ox, 1 cow, 2 sheep ○ Own farmland ○ Higher yields than poor households ○ Use of own family labour for cultivation practices
Rich households	○ Two heifers, 2 oxen, 1 cow, 2 sheep ○ Ability to cultivate the land without the need to hire oxen or labour ○ Own crop production can feed the household only for 2 months	○ Two oxen, 5 sheep, 2 goats

In Gobo Deguat three important criteria can be identified: livestock, land and production of food. Labour availability may be a fourth. The women in Gobo Deguat indicated that poor households "do not have enough cereals to feed the household" and that average and even rich households can only produce enough cereals to feed the household for two months. When we probed this, the women indicated that a poor household produces enough crops to feed the household for 2 months. For the rest of the year they buy food or get free food aid. They earn an income by off farm employment (off farm *wage* employment) including food for work. The

women also mentioned that these household occasionally go begging for food from the richer tabias in the valley bottom. For average households, the women admitted it was more likely to be a bit more than 2 months, but did not indicate how many more. When asking how many months the rich could survive on their own crop production the women answered again two months. The translator interpreted the answers as being an indication of expectations that more food aid could be acquired when stating little own production. However the women did state that the average and rich households earned an income the same way as the poor households and also depended on free food aid. This is an indication of the fact that none of the households in Gobo Deguat are self-reliant in their own cultivation, and that Food Aid and Food for work programmes are an indispensable source of food. There were very few differences between the men's and women's wealth ranking and therefore they were lumped together. The results can be seen in figure 6.

Figure 6 Wealth distribution in Gobo Deguat



Almost three-quarters of the population of Gobo Deguat is considered to be poor. There are almost as many households of average wealth as there are rich households (14% and 12% respectively).

Teghane

Table 8 Wealth ranking in Teghane

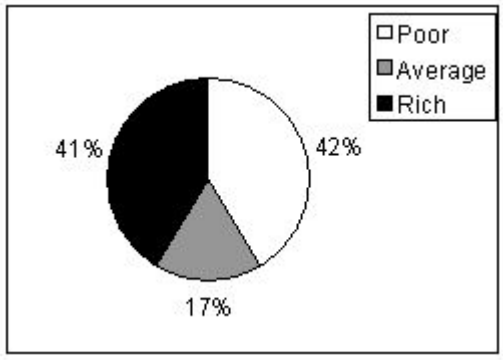
Teghane	Women (N=10)	Men (N=10)
Poor households	○ No livestock, not even chicken ○ No land (plot) ○ Plot but no ox to plough ○ Poor household management	○ No oxen, but 2-3 chickens ○ Share-cropped land (do not own land themselves) ○ Doesn't have enough production for the entire year. Participate in Food-for Work activities and beg for food ○ Involve in daily labour (go out of village to seek work)
Average households	○ One donkey, 1 oxen, 5 sheep, 1 cow ○ Share-crop out ○ Plough own plot ○ Sons can work (exchange labour for oxen) ○ Exchange straw and grass for crops	○ One oxen, 10 sheep, 1-2 donkeys ○ Owns land
Rich households	○ One cow plus heifer, 7-10 sheep ○ Can cultivate own plot	○ Two oxen, 2 cows plus 1 calf, 1-2 donkeys ○ Share-cropped in land (1-2 tsmdi[4])

[4] 1 tsmdi = 0.25 ha

○ Own labour on own land	○ Has enough seed for planting and has enough production (consumption) for the next cropping seasons

In Teghane the same three important criteria are relevant: livestock, land and production of food. Poor households do not own livestock (most importantly do not own an ox). They may own few chickens. Farm households with average wealth in Teghane also own donkeys and own a few sheep, which indicates that Teghane has more favourable conditions than Gobo Deguat. This is also confirmed by the fact that in Teghane rich households are able to produce enough food to last until the next cropping season, while in Gobo Deguat the rich households are not. Finally, in Teghane, there are fewer households that are classified as poor (42%) and more that are classified as rich (41%). The reported wealth distribution in Teghane is shown in figure 7.

Figure 7 Wealth distribution in Teghane



Because of the history in land tenure in Ethiopia (land was distributed among farmers equally), the land size of each farm holding is more the same. However, due to specific circumstances, some farmers were left with no land. Poor households with little or no land are sometimes forced to share crop out (hire in) land, while rich households can afford to share-crop in (hire out) land. Maybe more important than the size of the land holding is the ability to cultivate it. Poor households are faced with several constraints, mainly the lack of oxen to plough the land. Households of average wealth are also constrained by not having enough oxen to plough (two oxen are required, while most households of average wealth own only one). They can resolve these constraints by trading labour for oxen power (see for instance the entry "sons can work" mentioned by the women in Teghane). Rich households can rely on their own resources - they have sufficient oxen to plough their land, enough labour and sufficient planting material.

Though farmers may over-emphasise the poverty in their village, the results indicate that the majority of farmers do not produce sufficient food for their own consumption, this being more so in Gobo Deguat than in Teghane. This result is confirmed by the outcomes of the coping strategies farm households deploy.

Coping strategies

Given the fact that many households in Teghane and Gobo Deguat cannot meet the food requirements of their own household, we were interested to identify the coping strategies of farm people, the resources available to them in their coping and the explanations for adoption of

coping strategies. We defined coping strategies as measures that households would take when there was food shortage. During the exercises, we separated again the women and men, because the two groups might have different roles in coping strategies. The farmers indicated that coping strategies of the various wealth groups differed and therefore we give the various strategies per group.

Gobo Deguat

Coping strategies differ slightly by wealth group. In difficult times, poor households cannot rely on their own resources and are forced to look for opportunities outside of their farm. Food for work was considered to be most important one. It provides an important safety net close to home. Food for work programmes have a long history in Tigray. Tessema (2000) reports that at the time of the Derg, "peasant associations" were set up, which were mobilised to provide rural labour through food for work programmes, meant to stop the environmental degradation in the area. Soil and stone bunds were built on hundreds of thousands of hectares of cultivated land in the central and northern highlands. According to Tessema (2000) these did not last or achieved much in terms of improving degraded land because the local communities were not consulted and felt no responsibility for them, and the structures were not compatible with existing practices. Although environmental policy has changed considerably since (see Tessema, 2000), FOOD FOR WORK programmes are still used to construct stone and earth bunds. Our observations in Gobo Deguat suggest that farmers involved in FOOD FOR WORK programmes in which stone bunds are constructed are not interested in the SWC structures per se, and that many stone bund structures had been ill-conceived.

Other off farm opportunities mean moving to far away places such as Mekelle and other major cities or even to Sudan to find off farm (wage) employment. The women group also mentioned begging for food in the tabias that are located in the richer downstream valleys.

For households who are of average wealth, off farm employment (e.g. masonry) is also considered to be most important strategy, with Food for work ranking highest. However, these households can rely more on their own resources. One strategy consists of selling their own produced cereals and buying cheaper cereals (such as linseed) in return. The women group mentioned several strategies that involved own resources. Households of average wealth can sell eucalyptus trees in the form of fuel wood or timber, and sell of livestock. The women pointed out the importance of "prickly pear" (*Opuntia Ficus-indica*) as food and livestock feed. The fruit of the cactus is used for food and the cactus leaves for fodder. The use of prickly pear seems quite important in Gobo Deguat, according to our field observations. Guinand and Lemessa (2001) describe the process to make them edible:

> *" Opuntia ficus-indica is a cactus with edible reddish fruits when ripe. Children and women collect the ripe fruits with a long wooden stick with a large nail at its end. The fruit is pierced by the nail and torn off the plant. It is then rubbed on the ground to remove the bothersome spines. The upper end of the fruit is sliced-off with a knife and the remaining piece sliced open on one side so that the thick skin can be easily removed by hand to eat the inner part. High consumption of O. ficus-indica fruits, even though rather pleasant and tasty, causes intestinal problems. Opuntia species are spread all over Ethiopia and well known in most parts for their fruits as a 'famine-food'. In many parts of Tigray Region, the fruits are even sold on local markets, such as in Mekelle town."*

The farmers informed us that they use the leafy parts as fodder. Although Ethiopians have a deep knowledge on the medicinal and nutritional value of wild plants, wild-foods are considered to be a low-status food and its consumption regarded as a source of shame. In normal times only children, youngsters and the poorest families collect and consume regularly wild-food.

Rich households employ similar strategies, but can rely even more on their own resources. As the other households, they also make use of off farm employment in major cities, sell own produced cereals to buy cheaper cereals in return. And they have more livestock to sell when necessary. But the women group mentioned that they also have access to credit from REST, something that the other households do not have.

For all households, rich or poor, finding off farm (wage) employment is the most important strategy. However, women and men had different views on which off farm employment strategy was the most important one. Women considered Food for work to be the most important one, while men considered migration to be most important one. In tables 25 and 26 in Annex 1 all the strategies per wealth group and their rankings are given.

Teghane

Also in Teghane, the coping strategies differ by wealth group. The strategies also differ in several ways with those of Gobo Deguat, reflecting the relatively better conditions of the community. In tables 27 and 28 in Annex 1 all the strategies per wealth group and their rankings are given. Poor households are less able to rely on their own resources in difficult times that richer households. Food for work and especially free food aid are important safety nets. Free food aid was ranked the highest by men and women. Off farm (wage and self) employment are other key strategies. Hiring oneself as a labourer on other farms was mentioned by the men's group. Another strategy mentioned by the men involves the trade between the Afar Region east of Tigray and parts of Tigray. The Afar Region consists of lowland with very hot and dry conditions. It is a salt-mining region. Salt is traded with other regions and transport is by donkeys. Poor households in Teghane engage in this trade by buying and reselling salt delivered by people from the Afar Region, or by renting out donkeys to them. Masonry is another off farm (self) employment option for poor households. Strategies that involve using the household's own resources include sharecropping out land. However, if there are rains, land can be sharecropped in to produce some food. The women mentioned that skipping dinner and/or lunch was a way to economise on food, and relying more on the use of 'prickly pear'. Finally, receiving credit from REST could help in difficult times. Apparently, poor households in Teghane do have access to credit, as opposed to poor households in Gobo Deguat.

For households of average wealth, off farm (self) employment (i.e. masonry) is also an important strategy. But other strategies involve the selling of own resources, in particular livestock and donkeys. Donkeys are sold or rented out to people from the Afar Region trading salt.

Rich households rely largely on their own resources in difficult times. They have more livestock to sell when necessary. Also, when there is a shortage of food, they will rent *in* more land, from poor households to increase production of food. Rich households have the means to do this, even in difficult times, while the poor households will do the reverse and rent *out* land. This suggests that households employ different strategies in times of need.

Free food aid was ranked highest (8 out of 10) by both the women's group and the men's group. Other strategies such as selling livestock, masonry activities, renting or selling donkey were ranked much lower. In Teghane the coping strategies were further investigated by asking what farm households do in case there is threat of acute food shortage, e.g. due to a completely failed harvest. The women replied that households would depend on Food Aid. And that they would reduce food consumption and rely on cactus (prickly pear) for human and livestock consumption. The men stated that households would migrate if there is enough labour in household. They also mentioned that households would rely on Food for work and Free Food Aid. The men added that they did not want to rely on credit, because the risk of crop failure was too great.

Activity Calendar

Activity calendars were established by discussing the farm related activities during the year (which in Ethiopia starts in September) and the activities that were done in each month. It was decided to do activity calendars with men and women separately, because the division of labour and responsibilities are different for both groups. The farmers indicated the main activity for each month, but in reality activities can overlap, start earlier or later depending on the time on the onset of rains. By giving weights to each month (and in Gobo Deguat for each activity) the labour requirements are indicated.

Gobo Deguat

In Gobo Deguat, we asked the farmers to give weights to each activity per month to better understand the labour requirements for each activity and each month. The weights add up to 54. The activities for men are given in table 9, those for women in table 10.

For men, January is completely occupied by mass mobilisation activities (SWC). After this, the agricultural calendar year start with ploughing. Food for work activities again occupies most of the time before the onset of the rains. When the Belg rains start (usually around March-April), the men sow various cereals. Manure application is again combined with a final ploughing and shrubs are cleared. At the onset of the Meher rains (usually around June-July), other crops such as barley, wheat, faba bean, lentils and linseed are sown. During the relatively quiet months in which the crops are maturing, men engage in weeding and house maintenance. As in Teghane, the men plough fallow lands in August. They explained that by ploughing in the weeds, they increase the fertility of the fallow plots. From September onwards, they start harvesting. First they collect hay and then harvest and thresh the crops until the end of December. Busiest months for the men are January and March. In January most of their time goes into SWC measures (mass mobilisation) and in March they involve in Food for work. About half of their time and energy (54%) is put into these off farm activities.

Table 9 Activity Calendar for men in Gobo Deguat (N=8)

Activities Men	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Cut and collect hay	**1**											
Harvest crops		**2**										
Collect and carry crops to *audi* for threshing			**2**									
Thresh				**2**								
SWC (mass mobilisation)					**15**							
Plough						**1**						
Food for work							**15**					
Sow teff, maize, finger millet, millet								**2**				
Plough									**3**			
Apply manure									**2**			
Clean unnecessary shrubs									**1**			
Sow barley, wheat, faba bean, lentil, linseed										**3**		
Weed											**3**	
House maintenance											**3**	
Mitsgae (ploughing of fallow land, to plough in the weeds and increase soil fertility)												**1**
% of total (N=56)	2%	3.5%	3.5%	3.5%	27%	2%	27%	3.5%	11%	5%	11%	2%

NB weights reflect labour requirements

The women have different responsibilities than men. Women are not engaged in ploughing. When ploughing starts in January, the women are still busy with processing the harvested crop (grinding). When the ploughing continues, women turn to collecting firewood, making baskets and selling crops The women report that they are involved in SWC in December, instead of January, like the men. Crops are sold in April, probably because at that time, the resources of the household are very low. They participate in Food for work programmes in May, again, because during these months, household resources are at their lowest point. During the early Meher rains, women engage in vegetable gardening. In August they clear the fields of weeds. In September (maize) harvesting starts and in October (and probably November) harvesting and threshing continues. Busiest for the women of Gobo Deguat is December in which they devote all their time in SWC (mass mobilisation) and July in which harrowing is the most time-consuming activity.

Table 10 Activity Calendar for women in Gobo Deguat (N=8)

Women (N=8)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Harvest maize	4											
Harvest		3										
Thresh		2										
SWC				6								
Grind					2							
Collect firewood						4						
Make baskets							5					
Sell crops								4				
Food for work									5			
Harrow (ploughing)										2		
Vegetable gardening											6	
Weed												2
% of total (N=50)	8%	10%	0%	12%	4%	8%	10%	8%	10%	4%	12%	4%

NB weights reflect labour requirements

Teghane

For men (table 11) the agricultural calendar starts in January, when the men start ploughing the fields. This continues several weeks, until after the first Belg rains have arrived (usually around March-April). During ploughing, manure is applied and ploughed in. While waiting for rain, there are Food for work and Soil and Water Conservation activities from February to around April. When the rains start, they start sowing. In Teghane there is some irrigation and this enables the farmers to harvested in May.

May is still a relatively quiet time, the men engage in maintenance work on their houses. When the Meher rains start (around July), other crops (such as linseeds, lentils) are sown. Weeding requires most of the time in the weeks after sowing. In August fallow lands are ploughed. The men in Gobo Deguat do the same, apparently to plough in weeds to increase the fertility of the fallow lands. During the dry spells in September to January crops are harvested and threshed.

We asked the farmers to assign weights to the months in accordance to the labour requirements of that month. Table 11 shows that December and January are the busiest months. According to the men's group, ploughing is the most time consuming activity, closely followed by harvesting. Soil and water conservation, consisting of building stone and soil bunds is less time consuming, but mentioned in the top three (weights are given in table 29 in Annex 1).

Table 11 Activity Calendar for men in Teghane

Activity men	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Collect hay												
Harvest and collect crops												
Thresh (mainly barley)												
Thresh mainly wheat (main crop), faba bean, field pea												
Collect straw												
Plough												
Plough fallow land												
SWC												
Manuring												
Food for work												
Sow maize, faba bean, *reie* (if there is rain)												
Harvest irrigated crops												
House maintenance												
Thresh irrigated crops												
Sow linseeds, lentil, planting seedlings												
Weed												
Weights	3	4	5	7	8	3	4	5	3	3	4	5
% of total (N=54)	6%	7%	9%	13%	15%	6%	7%	9%	6%	6%	7%	9%

NB weights reflect labour requirements

Women have different responsibilities than men (see table 12). Women are not involved in ploughing or sowing but they are responsible for weeding. While the men plough, the women engage in trading, gardening and spinning. When the rains start they start immediately weeding. While the men are sowing, the women are collecting animal feeds, making baskets (for which they use a special type of grass). Although the women do not sow, they do prepare the seeds before sowing. The women spend also time in getting Free Food Aid in June, when there are no harvests yet. During the Meher rains, the women engage in vegetable cultivation. Together with the men they collect hay, and harvest and thresh. The women are engaged in hulling faba bean. In October they again make baskets. Busiest months are December and January. For the women, private Soil and Water Conservation structures and threshing (in the *audi*) are most labour intensive, followed closely by weeding, FOOD FOR WORK (constructing SWC) and collecting hay (weights are given in table 30 in Annex 1).

Table 12 Activity Calendar for women in Teghane

Activity women	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Collect hay												
Weed												
Harvest barley												
Make baskets												
Hull faba bean												
Collect harvested product to take it to the *audi* (thresh place)												
SWC												
Food for work												
Bring products from *audi* to home												
Trade[1]												
Prepare garden plots near homestead												
Gardening												
Spin cotton												
Weed												
Collect animal feed (e.g. prickly pear)												
Make baskets												
Prepare seeds for sowing												
Get Free Food Aid												
Plant vegetables and harvesting												
Weights	3	4	5	7	8	3	4	5	3	3	4	5
% of total (N=54)	6%	7%	9%	13%	15%	6%	7%	9%	6%	6%	7%	9%

NB weights reflect labour requirements

Crop productivity and soil nutrient management

Crop productivity in terms of yields in Tigray lags behind the average for Ethiopia (see tables 13 and 14). Yields for cereals and pulses in Tigray remain 73% of those of Ethiopia's average. In terms of productivity, Tigray contributes only 6% to Ethiopia's cereal production and 2% to Ethiopia's pulses production. These figures illustrate the fact that Tigray is a marginal area in terms of crop production.

Table 13 Area ('000 ha), production ('000 tonnes) and yield (tonnes/ha) of cereals and pulses in 2001/02 Meher season in Tigray and Ethiopia.

		Teff	Wheat	Barley	Maize	Sorghum	Finger Millet	Other	Total Cereals	Total Pulses	Cereals and Pulses
Tigray	**Area**	170,6	71,1	88,7	66,7	209,3	106,9	51,0	764,3	47,3	811,6
	Production	107,7	69	74,7	74,1	227,1	81,8	44,7	679,1	24,5	703,6
	Yield	0,63	0,97	0,84	1,11	1,09	0,77	0,88			
Ethiopia	**Area**	2595	1658	1325	1973	1649	481	116	9796	1526	11322
	Production	1929	2288	1453	3250	1829	464	94	11306	1028	12334
	Yield	0,74	1,38	1,10	1,65	1,11	0,96	0,81			

Source: FAO/WFP 2002

From table 27 it can be seen that 1997/98 was a relatively bad year for Tigray in terms of cereal yields, with only 0.57 tonnes/ha. The following year was a very good year with 0.85 tonnes per ha, especially in comparison to the average of Ethiopia. Whereas Tigray's yields are usually around 70-75%, of Ethiopia's average this year it was 85%. For pulses also 1997/98 was the worst year with a yield of only 0.31 T/ha.

Table 14 Cereals and Pulses Production: Comparison of 1996/97 to 2001/02 Meher Season in Tigray and Ethiopia

	Cereals			Pulses			Cereals and Pulses		
	Area ('000 ha)	Production ('000 t)	Yield (t/ha)	Area ('000 ha)	Production ('000 t)	Yield (t/ha)	Area ('000 ha)	Production ('000 t)	Yield (t/ha)
Tigray									
'96/97	840	638.1	0.76	70.2	36.3	0.52	910.2	674.4	0.74
'97/98	889.1	505.2	0.57	56.5	17.7	0.31	945.6	522.9	0.55
'98/99	907.1	774.5	0.85	53.8	26.9	0.50	960.9	801.4	0.83
'99/'00	830	606.8	0.73	49.1	25.6	0.52	879.1	632.4	0.72
'00/01	827.4	667.9	0.81	50.5	25.2	0.50	877.9	693.1	0.79
'01/02	764.3	679.1	0.89	47.3	24.5	0.52	811.6	703.6	0.87
Ethiopia									
'96/97	9442.5	10842.2	1.15	1477	996.9	0.67	10919.4	11839.1	1.08
'97/98	9484.4	8104.5	0.85	1525.7	701.8	0.46	11010.1	8806.3	0.80
'98/99	9807	10398.6	1.06	1488.4	995.5	0.67	11295.3	11394.1	1.01
'99/'00	9290	10706.1	1.15	1504.9	1039	0.69	10794.9	11745.1	1.09
'00/011/	9813.9	11780.6	1.20	1504.7	1018.6	0.68	11318.6	12799.2	1.13
'01/02	9796	11306.4	1.15	1525.7	1027.7	0.67	11321.7	12334	1.09

Source: FAO/WFP 2002

Against this backdrop of overall low yields in Tigray, we asked the farmers in the two kushets about their cropping and soil and water conservation practices. We differentiated between knowledge about practices and actual implemented practices. Beyene et al., (2001) found in their study that at plot level, farms differ remarkably in terms of their biophysical resources and management. This will be further investigated in the follow-up NUTMON study.

The Ethiopian farmer predominantly uses long-established agricultural practices. For example, the Ethiopian plough or *maresha* is a wooden plough whose design has hardly been changed for centuries. A steering stick made of wood (2.2-2.5 m) is inserted at the end with a wedge-shaped metal share, which goes into the soil. Two wooden "ears" located on either side of the beam spread the tilled soil. The plough is pulled by two oxen (Nyssen et al,. 2000a). Goe (1999, cited in Nyssen et al 2000a) reports that the design allows it to be used on plots with different biophysical characteristics (few or many stones, flat, gentle sloping or steep lands). Nyssen et al (ibid.) found that tillage erosion can be held responsible for half of the sediment deposited behind newly constructed stone bunds. However, farmers we interviewed considered ploughing to increase soil productivity. Although ploughing may lead to soil erosion, it may also increase the permeability and mineralisation of the soil (pers comm. Nyssen).

There is a debate about the effects of land redistribution on investments made in land (e.g. in SWC). According to Jabbar et al (2000) the frequent land distributions have led to tenure insecurity and therefore to less investment (e.g. in trees). However, Nyssen (2000a) argues that even before land reform, there was already very little investment in plots away from the homestead and therefore he contests the argument that land is not invested in because of the

land reallocations. Brasselle (2002) argues that if there is a traditional village order, it will provide the basic land rights required to stimulate small-scale investment. Although there have been several land distributions in Tigray, it seems that with the current baito structure in place, tenure security is safeguarded to a large extent.

Gobo Deguat

Gobo Deguat lies in a narrow catchment area, with steep escarpments enclosing it at two sides. There is a small valley bottom where the communal grazing areas are situated. On top of the escarpment there is a plateau, which is also farmed by the villagers from Gobo Deguat. They mainly grow cereals such as barley, wheat (including black and white), and a mixture of barley and wheat called hanfest, finger millet, millet and teff. They also grow faba bean and lentils, various vegetables and hops. Although land is becoming scarce, much of it is left fallow, especially the steep plots that are infertile.

The farmers in Gobo Deguat use fertiliser to improve crop production, but only very little. The remote location and lack of roads leading to the village make it difficult to regularly purchase fertiliser. Another reason is that fertiliser is too expensive. Farmers also believe that SWC will be more effective. When they do use fertiliser, they use DAP and urea. Manure is the most preferred strategy to improve production mentioned by men (before fertiliser and improved seed). Children collect dung cakes from cows and donkeys from the communal grazing lands. Farmers mentioned that they sometimes mix mineral fertiliser with manure. However, use of manure is also limited because only few farmers are actively involved in livestock management because there is a shortage of feed in the kushet. Ash and compost are other fertiliser that farmers occasionally use. However, according to the group we interviewed, few farmers know how to compost or even heard of it. The farmers who do compost by collecting leaves, ash, cow dung in a hole in the ground. This mixture stays in the ground for 9 months. The women told us that they preferred composting above fertiliser and improved seeds.

Although the farmers are not well connected to markets, they do use improved seeds. Because of the steep slopes, erosion (including gully erosion) is severe and farmers are well aware of this problem. They are engaged in constructing check dams, and soil and water conservation measures such as stone bunds. They would also like to do more on water harvesting and irrigation. However, there are several constraints that prevent them from successfully implementing these measures. The main one is that they lack the physical energy to construct water harvesting or soil and water conservation constructions. Mechanised options (such as using a motor for irrigation) are not suitable because they lack the money.

However, the farmers do see SWC conservation and INM practices ("to prevent the soil from becoming poorer") as an integral part of strategies that improve production. Like in Teghane, the women ranked SWC highest as a way to improve crop production. Again, this may consist of a 'politically correct answer'. But besides participating in mass mobilisation for SWC, farmers also invest in SWC on their own land. On their own initiative, farmers prevent gully erosion by planting trees in the gullies. Gully erosion is a major cause of land degradation in Gobo Deguat and many farmers worry about this. In the section on resource history, we describe that according to farmers, the gullies worsened after trees in the area were uprooted. Nyssen et al,. (*no date*) distinguish several reasons for gully erosion, amongst which removal of vegetation and subsurface erosion in valley vertisol areas.

One of the older farmers told us that there used to be underground water acquifers, which had now all dried up. This may have resulted in sinking of semi-circular portions of soil by diffuse subsurface erosion. Nyssen et al., (ibid) label this 'blind head" gully.

We also again interviewed the village leader (Mr Birhanu) on his view on our identified alternative cropping and SWC.

A plough that needs two oxen, but that will need less rounds of ploughings, because the furrows are deeper.
The kushet leader underlined the importance of having two oxen. He told us that farmers who own two oxen can share crop in lands with farmers who own no oxen. It also enables them to plough farmland rapidly and leave for other, off farm activities. Another advantage of ploughing the land in time is that it helps to clear weed cover, and it enables the farmers to thresh on time. According to the village leader, especially sandy soils need quite a number of ploughings to increase the infiltration rate of the soil.

A plough that needs only 1 oxen
The kushet leader did not think this was feasible, and explained what households normally do when they own only one oxen. Households that own one ox need to exchange labour for oxen, or oxen for oxen to plough the land properly. They plough the land of another (richer) farmer for two days and can then borrow an ox for one day. These farmers also engage in *lifnti*, signifying labour to labour or oxen to oxen exchange.

Leaving crop residue in the field
The kushet leader acknowledged that leaving crop residues of maize in the field increases the fertility status of the field, but because there is a lack of livestock feed in the kushet, he prefers to use the crop residues as animal feed.

Zero grazing
The kushet leader did not seem to regard this as an innovative idea and explained how the farmers manage their livestock in the kushet. He confirmed what was told to us by the children when we interviewed them about livestock management (see below). In his view, it is better to send the livestock to the grazing area to get fresh grass, but he did see some disadvantages too. First, the livestock, while moving to the grazing area, can damage soil conservation structures. Secondly, the people guarding the livestock often cut down trees while taking their cattle to the grazing area. And finally, the cattle sometimes fight and hurt each other.

Using fertiliser for specific crops and soils
The kushet leader told us that he already distinguishes between fertilisers and crops and soils. DAP can be used in all types of soil, but it is especially used for sandy and loamy soils. DAP is used for barley, wheat, maize and hanfets. Urea is used for clay soils and for barley, wheat, maize and hanfets. He prefers DAP because with the soil type that is common in the area it gives a high yield. Urea, in his opinion, does not give sufficient production when there is a shortage of rainfall.

Conservation structures
According to the kushet leader, stone bunds are used to prevent erosion and to increase soil moisture. The disadvantage of stone bunds is that they provide a home for rodents, which damage the crops. Earth bunds are used to conserve soil moisture and to some extent prevent soil erosion. Terraces are used to prevent erosion and to increase soil moisture.

Although the village leader seemed more conservative in his views that the village leader in Teghane, he did point out some important factors. For instance the importance of having two oxen for ploughing to expedite the time it takes to plough. Some strategies he acknowledged as being important, such as leaving crop residues in the field, but explained why it was not feasible (because of lack of livestock fodder). Some ideas, such as the zero grazing, he may not have understood completely. There was no DA in Gobo Deguat that we could interview. This may be due to the remoteness of the community.

Teghane

Teghane has a small irrigation dam, which enables the villagers to grow crops in the dry season. The villagers of Teghane had to give up a substantial amount of grazing land, which was replaced by the dam. In return, they received plots of irrigated land in return. This land is located in a neighbouring kushet. Although originally, the villagers of Teghane were not happy with the loss of the grazing land, they now see the benefits of the irrigated plots. In Teghane farmers mainly grow barley, wheat (including black wheat), faba bean and vegetables. On the irrigated lands they grow mostly barley and vegetables. Although land is becoming scarce, it is also left fallow, especially the plots that are infertile.

During the RDA, technologies were discussed that improve crop production. Farmers use of fertiliser both for rainfed and irrigated areas. According to the men, use of fertiliser will enhance production, except at times of little rainfall. In those cases, fertiliser does not increase production. They mainly use DAP and Urea. DAP is preferred because when plots are waterlogged, it increases production more than urea. Also the women mentioned that waterlogging led to decreased effectiveness of fertiliser in waterlogged areas. The women also mentioned that fertiliser use was not a common practice because their land is of good quality (clay). Manure is also used to enhance crop production. The women mentioned composting, which they use to increase soil productivity. Manure and composting are not only used to improve fertility of the soil but also to conserve moisture in the soil. Of all *nutrient management* techniques, the men prefer applying manure to the soil, because it increases production and is not affected by a shortage of rain, like fertiliser. In case of waterlogging, they construct a drainage system to remove the surplus of water. The men rated fertiliser and composting rated after manure, and finally soil and water conservation. However, the women rated Soil and Water Conservation highest. This may indicate a 'politically correct' answer. What is interesting is that use of fertiliser was rated lowest by both men and women.

Soil and Water Conservation through mass mobilisation was also mentioned. However, according to the farmers, there are also farmers who invest privately in SWC on their own farmland. They prefer stone bunds to the soil bunds. When there is heavy rainfall, the soil bunds exacerbate waterlogging, while stone bunds conserves the water. Secondly, stone bunds are preferred because the soil bunds occupy much space (farm land). Thirdly, when there is heavy rainfall, the soil bunds erode away easily.

The farmers also used improved seeds. However, they did mention the risk of frost damage. Especially improved seeds are affected by the frost, which regularly occurs because of the high altitude of Teghane. The women mentioned that farmers prefer faba bean because it tolerates waterlogging better than other crops. It also reacts well to weeding: when the plot with faba-bean is weeded, the faba bean gives an additional harvest.

The responses from the men and women show that they have tried several strategies such as fertiliser and improved seeds, but that they also realise too well the constraints, such as the problems of using fertiliser in waterlogged areas and the vulnerability of improved seeds to frost. They also realise that soil and water conservation practices affect the production in a positive way. This confirms the results found in Esser et al. (2002). However, the women said that since they own only small sizes of land, they know and practise only few technologies.

Although there have been several NGOs active in the region, the number of technologies listed by men and women are rather limited. However, in discussions with farmers and later on with the village leader and the DA about experimental farmers, we found out that several farmers are experimenting with different strategies (see below). We interviewed the village leader of Teghane (Desalegn Berihu) about several alternative land use practices. The basis of the discussion was based on a literature survey (ICRA, 1997; Eweg et al, 1998; Herweg & Ludi, 1999; MacKenzie, 1987a; MacKenzie, 1987b; Shiferaw & Holden, 1998; Feoli, 1996)5. The village leader is elected and has a position of respect and standing in the community. His opinion on alternative technologies will matter if these are introduced into the village. The village leader in Teghane was much more open to new ideas than the village leader in Gobo Deguat (see next section). This may be due to the relatively more favourable circumstances in Teghane, which allows for more experimentation, but the presence of many NGOs, researchers etc. may also have contributed to this.

A plough that needs only 1 oxen
The village leader thought this was an important idea, because many farmers lack the money to buy (or hire) 2 oxen. There are many farmers who own at least 1 ox, but due to lack of *lifnti* cannot get a second ox to cultivate the field.

A plough that needs two oxen, but that will need less rounds of ploughings, because the furrows are deeper.
While he appreciated the idea of a plough that needs only 1 oxen, he feels that using 2 oxen but ploughing less would be more productive than ploughing more times with only one oxen.

No-tillage
So far he hasn't seen no-tillage practised in his area. What he knows though, is that repeated ploughing will increase the infiltration rate of the soil. He added that no-tillage may be a good method, but that it was the first time he heard about it.

Zero grazing
The village leader appreciated this idea for a number of reasons. The first point he raised is that if cattle are confined, you no longer need children to shepherd the livestock, which will allow these children to go to school. The second point he raised is that he liked the idea of the cut and carry system, because it facilitates the collection of manure from the confinement for fuel. Finally he mentioned that in times of frost, it is better to keep the cattle at home and feed it.

Mulching
The village leader was positive also about the idea of mulching. He said that especially in the beginning, it would protect young seedlings from sun and frost. Besides that, it would maintain

[5] See also Meijerink 2003 for a complete list of identified alternative land use practices. From this list we selected the ones which we reckoned to be most suitable to the area.

the soil moisture better. When asked whether there was enough plant material available to do this, he said that because the area is dry, it will not be easy. However, it might be possible in the rainy season, when farmers can easily obtain grass and other leaves. The time of seedlings which would especially benefit from mulching.

Green manure
Although most experts think that green manuring (using plant residues to fertiliser the soil) is not feasible in Tigray, the village leader told us that green manuring is applied in the kushet. According to him, it gives a better production, but due to the shortage of animal feed it is not applied widely in the area. Normally field pea, lentil, wheat, barley are commonly used for green manure. According to the village leader, these crops have the same effect as manure, but they do need good rains to be effective. Green manuring is generally used on loam and sand soils.

Using fertiliser for specific crops and soils
This practice he already applies. He said that fertiliser has to be applied to a specific type of crop and soil type, rather than applying it for all types of crops and soil types. He says that he uses fertiliser on wheat, faba-bean, barley and vegetables. In his area, the use of fertiliser is more productive if it is applied on sand, and loam. It can be applied on clay soils as well.

The village leader clearly appreciated several ideas and came up with additional reasons why the new technology might be beneficial. For instance, the fact that zero grazing may facilitate children going to school because they do not need to herd livestock all day. Other ideas he appreciated, but he also identified possible drawbacks. For instance the practice of no tillage may reduce rainwater infiltration. Other technologies were already used in the community, such as green manure or using specific fertilisers for specific crops.

We interviewed the DA (extension officer) Mr. Haftom on the soil and water conservation policies that had been introduced in the region. According to the DA, the government has been promoting conservation measures in the area:
◊ Soil bunds
◊ Stone bunds
◊ Trench bunds
◊ Semi-moon structures (normally used for tree plantation purposes).
Farmers are mostly interested in the stone bunds, soils bunds and check dams (in that order). They are less interested in soil bunds because of water logging, and they occupy farmland. This confirms what the farmers had told us earlier.

Traditionally, farmers have been constructing soil bunds using a spade. Planting cactus in rows is another traditional technique. The government has been discouraging the planting of a type of cactus usually termed “ficus” in Tigray because it occupies land and gives refuge to rodents. Disadvantages of cactus are, according to the DA that the fruits (prickly pear) are seasonal and the cactus disappears when it is dry. Finally the DA mentioned stone terraces as a traditional technique. According to him, of the traditional techniques, farmers use the cactus most often, followed by stone bunds.

There are quite some farmers experimenting in the area. Experiments include digging a small pond down in the watershed and after water has been collected in these ponds it is diverted to the farmlands higher up. This way, they are conserving their fields from erosion. The soil that is eroded down is collected in these ponds, instead of washing away completely. Secondly, they

can water the fields when the rainfall has stopped. Other experiments (not necessarily SWC) include planting perennials such as banana and fruit trees instead of cereals, gardening (vegetables and fruits). A few farmers have invented a wheel to get the water from down the stream or pond to the fields located up the hill slopes. A group of farmers have received a loan from the Bureau of Agriculture to buy a generator for irrigation purposes.

He also told us about a female farmer, who had lost her husband, and had no-one to plough for her. She decided to plough the land herself, which was regarded as quite revolutionary. This underlined the strict gender divisions of labour that exist in Tigray and the difficulties that female-headed households are facing. Quisumbing and Maluccio (1999) support this and find that the women in Ethiopia own less land than men. The importance of this is underlined by their finding that the amount of the wife's assets is positively correlated with food security.

According to the DA these experiments are normally done by the farmers with average means. Usually farmers from this group are innovators. Poor farmers have no time because they are too busy looking for a job. The rich have sufficient means and see no need for experimentation. They even look down a bit on these experiments, regarding these as an necessity for poor farmers only. This was an important remark, as it makes clear the importance of socio-economic stratification in analysing farmers' strategies.

Livestock management

To gain knowledge about livestock management, we discussed these with children (mostly young boys). They usually herd the livestock throughout the year, and spend almost the whole day with them. During the interviews, it struck us how knowledgeable they were, in particular about the rules determining the grazing area and period. They also seemed less inhibited in their answers than the adult farmers. Where quantitative data was concerned we asked them directly (as most of the boys had gone to primary school), or by visualising quantitative data by a number of stones.

Gobo Deguat

In Gobo Deguat, the villagers keep oxen (mainly for ploughing), cows (mainly for milk), sheep and goats, chicken and donkeys[6]. Table 15 lists the importance (rank) and uses of livestock. The value (or price received at a sale) determines for a large share the importance.

Table 15 Importance (ranking) and purpose of the different livestock in Gobo Deguat

Rank	The types of livestock	Main purpose
1	Ox	For ploughing, beef and threshing
2	Cow	For milk, beef and calves
3	Donkey	Transportation of products from the field to the home Sale
4	Sheep	For meat and sale
5	Goat	For sale and milk
6	Chicken	For sale, meat, their eggs for sale, and the production of chicks

[6] See the footnote under livestock in Teghane

Livestock management is also a shared responsibility in Gobo Deguat. Oxen, cow, sheep and goat herding is the responsibility of the children (both male and female). Older children also milk cows and goats. The sale of milk is the responsibility of women (one child mentioned that the sale of milk is sometimes taboo). Chickens are mainly the responsibility of the women. Manure is used mainly as fertiliser, and secondly for fuel purposes. This is the same as in Teghane.

Rules of common grazing are clearly defined. Grazing in the area enclosure is only allowed in the month of September. During all the other months it is forbidden to graze. Penalties are determined by the guard, according to livestock type. There is a common grazing area, where the cattle is sent during the dry months. During the wet months the cattle are kept in the homestead and fed crop residues.

Teghane

Households in Teghane keep oxen (mainly for ploughing), and cows (mainly for milk), sheep, chicken, donkeys and horses (although these are few). According to Guinand, & Lemessa (2001), the Christian Orthodox Church of Ethiopia does not allow the consumption of ducks, pigs, donkeys, horses, snakes, rabbits, rats, cats and dogs. This may explain the absence of farm animals such as pigs, ducks and rabbits, which in other countries are mainly used for consumption. The importance and purpose of the different livestock is shown in table 16.

Table 16 Importance (ranking) and purpose of the different livestock in Teghane

Rank	The types of livestock	Purpose
1	Ox	◊ Ploughing ◊ For sale (income source) ◊ For consumption
2	Cow	◊ Milk ◊ Calves ◊ For sale ◊ Ploughing (only a few farmers apply this) ◊ For consumption
3	Horse and mule (very few in number)	◊ Transportation (In the area there are major transportation problems, especially for wedding ceremonies of relatives who live further from the village) ◊ Horse also for breeding
4	Donkey	◊ Loading (products such as production, animal feed and fuel wood) from farm land to home, and from home to the market
5	Sheep	◊ Milk ◊ For sale ◊ For breeding ◊ For consumption
6	Chicken	◊ Eggs for sale ◊ Eggs for chicks ◊ For sale

Livestock usually grazes on communal lands. In addition, they are also fed. The boys mentioned three types of feed. There is special type of grass called *fea* which is grown on from farm land (strips). Secondly livestock is fed hay. And finally crop residues (straw) of crops such as wheat,

barley and other cereals is used. Livestock management is a shared responsibility. Children take care of all livestock throughout the day. Men mostly milk cows, and occasionally women. Sheep are milked by women and children. Milk is not sold because this is apparently taboo[7], but butter can be sold. All livestock, except chickens are sold by men. Chickens can be sold by men, women or children. They are cared for by women, who also sell the eggs.

Communal grazing land arrangements were changed after the construction of the dam. The whole grazing area near the dam belongs to the kushet Teghane, but the area behind the dam belongs to the kushets Teghane and Kenchebet. The whole grazing area has been divided amongst the households of these two kushets. Within each plot allocated to the households, there are no restrictions for grazing of livestock.

The construction of the dam did not change the ownership of grazing land behind the dam. But because Teghane lost grazing land in front of the dam (where the lake is now), the households of Teghane were compensated with land from Kenchebet that can be irrigated. When the irrigated land was distributed the distribution was:

◊ For wife and husband: 1 tsimdi[8]
◊ Single (widow or widower): less than 1 tsimdi

The number of children per household was not taken into account. The division of irrigated land between Teghane and Kenchebet is as follows:

◊ Teghane: 60%
◊ Kenchebet: 40%

At first, the households of Teghane were not happy with losing their best grazing land. But when the irrigated plots contributed to increased production and straw for animal feed, they were more content.

Livestock products that are used for own consumption include eggs, milk, meat (chicken, sheep, cow, ox) and hides that are used for carpet. Products that are sold include chicken, meat (sold by men), hides (sold by men and women), butter (sold by women), eggs (sold by women). Manure is not sold, but used for different purposes. Around 70% of the manure is used as fertiliser and 30% is used as fuel.

[7] Apparently, it is taboo to sell white things, because white is a holy colour. This corresponds with the observation made by Guinand, & Lemessa (2001) that the Christian Orthodox Church of Ethiopia has a significant influence on consumption patterns.
[8] 0.25 ha

Conclusions

From the RDA, supported with background literature on Ethiopia and Tigray, a picture emerges of two different communities in Tigray who face many similar problems. Like many other communities in Tigray, they face poor conditions such as limited and erratic rainfall, poor soils, and they have to manage restricted resources in such a way to sustain a livelihood. The RDA was focused especially on land degradation. Especially in Gobo Deguat, we found evidence of severe degradation. However, Jones (2002) cautions against being too deterministic or simply presenting "shopping lists" of causes in trying to explain the causes of land degradation. Deterministic studies often lack explanatory value as specific links and mechanisms between social variables and land degradation are not revealed. Many adoption models, particularly those underpinned by economic thinking have not been very successful in explaining farmer behaviour. Beyene et al. (2001) and Leach & Mearns (1997) have warned against drawing conclusions based on extrapolation of (quantitative) data that has been collected in the short term. These are important points that will have to be taken into account not only in this report but also the subsequent nutrient monitoring phase. The information and data collected should be analysed as a snapshot view of the current situation. Secondly, land use in Tigray and the landscape resulting from it should be placed in the wider socio-economic and political context of Ethiopia, which has been tumultuous for the past centuries. Thirdly, land degradation (and deforestation) processes should not be seen as linear processes of continuing degradation, but in a more dynamic way, linked to the land use strategies of the people living off them.

From our RDA we can conclude that the current situation for the communities in Teghane and Gobo Deguat is difficult and that opportunities for improvements are limited. Most of their livelihood relies on agriculture, whose success depends for a large part on rainfall. However, the amount of rainfall is on average low and unreliable. This limits their livelihood strategies in many ways. The limited extent of rainfall results in harvests that are low and consequently food consumption is reduced to a minimum. Some of the farmers in Gobo Deguat said they lacked the physical energy to implement soil and water conservation measures. But low rainfall not only reduces harvests, but also affects fodder production for livestock. Livestock plays an important role, providing traction, transport, milk and meat, and manure. Fodder shortage therefore means that livestock can provide less of these products. Low rainfall also has consequences for soil fertility as fewer sources of green manure are available, and less manure. Farmers in Gobo Deguat often have to rely on drought-tolerant plants such as the prickly pear.

The erratic nature of the rainfall implies that often there is too little, but sometimes there too much. In Teghane, the farmers said that occasionally there was too much rain in a short time, resulting in flooding and waterlogging. But although this problem did not occur in Gobo Deguat, heavy rains do have detrimental effects, by aggravating erosion, such as increasing gully erosion.

Farmers in both villages indicated that their reliance on Food for work programmes is still substantial and this indicated the severity of the situation. They pointed out that the resources available are often not enough to provide a sufficient and stable income. The amount of arable land available is especially constraining, and they were worried about how their children will be able to live of the land in the future. There are many efforts underway to come up with solutions for the problems the farmers are facing, ranging from soil and water conservation measures to improving marketing. However, due to the erratic and low rainfall, Tigray will always be a

marginal area that cannot sustain a large farming population. We might conclude therefore that some if not many of the solutions for the rural communities in Tigray lie *outside* of the agricultural sector.

Stimulating the off farm sector is a challenge. Besides food for work programmes and occasional off farm employment activities such as masonry, and salt trade (in Teghane), there are few off farm opportunities available to most farmers. Employment in the urban sector is still very limited. Off farm self employment such as trade requires considerable resources that are not available to all farmers. It is also hampered by a lack of basic infrastructure such as roads, which do not exist at all in Gobo Deguat, and information. In short, there is much scope for improvement in this area.

But there are also opportunities in improving the agricultural sector. We found that especially for a remote area such as Gobo Deguat, little knowledge or information has been shared with farmers. They mostly rely on long-established practices that have stood the test of time and are well adapted to their local circumstances. And although the farmers are rather risk-averse due to the vulnerability of their livelihoods, they are open to new ideas and improvements. The farmers realise probably more than anyone else what impact environmental degradation has on their livelihoods, as they almost fully depend on natural resources. Improving farmers' lives and improving the environmental go hand in hand.

Alternative solutions such as those within Integrated Nutrient Management (INM) strategies are probably the "best bets". Because they are severely constrained by the shortage of resources such as (green) manure to work with, INM and soil conservation strategies have to be combined with water conservation strategies. We found that farmers were already experimenting with these and were clearly interested in pursuing these.

However, as a concluding remark, we have to agree with Blaikie (1985) that environmental degradation might only be stopped as an associated result of other fundamental social changes. We have seen from our literature review that the change in society has been significant in Ethiopia during the last century, and this has had a significant impact on the environment. Agricultural policy needs to be geared towards the marginal areas in Ethiopia. As Georgis et al. (no date) have observed, hunger is usually a result of crop failures in marginal areas.

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Annex 1: Additional tables

Table 17 Information on rainfall in Tigray 1997-2002.

Year	Rains in Tigray
1997	Belg rains were late and subsequent rainfall erratic. But the weredas of Atsbi and Wombatu in the highlands of the eastern zone may have had their best rain for many years. The weredas of the Western, Central and Eastern zones were also noted to be producing much less than normal due to poor rain at flowering and grainfill with the sorghum crop being particularly poor. (FAO/WFP, 1997)
1998	Poor rains in April/May which limited the area of long cycle crops, particularly sorghum. Areas were switched to lower yielding short-cycle crops, which were planted in the normal Meher season. The Meher rains started a little late in most areas but were relatively continuous and heavy, especially at the higher altitudes. Rainfall was excessive in July/August on vertisols in the highlands and waterlogging damage occurred on barley and pulses particularly. The rains ended abruptly in early to mid-September and harvesting has proceeded in excellent conditions. Yields, although relatively high, are still only 0.75 tons/hectare overall. Teff has done exceptionally well as has wheat and hanfest (mixed barley and wheat). All crops are much more productive than in the poor 1997 season. Regional agriculturists have stated that this is the best harvest for 30 years. (FAO/WFP 1998)
1999	Meher rains were late by two to six weeks and in many areas stopped earlier than usual, leaving crops without sufficient moisture to ensure proper grain fill. However, intensive rainfall during July and August in some areas resulted in water-logging and, to a lesser extent, flooding, while other areas (often within the same wereda) suffered from drought. All weredas in East Tigray suffered from excess rain. Frost and hail were reported in pockets in all zones. In general, mid-altitude and highland areas suffered from excess rain, while lowland areas received insufficient rain. (FAO/WFP 2000)
2000	Rainfall, the main production determining factor began badly with the failure of the Belg rains for the sixth successive year and a late start to the Meher season throughout the Region. After the onset of the rains at the end of June/early July, the season varied from zone to zone. In the Eastern Zone, the rains were patchy and finished early. However, the appearance of "azmara" rains in November-December has prompted preparation of land for opportunistic early maturing barley and chick pea production typical of the zone (FAO/WFP 2001)
2001	Contrary to the usual trends, rainfall this year was proportionally better in the East and South zones than in the West. In absolute terms, the rainfall was higher in the West but the distribution of rains in the South and East was the best for many years. Good Belg rains, which supported some production in South Tigray and encouraged planting in East Tigray, were followed by timely Meher rains. The precipitation continued without significant breaks in most localities until the end of August/early September, with positive results. (FAO/WFP 2002)
2002	The onset of the 2002 Belg rains had been generally good and led to timely planting of short cycle crops in most high and mid altitude areas of the eastern parts of Amhara and

Tigray Regions. Rainfall during the latter part of the Belg season and the early part of the Meher season this year has been poor compared to last year. Rainfall amounts have been lower and the number of rainy days less frequent this year compared with last year. The 2002 Meher rains have been late by about one month in most midland and lowland areas of eastern parts of Amhara and Tigray Regions.
(Sewonet et al., 2002)

Table 18 A Comparison of 2001 and 2002 Belg and Early Meher Season Rainfall in Hawzen and Atsbi

Month	Hawzen				Atsbi Wemberta			
	2001		2002		2001		2002	
	MM/1	RD/2	MM	RD	MM	RD	MM	RD
January	0	0	0	0	0	0	4.7	3
February	0	0	22.3	2	0	0	18.8	2
March	32	4	18.5	2	0	0	11.9	3
April	72	7	27.7	2			40	5
May	4	1	0	0			0	0
June	84	14	54.3	6	56.6	4	63.2	7
July	123.9	20	58.9	7	377.6	20	33.7	6

(Source: Rural Development Offices of the respective weredas. Cited in Sewonet et al., 2002)
Notes: 1/ MM refers to total rainfall during the month (in millimetres)
2/ RD refers to the number of days in a given month during which some rainfall was recorded.)

Table 19 Rainfall according to the women in Teghane

Year	Index	Weight	Distribution
1997	100	15	Rain started on time (in May)
1998	47	7	Rain started on time, but intensity was not sufficient
1999	73	11	Rain started late and stopped late
2000	60	9	Rain started on time, but stopped early
2001	47	7	Rain started on time, but stopped early
2002	73	11	Rain started on time and stopped on time, but production failed due to water logging
Total		60	

Table 20 Rainfall according to the men in Teghane

Year	Index	Weight	Distribution
1997	100	9	Rain starts early but stops early
1998	100	9	Rain starts late but good distribution (good production)
1999	111	10	Rain starts early and stops early
2000	78	7	Rain starts on time and had very good distribution
2001	200	18	Rain starts on time and had good distribution
2002	78	7	Rain starts on time, but there was excess rainfall
Total		60	

Table 21 Rainfall according to DA and village leader in Teghane

Year	Distribution
1997	Rains started on time and the distribution was even. The production was very good
1998	Rains started on time but there was excess rainfall as well as hail storms that damaged crops, especially faba bean, barley and wheat.
1999	Rains started early but were erratic, with long dry spells and heavy rainfall showers.
2000	Rains started on time and the distribution was good. Production was very good.
2001	Rains started on time, but there was too much rainfall. Production was not very good due to waterlogging.
2002	Rains started on time, but were in excess.

Table 22 Rainfall according to the men in Gobo Deguat (N=8)

Year	Index	Weight	Distribution
1997	100	15	Early and good rain distribution
1998	67	10	
1999	67	10	
2000	73	11	
2001	73	11	Rainfall was on time and good distribution
2002	20	3	Rainfall is late (by end of May it had not rained yet)
Total		60	

Table 23 Rainfall according to the women in Gobo Deguat (N=8)

Year	Index	Weight for drought	Weight for rainfall	Distribution
1997	100	5	15	Rain started early
1998	73	9	11	Rain started early but stopped early
1999	60	11	9	Rain started early
2000	67	10	10	Rain was very late
2001	60	11	9	Rain started early
2002	40	14	6	The rains are very late, there was even no shower
Total		60	60	

Table 24 Coping mechanisms of different socio-economic strata in Gobo Deguat mentioned by men and women

Gobo Deguat	Women (N=10)	Men (N=10)
Poor households	o Food for work o Begging for food in richer tabias o Earning money through off farm labour in Mekelle and other cities o Get food aid from the government or migrate (to Sudan)	o Migratory labour to Mekelle o Involving in off farm labour activities
Average households	o Off farm employment (masonry) o Engage in Food-for Work, use cactus ("prickly pear", *Opuntia Ficus-indica*) as food and livestock feed, the fruit of the cactus is used for food and the cactus leaves fodder	o Cultivating their own land o Trade cereals, households sell cereals and buy cheaper cereals (e.g. linseed) in return

Rich households	o Sell eucalyptus trees and/or livestock o Access to credit from REST o Off farm employment (in towns) o Sell their livestock.	o Cultivating their own land o Trade cereals: households sell cereals and buy cheaper cereals (e.g. linseed) in return. o Sell their livestock

The strategies were also weighted to get an idea of the importance of each strategy. In Gobo Deguat, only women differentiated according to socio-economic stratification level (see table 16).

Table 25 Ranking of coping strategies by women in Gobo Deguat

Poor Household (74%)		Average Household (14%)		Rich Household (12%)	
Strategies	**Weights**	**Strategies**	**Weights**	**Strategies**	**Weights**
FOOD FOR WORK	5	FOOD FOR WORK	5	Selling Livestock	2
Off farm work	3	Selling Eucalyptus	3	No strategies	8
Migration	2	Selling Livestock	2		

NB Total weights add to 10

The weights of table 16 were weighted with socio-economic stratification groups and combined with the weights men assigned to the different strategies to obtain table 17.

Table 26 Ranking of coping strategies for men and women in Gobo Deguat

Women		Men	
Strategies	**Weights**	**Strategies**	**Weights**
FOOD FOR WORK	4.4	Migration	5
Off farm work	2.22	Free food aid	3
Migration	1.48	Food for work	2
Selling Eucalyptus	0.42		
Selling Livestock	0.52		
No strategies (only the rich)	0.96		

Table 27 Coping mechanisms of different socio-economic strata in Teghane mentioned by men and women

Teghane	Women (N=10)	Men (N=10)
Poor households	o Food for work o Food aid o Sharecrop out o Reduce consumption (skip dinner or lunch) o If there are rains, sharecrop in land to get some production	o Off farm activities[1] o Daily labour o Free food aid o Access to credit from REST
Average households	o Sell donkeys to Afar people (who transport salt) o Sell livestock o Off farm labour (masonry men)	o Sell livestock
Rich households	o Sell livestock	o Sell livestock o Sharecrop more land in from poor households

[1] Off farm activities include:
1 Trading salt from Afar
2 Renting out donkeys to Afar people (who trade salt for grains)
3 Masonry activities

Table 28 Ranking of coping strategies for men and women in Teghane

Women		Men	
Strategies	Weights	Strategies	Weights
Sale livestock	0.6	Free Food Aid	8
Free Food Aid	8.2	Donkey renting	1
Use of prickly pear	0.6	Masonry	1
Masonry	0.6		

NB The weights of women totalled 17 and were standardised to total 10

Table 29 The three most labour intensive activities according to the men in Teghane

Activity	Weights	In %
Ploughing	25	50%
Harvesting	20	40%
SWC	5	10%
Total	50	100%

Table 30 The three most labour intensive activities according to the women in Teghane

Activity	Weights	In %
SWC & “audi”	16	31%
Weeding	13	25%
FOOD FOR WORK and SWC	13	25%
Collecting hay	9	18%