Understanding Farmers

Explaining soil and water conservation in Konso, Wolaita and Wello, Ethiopia

Tesfaye Beshah

Tropical Resource Management Papers
Documents sur la Gestion des Ressources Tropicales
41

Tropical Resource Management Papers,
ISSN 0926-9495

Correspondence on this particular volume:

Wageningen University and Research Centre
Department of Environmental Sciences
Erosion and Soil & Water Conservation Group

Nieuwe Kanaal 11
6709 PA Wageningen
The Netherlands

Tel: +31 (0)317 484190
Fax: +31 (0)317 484759
Office@SEC.TCT.WAU.NL
http://www.dow.wau.nl/eswc/

Documents sur la Gestion des Ressources Tropicales, ISSN 0926-9495

Pour toute correspondance au sujet de la présente publication, s'adresser à:

Wageningen Université et Centre de Recherche,
Département des Sciences de l'Environnement
Groupe d'Erosion et des Conservations Eaux et des Sols

Nieuwe Kanaal 11
6709 PA Wageningen
The Netherlands

Tel: +31 (0)317 484190
Fax: +31 (0)317 484759
Office@SEC.TCT.WAU.NL
http://www.dow.wau.nl/eswc/

Tropical Resource Management Papers, No. 41 (2003); ISSN 0926-9495, ISBN 90-6754-691-7

Also published as thesis (2003), Wageningen University and Research Centre ISBN 90-5808-795-6

This PhD thesis was financed by AUA - Larenstein Project

Cover and interior design: studio DS (Luc Dinnissen)

Cover photo: Lake Maybar catchment, South Wello, Ethiopia

All photos and illustrations not acknowledged were made by the author

Understanding Farmers

Explaining Soil and Water Conservation in Konso, Wolaita and Wello, Ethiopia

Tesfaye Beshah

2003

To Asnakech, Wondimagegn, Gebriel and Tsega

Preface

This doctoral dissertation deals with soil and water conservation (SWC) practices that are vital to Ethiopia's agriculture and economy. Since the 1980s, many SWC projects have been implemented in the highlands of Ethiopia for which millions of dollars were spent. However, the legacy of these projects did not leave the country with the outcomes promised two decades ago, regarding sustainable land use, food security, and natural resource management. In view of these observations I decided to devote my doctoral work to finding out at least some of the reasons for this lamentable outcome.

Two interrelated observations prompted me to focus on this issue. First, the gap between farmers' practices and the claims of research organisations and second, the variation among farmers' land management practices in specific localities in different parts of the country. The information available on these issues was less satisfactory when I started looking to gain an understanding of *why farmers are doing what they are doing* on their farms. In spite of the inadequate knowledge on this issue, project after project is carried out without learning about the pros and cons of the previous ones. Thus, there is very little improvement in the performance of research and development interventions in the country in spite of the growing gaps.

Understanding farmers' soil and water conservation practices therefore became the main theme of my research. This study provides insights on how farmers have reacted to externally introduced SWC technologies within and across farming systems. Their responses were analysed in terms of their knowledge and attitudes on soil erosion and soil and water conservation. These analyses were carried out at the watershed, household, farm and plot levels, as deemed appropriate. The relationships between knowledge, attitudes, and practices were assessed. In this process, determinants of farmers' SWC practices were analysed within and across farming systems. Suggestions for improvements are provided based on these findings.

It is my hope that this study will challenge the R&D and extension professionals in the country, particularly with respect to natural resource management, to work towards *understanding farmers* as a basis for promoting a genuine development partnership with them.

My PhD journey has brought me in contact with many people both in my country and abroad. These contacts have helped me to cope with academic tasks and to achieve my goal in many ways.

Among these people, my utmost words of thanks go to Prof. Niels Röling to whom I remain very much indebted. His unique resourcefulness and guidance in science and kindness were sources of energy for my long and demanding research processes. I met Niels when I did my MSc degree in MAKS at Wageningen. He was my teacher and the first supervisor for my MSc thesis. Years later he gave me the opportunity to be his PhD student. His supervision and guidance during my PhD study was not limited to Wageningen. He also visited me in the field in 1999, which was very inspiring and useful in filling the gaps in my research. His contribution to my career is unprecedented and always remembered. Besides this, I have been invited to his house a number of times during my stay in Wageningen. I would also like to thank Niels and his wife, Dr. Janice Jiggins, for their hospitality throughout these years.

The topical area of my research, soil and water conservation requires supervision and support from a scientist in that area. Prof. Leo Stroosnijder kindly accepted my request to become my promoter. Leo supervised me with patience in my 'cross-border' study, as many of the technical concepts in SWC were new to me, coming from a social science background. I benefited a lot from his critical and stimulating comments at all stages of my study. Thank you Leo for your guidance and encouragement that helped me to browse the vast field of soil and water conservation so that I could marry my knowledge of social science with technical science.

Many solutions to the puzzles in my research came to light with the insights provided by the farmers of Konso, Wolaita and Wello. Listening to them as they spoke from their life experiences is addictive. With three years of intermittent field visits to each of these areas, I was privileged to enjoy hospitality from several farm families. Without their unreserved co-operation and support, my PhD journey would not have come to a successful end. I thank them all for showing me their world.

My communication with farmers was facilitated by my interpreters and assistants. In Konso, I thank Mr Orkaido Olte and Mr Kora Gera. Orkaido's contributions ranged from day-to-day activities to stimulating professional discussion on Konso's life and agriculture. The assistance of Mr Kora Gera, who is well informed about the Konso culture, at a later stage of the study was very useful. In Wolaita I had the assistance of Mr Birega Uka. I thank Birega for his genuine concern and contribution to my project. At Maybar, South Wello, I met a team of three persons working at the Maybar Soil Conservation Research Station. These are Ali Ahmed, Seid Belay and Seid Hussen. This team was a great asset to my integration into the community and in assisting me in a range of research activities, at times under great pressure. Thanks to them, I felt very much at home at Maybar, in spite of its pseudo-remoteness, as it is poorly connected with the nearby towns. My stay in the three research villages and meeting waves of farmers coming to the centre is an unforgettable experience. I would also like to thank Dr Eva Ludi, for her kind and collegial co-operation during our joint stay at Maybar station in 1999. In addition, I want to thank many high school graduates in Wolaita and Wello who assisted me in the survey work. I thank friends that I met in Konso, Wolaita and Wello over the years for their support and for providing a friendly environment while I was away from my family.

The bureau's of the Ministry of Agriculture in the SNNPR and the Amhara Regions, Zonal and *Wereda* Office of Agriculture, *Wereda* Administration and Peasant Associations have facilitated my access to the communities in the study area. Offices of agriculture at various levels also provided the secondary data. I thank the officials and experts in these offices for their time and interest in my research. Their professional participation is highly appreciated. My thanks also goes to Mr Amare Mengiste and Michael Assefa of the FARM-Africa for their support during my work at Konso.

Owing to the requirement of my research, I carried our case studies in areas that are substantially distant from each other. The major limitation in this connection was transportation problem. Thanks to their understanding and kindness, Dr Marco A. Quinones and Mr Takele Gebre of SG-2000, provided me with transportation for the entire research period. Without their support, the cost for rental cars would have made my research operation impossible. In addition, they gave me access to their office facilities, whenever I needed them. Everyone at SG-2000 was friendly and kind to me. I thank them all.

My other source of logistic support during the early stage of my research came from the Natural Resource Management and Regulatory Department of the Ministry of Agriculture. I thank the co-operation of Mr Tamiru Habte and Mr Diribu Jemal, who accommodated my requests from their limited resources in the department. The staff of the department was very helpful in providing information on SCRP sites and professional discussions on SWC in Ethiopia. I thank them all.

My study has benefited from the excellent academic environments of Wageningen University and Research Centre. It is indeed a 'knowledge centre' where I could meet a number of people during courses, seminars and workshops from whom I obtained valuable suggestions and stimulating questions that helped me to think further on my subject of study. Some of them were kind enough to take time to read one or more of my case study chapters with useful comments followed by discussion. In this regard, I would like to very much thank Dr A.W. Van den Ban who read all of my case study chapters and gave me invaluable comments. I also thank him for access to his library and lively discussions on my topic and a range of other issues on extension in developing countries. Dr Ruerd Ruben, Dr Niek Koning and Prof. Cees Leeuwis also helped with the earlier version of chapter 6. I thank them all for their enlightening comments and suggestions to deepen the chapter. I thank Dr Loes Maas for a vivid discussion on the survey design and several tips on statistical analysis. She was always ready to help me. I also thank Dr Ivo Van der Lans who provided me with suggestions during the early stage of my data organisation and analysis. I thank Dr Geert Sterk for translating my summary into Dutch. Whenever my computer was stuck because of the huge load of data, I could always get the help of the experts from Systems Management at the Leeuwenborch. I thank all of them for their instant help during my entire study period. I also thank the librarians of the WUR, specially those at the Leeuwenborch for their friendly and professional assistance.

My friends and colleagues in the Communication and Innovation Studies Group, former and current PhD students are my family circle to whom I returned to for all my needs and support. Among these I would specially like to mention my office-mate Mr Jasper Eshuis for his collegial and friendly treatment and Mrs Joke Janssen for all the support she gave me. I thank the staff members of the Soil Erosion and Soil and Water Conservation Group for their hospitality and encouragement during my study. The other source of social support has come from my Ethiopian friends with whom I play 'Little Ethiopia' in Wageningen. Moreover, many of my friends and family members in Ethiopia have supported and comforted my family in my absence. I thank you all...

Great thanks go to AUA-Larnestein Project that very generously financed my study. I would particularly like to thank Mr Kleis Oenema, Co-ordinator of the Ethiopia Project, for his continuous support, encouragement and concern for the progress of my study right from the beginning. He has been very understanding and flexible when it came to making my progress possible. My words of thanks are also due to the former CTA of the project, the late Dr M. de Boer and his successor, Dr R. Baars for their facilitation of my project. I thank the Alemaya University for granting me a study leave.

I thank Mrs Mundie Salm who edited the language. I particularly appreciate her timely feedback and readiness to help me. I thank Mr Luc Dinnissen for designing this volume with a professional engagement.

Being brought up in a village near the then Alemaya College of Agriculture, now University, one of my early wishes was to obtain a Doctoral degree. Thank God my dream has come true. For this I thank my parents who brought me to the school gate, while they remained illiterate. I thank them for such a gratifying and lasting gift.

My last but not least words of thanks go to my wife Asnakech Estifanos, our children, Wondimagegn, Gebriel and Tsega for all the inconvenience you have encountered during my long years of absence and long-distance support. I specially appreciate and thank Asnakech for her endurance in shouldering all family responsibilities by herself. Tsega in particular is too young to understand my extended field trips and travel abroad. I dedicate my dissertation to you all with honour and pleasure!

Tesfaye Beshah

17 February, 2003

Table of Contents

List of Illustrations

List of Boxes

List of Figures

Map

List of Plates

List of Tables

1 Introduction

1.1 Background of the research

The initial idea for this study was born during a long period of observation of my neighbourhood where ponds and lakes have dried up and continue to dry up partly because of siltation. The cases in point are Lakes Adele, Langay and Alemaya, located in eastern Ethiopia where I grew up. The last lake has lost a considerable part of its surface area and depth. In addition, I know of gullies that have claimed long and wide tracks of land in my neighbourhood, but that have not seen any remedial action.

Travel opportunities in 1995 and 1996 to the north and south have allowed me to compare the land features in many parts of the country. During these trips, I witnessed extensive land degradation in South Gondar, Wello and Tigray. My travels to southern Ethiopia helped me to appreciate the diversities of Ethiopia's agriculture. Information from workshops and literature have added to my concerns about the soil erosion issue in my country. One report that particularly rose my interest spoke of 1,900 million tonnes of soil eroding annually from Ethiopia (equivalent to 100 t ha^{-1} yr^{-1}).

In the past, I wondered why farmers were not adopting soil and water conservation practices that were recommended by researchers. After my observations of various farming systems in the country, I began to think that farmers should have alternative options of soil and water conservation to protect their soil from erosion and that I needed to understand what the issues are that influence their actions. Owing to my educational background in 'Management of Agricultural Knowledge Systems' (MAKS), I have been following the extension approaches and strategies in my country. Farmers' responses to the introduced soil and water conservation (SWC) practices became one of my preoccupations. When I was given an opportunity to pursue a PhD degree, I geared my attention to these issues. The outcome is the dissertation that lies before you.

My research interest then focused on gaining an understanding of what farmers know and what they do to protect their land from water erosion. This query was pursued for two widely different systems. The first system did not receive any significant external intervention, whereas the second system experienced intensive soil and water conservation (SWC) interventions. The purpose of studying the first system was to learn what farmers do to manage their land without external intervention, while the examination of the second system was to understand both farmers' land-management strategies and responses to the interventions.

In order to find contexts in which to carry out my study, I began a literature review and consultation with experts in the field. Finally, I selected Konso for the first case (an indigenous system) and Wolaita and Wello for the second case (intervention systems). Wolaita and Wello hosted the former Soil Conservation Research Project (1981-98).

1.2 Introduction to the country

Ethiopia is a country typified by a predominantly subsistence agrarian economy. The major contribution of agriculture to the economy is evident from its share of the GDP that has varied between 46% and 58% between 1980/81 and 1997/98, (Multat, 1999). In addition, it provides a livelihood for 85% of the population, generates over 90 percent of the export revenue mainly from coffee (60 percent), and produces raw materials for the industries and food needed by its fast-growing population, though hardly meeting these needs in the last three decades or so. The per capita income level of the country in 2000 was US$100 (World Bank, 2002), from only around $120 in the late 1980s.

Ethiopia has a total area of 1.223 million square kilometres (Ethiopia, 1992). Of the total area of the country, 60% is said to be suitable for cultivation. A substantial proportion of this land is rainfed, whereas irrigated agriculture covers only 4.6% (FDRE, 1997).

According to the 1994 population and housing census, Ethiopia's human population numbered 53.5 million (CSA, 1998). In 2000, the population projection was 64.3 million, with an average annual growth rate of 2.7 for the period of 1980-2000 (World Bank, 2002).

Ethiopia's livestock population is the highest in Africa and the tenth highest in the world (Togoe and Dejene, 1983; Jahnke and Getachew, 1983). The country's livestock population based on the 1985 survey was 30.6 million TLU (MoA, 1984; cited in FDRE, 1997).

Though land provides a means of livelihood for the majority of the population of the country, land resources are facing increasing degradation mainly due to water erosion in the form of sheet and rill erosion (Constable, 1985; Hurni, 1993).

1.3 Problematic situation

Being one of the oldest civilisations in the world, Ethiopia has an agricultural tradition that is over 2,500 years old. However, the land was brought into cultivation at different times in history. Generally, the northern part of the country has experienced extensive agriculture for a long time, whereas the southwestern highlands, which show relatively less soil degradation, were brought into agriculture in the last couple of centuries (Hurni, 1994). Generally, farming is said to have been intensified gradually since the fourth millennium B.C., leading to subtle soil erosion that had remained unnoticed for centuries (Galperin, 1981; cited in Mulugetta, 1988). Soil degradation due to extensive agriculture in the northern part of the country is postulated to have caused the collapse of the Axumite Kingdom in the seventh century A.D., which was one of the earlier civilisations in the country. Consequently, the centre of dominant civilisation gradually moved to areas with better soils. Lalibela between the 11th and 14th centuries, and Gonder and Menz, between the 16th and 17th centuries experienced the same shift. The Gonder and Menz civilisations are also believed to have declined due to soil degradation (Hurni, 1988).

The roles of the agricultural sector remain unsurpassed despite ill-conceived policy measures and development strategies that have crippled the sector over the centuries.

Prior to unification of the northern kingdoms, which took place in 1855-68, there was widespread instability between tribes, religious groups and regional kingdoms. During the monarchy (before 1974) internal instability and exploitation of the peasantry by landed classes were notable agrarian problems, among others. During the military government (1974-91), land tenure insecurity, war and the shadows of the centralised economy were the bottlenecks of the agrarian economy. The economic policies pursued at that time included: a production quotum based on fixed below-market prices, misguided co-operative movements, poor support services such as in extension, input supply and credit for smallholders, and forced villagisation, to mention a few. The 1990s came with the decentralisation of the state without adequate pillars to readdress the cumulative negative consequences of the past. During these historical epochs, there were human diseases, drought, livestock and crop diseases and pests that tested the country's development.

The extent of land degradation in Ethiopia was studied by different agencies at national, watershed and plot level using standard technical procedures (EHRS; SCRP; EFAP –Vol. II, 1994; World Bank, 1996; PDRE, 1997). Among these agencies, Ethiopia Highlands Reclamation Studies (EHRS), financed by the FAO and the Swiss-financed Soil Conservation Research Project (SCRP) are widely cited sources.

The EHRS estimated that half of the highland area (27 million ha) was significantly eroded, and another 14 million ha were seriously eroded and left with relatively shallow soils. The study designated over 2 million ha of land to suffer from irreversible erosion, which is said to be unlikely to sustain farming in the future (Constable, 1985).

In the mid-1980s, the EHRS estimated soil loss in the Ethiopian highlands at 1,900 million tonnes annually. Excluding about ten percent of the sediment that is carried away by perennial rivers and adjusting for deposition within the highland, the soil loss from cropped land is estimated at around 100 t ha^{-1} every year. About 80% of highlands erosion occurs on croplands. The resulting on-site effect of erosion was estimated at about 2 percent annual reduction in grain production. Agricultural cost of degradation from the mid-1980s to 2010 was estimated at a total of 15 billion birr, which is equivalent to a present value of birr 4.2 billion, at a 9 percent discount rate (Constable, 1985).

Hurni estimated rates of soil loss on slopes in Ethiopia at approximately 1493 million t yr^{-1} and on average 12 t $ha^{-1}yr^{-1}$ (Hurni, 1987; cited in Hurni, 1993). An estimated annual rate of soil loss on croplands is 42 t $ha^{-1}yr^{-1}$. At this rate, the total soil of the present cropland will be removed within 100-150 years. The resulting annual production loss due to soil erosion is between 1 and 2%. An additional 1% loss to annual production due to biological soil deterioration is estimated to take place (*ibid.*).

From the above discussion, the two widely cited sources on soil erosion in Ethiopia show a substantial difference with respect to annual erosion rates. However, their annual loss to crop production shows comparable trends.

In spite of the above-mentioned observations, a study by Bojö and Cassells (1995) argues that previous analyses of soil erosion in Ethiopia have not made allowances for the re-deposited eroded soil within and between areas of productive land. A response to this argument from researchers at the University of Berne, Centre of Development and Environment (1997) disagrees with their findings. They contend that the database used by Bojö and Cassells has limitations. Dessaglegn (1998) also dismisses the claims of both the EHRS and that of the SCRP on the grounds that the estimates provided by these sources are simplistic and misleading, and have had disastrous policy implications.

Apart from the result of scientific studies on specific areas, the prevalence of erosion in the country is directly visible in major watersheds and basins. In the north, the hills and mountains have suffered from loss of vegetation cover and fertile topsoil, leaving bare stones behind. This is visible from the thick mass of soil taken away by major rivers such as Abay (the Blue Nile). The soil carried away by the river is partly the result of people's style of resource management in the upper catchments. The damage is clearly observable during the rainy season as the Abay river crosses over Lake Tana. The lake is coloured (brownish) with soils brought down by Abay and its tributaries, showing the action of human agency along the catchment like a mirror. In the south, the Rift Valley lakes with closed basins are threatened by siltation due to the cultivation of hills and mountains in the catchments. One good example is Lake Abaya with a total area of 1,070 square kilometres that is virtually coloured by reddish soil from the drainage area of 14,487 square kilometres (FDRE, 1997). Lake Chamo that is separated from Lake Abaya by a small piece of land commonly called a 'natural bridge' does not show a similar level of colour change [1]. Gullies and the total removal of the soil body are widely observed phenomena on roadsides and riverbanks in many parts of the country. The other clear evidence of soil erosion, if not the rate, is the siltation of Koka Dam, an important source of hydroelectric power in the country. The dam was built in 1960 and now faces difficulties to operate regularly due to siltation (Ministry of Water Resources, 1999). Power interruptions during lower rainfall periods force the electric power authority to ration electric supplies by zones.

Cereal production in Ethiopia averaged 5.7 million tonnes over the period 1980 to 1997. This production was obtained from 4.8 million ha of land (with a yield of 1.19 tonnes per hectare). Over the same period, cereal production increased by only 0.9% with a 0.3% increase in yield per annum after 1994, due to an improved policy environment, increased availability of inputs such as fertiliser and relatively good weather. However, the achievement of the mid-1990s was not maintained due to bad weather in the subsequent years (Mulat, 1999).

While the country has a very large livestock population, for which it is said to rank first in Africa and tenth in the World, performance of the sector remains poor. For instance, beef and milk yields are 120 and 350 kg per animal per year, respectively (Jabbar, *et al.*, 2000). Performance of the sector is limited by a lack of feed and by animal diseases.

Forested land is said to be declining in Ethiopia at a rate of 6% per annum, i.e., between 150,000 to 200,000 ha per annum. At this rate the country's forest resource will vanish within 15 to 20 years (EFAP, Vol. II; 1994). An extensive crop production system is increasingly threatening hillsides, mountains and grazing areas, aggravating the decline of vegetation cover under different land-use systems. For instance, a study by Tolcha (1991) in the eastern part of Ethiopia shows that 81.3 percent of visible erosion was due to human factors, whereas the remainder was attributed to natural causes. Deforestation is evident from a shift of primary forest to secondary vegetation that is seen in the remaining hillsides and mountains, with the exception of limited protected forests. Cultivated areas in the steep slopes are quickly exposed to water erosion. This is even more serious in the areas where relevant soil and water conservation practices are missing.

According to recent studies, centuries of dependence on agriculture and forestry for food

1 These differences are interesting to investigate in case there are any other reasons.

and energy supplies has exposed the country to severe soil erosion. The country's forested land base has fallen from the reported 40 percent to less than 3.5 percent within about a century (Aklog Laike, 1990; cited in FDRE, 1997). The estimate of 40% is far from being true according to Ritler (1997) who based his argument mainly on traveller's accounts from 1699-1865.

Agricultural and rural development in Ethiopia, although claiming that it includes people's participation, remain delivery-oriented in terms of its extension service rather than encouraging farmers' innovations. Extension systems formulate and promote 'on-the-shelf' package technologies that result from past research. The operation of the national extension approach is modelled after the Sasakawa-Global 2000 extension approach. The overall organisational framework of the system is designed on the basis of a locally developed extension approach called the Participatory Demonstration and Training Extension System (PADETES) (Tesfaye, 1999). Even though much is still desired on the technical side, methodological shortcomings can explain the limited success of one of the largest conservation programmes in Africa over the last two decades (Bekele-Tesemma, 1997).

With respect to the country's research system, the research agenda has been identified by researchers and approved through peer reviews. The farmers' roles have been and still are very passive in technology generation. A new direction of change in this regard is found in a series of research strategies prepared by the newly reorganised Ethiopian Agricultural Research Organisation (EARO) over the last five years. In addition to disciplinary areas of agriculture, EARO's research strategies include Farmer-Research-Extension Linkages. However, how farmers participate in technology generation is still under consideration.

In the 1980s, a massive soil conservation programme was launched in Ethiopia using the food-for-work incentive. During that period, 15% of the Ethiopian highlands that required conservation efforts was covered (Hurni, 1988). In terms of physical works:

- about 600 km of earth and stone bunds were constructed on cultivated lands;
- about 300,000 km of hillside bunds were built for the afforestation of steep slopes;
- about 100,000 ha of hilly land were closed for regeneration of natural vegetation; and
- thousands of tree seedlings were raised in nurseries and transplanted on the afforestation sites (*ibid.*).

1.4 Statement of the problem

Different explanations have been given to the low performance of agriculture in Ethiopia. Commonly mentioned problems are drought, war, pests, insecurity of land tenure, population pressure, soil erosion, overgrazing, deforestation, lack of efficient rural organisations, stagnant technology, distorted economic policies, weak institutional supports, etc.

These explanations often lead to solutions coming from outside the very community that is facing the multitude of problems. The community's indigenous knowledge on resource management, local institutions and coping mechanisms were not given any attention. Instead, the methodological approach used is the transfer of technology that suits research and extension agencies. The introduction of a soil and water conservation programme is no exception to this.

In the early 1980s, the Soil Conservation Research Project (SCRP) initiated soil erosion controlled experiments in representative agro-ecological locations in the country. The overall objective of the SCRP was to support soil and water conservation activities in the country. Its specific objectives were:

- to monitor soil erosion damage, soil loss and runoff, catchment sediment loss and runoff,

land use and production, and human and livestock parameters in seven research units representing different agro-ecological zones[2];
- to develop viable models of soil loss, runoff, catchment runoff, and sediment and productivity losses for the research areas, and to test their applicability for larger areas;
- to develop ecologically sound, economically viable, and socially acceptable conservation measures and approaches in different research regions; and
- to train project personnel and to have research fellows to improve the country's research and implementation capability in soil conservation.

The research activities of the project were more or less similar in most of the research units. The SCRP catchments and surrounding areas were conserved through mass mobilisation with food-for-work and other incentives. The SCRP project was decentralised in 1996 and finally phased out in 1998. The research sites are now managed by regional research systems.

This study revisits the way the project introduced its conservation practices, assesses changes in farmers' land-management practices both within the SCRP catchments and surrounding areas, notes the time taken for any observable changes in land-management practices, and draws lessons at the national level for initiating technical interventions. Insights into these issues are of paramount importance for the country's research and extension systems in promoting sustainable land-management practices.

The other focus of this study is on indigenous soil and water conservation methods. Farmers in Ethiopia have developed a variety of soil and water conservation practices over time. Unfortunately, adequate studies have not been made on indigenous soil and water conservation methods in order to design sustainable land-management practices, particularly with respect to the role of social institutions in land management. This study deals with previously overlooked issues in indigenous soil and water conservation in Ethiopia. The focuses of this study are therefore to understand the foundation of indigenous soil and water conservation and to assess the current situation and bottlenecks. This aspect of the study provides insights into the shortcomings of the technical interventions that have characterised formal soil and water conservation initiatives in Ethiopia over the last three decades.

This research deals with a range of factors that are likely to influence farmers' decisions on soil and water conservation. These include: social, economic, institutional, biophysical and technological issues. The study employs different levels of analysis, as deemed necessary; these are the plot, farm, household and watershed levels.

In the end, active soil and water conservation is the outcome of farmers' decisions and actions. Change in the current rather disastrous trends in soil erosion in Ethiopia can only come about from changes in land use by farmers. This land use is not easy to affect by regulations, subsidies and other impositions. Land use can only be changed on a voluntary basis. Farmers must understand and profit from the changes. Therefore, it is of paramount importance to understand farmers' soil and water conservation practices.

1.5 Objectives of the study

The overall objective of this study is to examine the land management behaviour of Ethiopian farmers with specific reference to soil and water conservation, by analysing individual and collective reasons for using indigenous technical knowledge and/or technologies from formal research institutions.

2 Six out of seven research units are located in the present Ethiopia while one of the units is located in Eritrea.

The specific objectives are:
1. to assess farmers' response to SWC introduced by the SCRP;
2. to understand farmers' knowledge and attitudes with respect to soil erosion and SWC;
3. to identify farmers' SWC practices;
4. to identify determinants of SWC among small farmers within and across agro-ecological and socio-economic environments; and
5. to identify alternative approaches and strategies to promote improved soil and water conservation practices.

1.6 Research questions

An understanding of farmers' land management practices in general and that of soil and water conservation in particular requires a holistic approach, rather than a reductionistic discipline-oriented research study. This approach is combined with survey research to develop an understanding of farmers' land-management practices at the household and watershed levels. Each farm household has its objectives and opportunities. Attempts to achieve the objectives involve a balance between opportunities and constraints. Thus, farmers' perception of resources, natural and social environments, and their specific land-management knowledge and skills need to be examined to understand their management decisions. The present landscape is the result of the past pattern of resource utilisation that was found to be socially desirable and appropriate according to the prevailing level of know-how. Repairing the damage done certainly requires an understanding of the root causes of the problem, their dynamics and determinants.

With this in mind, this study tries to reveal farmers' soil and water conservation practices in a broader land-management perspective. The analysis is made in a historical context to help understand the current land-management practices and their problems. It deals with both indigenous and introduced soil and water conservation technologies. This approach was adopted first because of variations of farmers' practices in both indigenous and introduced practices. And secondly, such an approach gives the opportunity to examine the dynamics of farming systems.

The specific research questions dealt with are:
1. What are farmers' responses to the SWC initiatives introduced by the SCRP?
2. What are the farmers' knowledge and attitudes on soil erosion and SWC?
3. What do farmers do to conserve soil and water on their farms?
4. What are the determinants of SWC among small farmers within and across socio-economic and agro-ecological environments?
5. How can constraints to promote SWC practices be overcome?

1.7 Relevance of the study

Formal and organised intervention in soil and water conservation in Ethiopia dates back to the 1970s. This was mainly triggered by the famine relief operation from 1973 onwards, which was further intensified by another famine in 1984. The focus of intervention over the last three decades was mainly technical without due consideration of social, economic and institutional factors. This study, which focused on an understanding of farmers' views, is of paramount importance to the country's natural resource management.

With respect to research and extension, among others, this study comes up with a suggestion for a strong farmers' participatory framework that will guarantee a technology generation and utilisation process that takes into account farmers' knowledge, attitudes and practices that ultimately determine the kind of land-use techniques that will be adopted. Thus, understanding farmers' current land-management practices is a good entry point.

1.8 Organisation of the thesis

This thesis argues that farmers' land management, as a concrete behaviour, is a result of the interplay of several socio-economic, institutional and technical variables, which are also affected by emergent behaviour from these interactions. Thus, a better understanding of land management can only be achieved if one tries to understand the interrelationships among these variables. Furthermore, this study argues that entry points and actions for improvement become clearer with such a holistic approach.

Chapter two provides the physical setting for this study. It includes a discussion of the relationship between the physical environment of Ethiopia such as its land features and rainfall that are closely related to forces of erosion, farming systems, social and institutional factors such as population, rural institutions, land tenure, research and extension organisations and environmental policies.

Chapter three deals with the theoretical and analytical framework of this study. The determinants of land management are complex and manifest themselves at various levels and among various actors, often with different responses. Owing to this, the study draws on various theoretical perspectives and concepts to explain field observations reported in Chapters 5 to 7. The theoretical perspectives are land degradation and intensification, planned change and development intervention, farming systems, indigenous knowledge, social learning, and an attitude-behaviour model. Following that, the chapter presents empirical studies and an analytical framework.

Chapter four presents the general methodology employed in the study, while each case study also has its own detailed methodology section. Issues dealt in this chapter include; the selection of study units, methods of data collection and analysis.

Chapter five presents a case study of indigenous soil and water conservation practices from Konso, in southwestern Ethiopia. A discussion about indigenous SWC methods is by no means unique to Konso and has taken place in other case study areas as well. The Konso case is however here given special emphasis due to its widespread use of indigenous SWC methods that have existed for over four centuries. This thesis uncovers the historical background of the system, its knowledge basis, institutions that facilitate a process of innovation and mechanisms of social learning. Furthermore, critical arguments as to whether it is possible to adapt Konso's case to other areas, as well as a description of its current situation and future prospect are discussed.

Chapter six and *seven* are intervention cases that deal with the Soil Conservation Research Project (SCRP) at Wolaita and Wello, in southern and northern Ethiopia, respectively. Here the focus is on how farmers have responded to the interventions introduced by the SCRP. The chapters provide a biophysical and socio-economic background of the area, followed by an in-depth analysis of farmers' knowledge about, perceptions on and practices for SWC. The chapters end by discussing farmers' responses to the SCRP intervention.

Chapter eight presents a synthesis of the case studies. It addresses the major lessons learned and identifies the determinants of SWC at the micro and macro levels. Finally, the chapter closes the thesis by presenting issues for further research.

2 Context of the Study

2.1 Introduction

The purpose of this chapter is to provide a contextual setting for the present study. Section 2.2 deals with the physical environments of Ethiopia where its topography, climate, soils, vegetation and agro-ecological zones are briefly discussed. Sections 2.3 and 2.4 respectively deal with population pressure and rural organisations. Following that, the chapter dwells on farming systems and technology in section 2.5. Thereafter, section 2.6 presents a historical profile of land tenure in the country. Sections 2.7 and 2.8 present an overview of agricultural research and extension in Ethiopia. The final section (2.9) discusses environmental policies in Ethiopia.

2.2 Physical environment of Ethiopia

2.2.1 Topography

Ethiopia covers a geographic area of about 1,223 million square kilometres (Ethiopia, 1992). The country is characterised by diverse topographic features. It is noted for its high mountains, a few of which exceed 4,000 masl. For instance, Ras Dashen is 4,620 masl. The largest share of the country's land falls under what is often called the 'lowlands' (55%), whereas the remaining area falls under the 'highlands'. The demarcation line between the lowlands and highlands is 1,500 masl (FDRE, 1997a). The highlands are divided into two parts by the Rift Valley, which runs from the northeast towards the southwest. More than 80% of Ethiopia's human population and about 60% of its livestock population depend on the highlands, which are suitable for agriculture and human settlement.

Four topographic regions are recognised in Ethiopia (WCMC, 1991). These are *Wurch* (2,900 to 3,500), *Dega* (2,500 to 2,900 masl), *Weyandega* (1,800 to 2,400 masl) and *Kola* (below 1,800 masl).

The terrain is characterised by an undulating landscape, which is extremely vulnerable to water erosion, particularly when ecological disturbance occurs due to removal of vegetation. According to Constable (1985), 23% of the highlands falls within the slope category of less than 8%, while 18% of the highlands is estimated to have slopes of between 8 and 16%. About 60% of the highlands have slopes that exceed 16%, while 34% of the area exhibits slopes that exceed 30%. The distribution of slopes in the three highland agro-ecological zones is given in table 2.1 below.

Table 2.1: Slope and area coverage in highland agro-ecological zones

Zone	Slope (%)	('000) km^2	Percent of total
High Potential Perennial	0-8	15	10.4
	8-16	31	21.5
	16-30	39	27.1
	>30	59	41.9
Total		144	100
High Potential Cereal	0-8	44	33.5
	8-16	22	16.8
	16-30	26	19.8
	>30	39	29.8
Total		131	100
Low Potential Cereal	0-8	38	25.3
	8-16	25	16.7
	16-30	42	28.0
	>30	45	30.0
Total		150	100

Source: Constable, M. (1985). Ethiopian Highlands Reclamation Study (summary). Working paper 24. Land Use Planning and Regulatory Department, Ministry of Agriculture and FAO, Addis Ababa.

2.2.2 Climate

Climate is a crucial physical factor that determines land-management practices for agriculture. Farming systems that prevail in Ethiopia are partly the result of climatic situations that affect the soil fertility, vegetation and length of the growing period. The climate in Ethiopia is highly determined by the topographic conditions of the country (Westphal, 1975; McCann, 1995). This is reflected in its temperature and rainfall quantity and distribution. The average annual temperature varies between 20 and 29 degrees centigrade. Rainfall ranges from 200 mm per year up to 2,700 mm for the southwestern part of the country (FDRE, 1997a). The average rainfall decreases from the southwestern margins of the Ethiopian highlands eastwards to the Horn of Africa (Westphal, 1974).

Following rainfall and temperature patterns, four traditional seasons are known in the country. These are: *Kiremt, Bega, Belg* and *Tsedey*. *Kiremt* is the wet season (June-August/September), while *Bega* is the dry season (October-February). March to May (*Belg*) is the short rainy season in the north and the central highlands, while it is the main season for some areas in the south. The distribution of rain between *Kiremt* and *Belg* creates a bi-modal rainfall pattern in the country. Unlike the temperature, its rainfall shows high variability. Rainfall variability in both quantitative and temporal distribution is one of the primary agricultural problems reported in all corners of the country.

2.2.3 Soils

Ethiopia's soils are formed from three types of parent rock (Last, 1962; cited in Westphal, 1974):

- the granites of the crystalline basement which tend to form shallow, sandy soils;
- the volcanic rocks, such as basalts, which tend to produce fertile loams, generally red in colour, but sometimes black; and
- the limestones and sandstones which form shallow, poor, sandy soils.

According to the assessment so far, there are 18 soil type associates in Ethiopian. The major ones are: Lithosols, Nitosols, Cambisols, Regosols, Vertisols, Fluvisols, Xerosols, and Acrisols. Among these Nitosols, Cambisols and Vertisols account for 23%, 19% and 18% of arable lands respectively. It is noted that the exact characteristics and distribution of the Ethiopian soils are still not fully documented and mapped (EARO, 2000a).

2.2.4 Vegetation

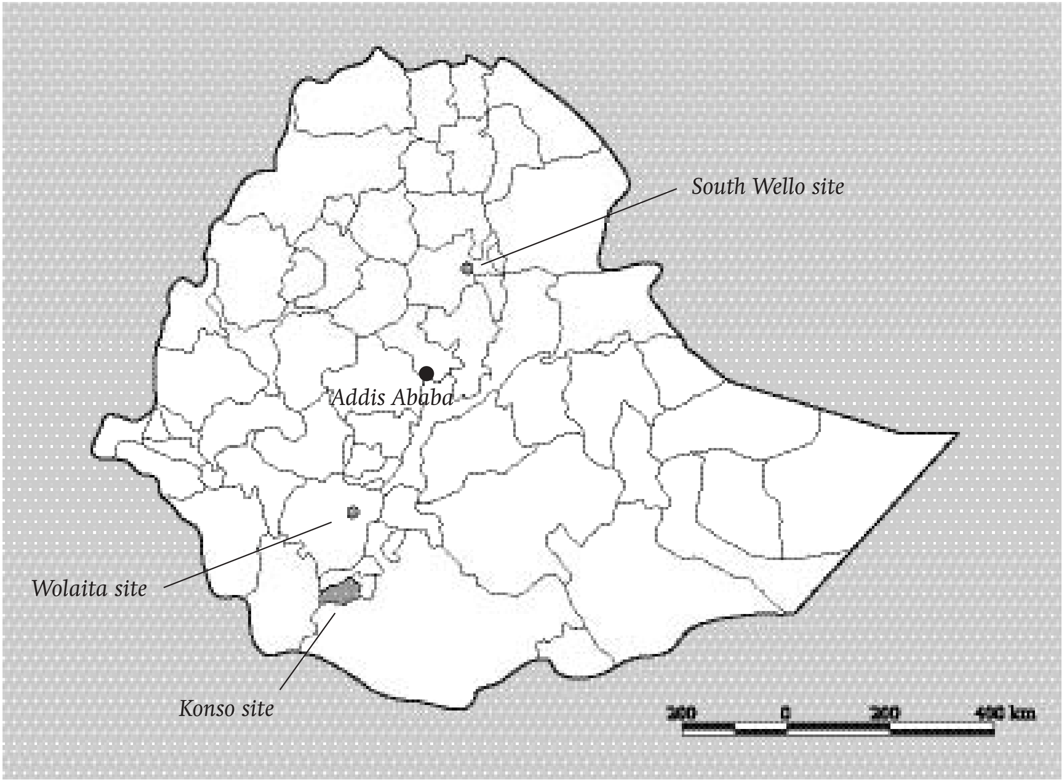
Vegetation is one of the biological features resulting from the integrated forces of topography and climate. Speaking from a biophysical point of view, the *Kola* zone is characterised by steppe, savanna and woodlands, while dense forests occupy the Weynadega zone. Savanna and steppe formation occurs in the lower part of *Dega* too. The *Wurch* zone is covered by montane forests and alpines (WCMC, 1991). Apart from the *Wurch* zone, which has massive, high mountains and a few extremely inaccessible areas, the rest of the country has changed to a cultural landscape. This is because of human interference in the form of parks, livestock grazing, bush fires, and farming (commercial or smallholder) that has greatly changed the natural vegetation.

2.2.5 Agro-ecological zones

The interaction between biophysical and socio-economic factors has resulted in a classification of five different agro-ecological zones in Ethiopia (Constable, 1985). These are: the High Potential Perennial (HPP), the High Potential Cereal (HPC), the Low Potential Cereal (LPC), Agro-pastoral (AP) and the Pastoral (P) zones. Zones with perennial and cereal crops fall in the highlands, whereas, the two forms of pastoral systems fall in the lowlands. It should be noted that this classification is based on an assessment in the early 1980s.

This study covers three of the above agro-ecological zones; Wello, in the LPC zone of the northern highlands; Wolaita, the HPP of the southern highlands; and Konso in the AP area (see Map 1). This last area is better described as seed-hoe-terrace, after Westphal (1975).

Map1: Location of the study areas in Ethiopia



2.3 Population pressure

A record of the Ethiopian population first appeared in the early 1960s. Before the first national population and housing census in May 1984, population estimates were based on sample surveys. The second national population and housing survey was carried out in 1994. The existing data show rapid population growth during the last three decades.

In 1960, Ethiopia's population was estimated at 23.5 million, with a 2.0% annual rate of growth. In 1984, the census data revealed that Ethiopia's population numbered 42.2 million, with an annual growth rate of 2.9%. Since then the growing rate of Ethiopia's population increase has attracted the attention of policy-makers and the international community. In 1994, the population reached 53.5 million at an annual growth rate in excess of 3.0% (CSA, 1998). The country's population is expected to double after 25 years, based on the 1992 rate of increase (about 3%). On the same basis, the population of the country is projected to reach 94 million and 140 million in the years 2010 and 2025, respectively (Jones, 1990).

During the time of the monarchy (before 1974), population pressure was not explicitly associated with resource degradation. However, there were considerable initiatives in environmental conservation and protection. These were achieved through the establishment of different authorities for forestry and wildlife. This has by and large served to increase government revenue at the cost of rural people who are denied access to the resources in the national parks and state forest. The issues of soil erosion and food security are not included in the primary agenda for development. During the reign of Haile Sellassie, tax incentives were given to bring more land under cultivation (Pankhurst, 1966).

An appreciation of a large human and livestock population is deeply-rooted in the value system of Ethiopians. The previous acceptance of a large human population can be ascribed to continuous regional tribal conflicts, which more often than not led to bloody conflicts. In addition, high human mortality has also contributed to the attitude favouring large numbers of children who are often seen as both assets and insurance during old age and times of calamity. Besides being one of the essential resource bases for survival, livestock is also seen as a sign of social status. Animals are used in cultural and religious ceremonies, and as a means of exchange and settlement of social and state commitments. These value systems have been reinforced because of risks of animal disease, in addition to man-made and natural disasters.

The image of population among state and scholars began to change in the 1970s and 1980s. Population growth came to be seen as one of the major causes of land degradation in Ethiopia. This theory subscribes to the Malthusian school of thought and claims that population growth causes an increased demand for fuelwood, crop- and grazing lands, which cause clearing of trees for cultivation (see 3.2.2 for details). This problem is said to be reinforced by aggravated erosion, which is created by the removal of the vegetative cover and crop residues, and the diversion of dung that apparently reduces land productivity. This view is widespread in the government reports (EFPA, 1994; FDRE, 1997a). For instance, EFAP (1994) states that '... population density in the HPC zone will increase from a 1985 level of 62 to 166 persons/km^2 in 2015. The livestock population is also growing at 1.1 percent per annum, resulting in serious overgrazing...'

Paradoxically, this conviction did not lead to a family planning campaign to tackle the perceived root cause of resource degradation; i.e., population pressure. Instead, a massive physical soil and water conservation and tree-planting programme was carried out in the 1980s, which is the technical option. However, a state-led resettlement programme that involved 200,000 families, with an average of three people per family of settlers took place after the mid-1980s (Pankhurst, 1990). In 1994, the government issued a population policy, which targets a decrease in human fertility rates. According to the policy, it is envisaged to reduce fertility from 7.5 to 4%. It is worth noting that the existing population is enough to intensify the resource pressure for a few decades to come.

2.4 Rural organisations

Discourse on the impacts of rural organisations dominates the post-monarchical era of Ethiopia. These works revolve around organisations created by the *Derg* in its pursuit of socialist transformation, i.e., the Peasant Association (PA), Service Co-operatives (SC) and Producers' Co-operatives (PC). There are several studies, which have focused on the evolution of these institutions in the country and their impacts on the agrarian economy (Dessalegn; 1984, 1990; Mengistu, 1986; Aster, 1982). Thus, it suffices to mention only the most relevant issues to the present study.

Peasant Associations (PAs) were established soon after land reforms in March 1975. One PA was organised on a territory of approximately 800 ha. PAs were charged with administrative matters under their jurisdiction, including that of land distribution. Staff of the Ministry of Agriculture provided technical backstopping to PAs. Generally, PAs were given the authority to reinforce law and order at the grassroots level.

During the *Derg* period, even though members elected PA leaders, the latter maintained their loyalty to the government bodies rather than to the farmers. As a result, they continued to implement unpopular government programmes such as villagisation, military services, forced resettlement, tax levies and contributions from the peasants. Thus, they turned into a puppet organisation instead of a means to empower farmers and ensure self-governance. This gap still persists, leaving much to be desired for popular participation.

With the intention of increasing access to household merchandise and farm inputs to the rural people, the government also established Service Co-operatives (SC), which encompass a minimum of four adjacent PAs. Service co-operatives have benefited the rural people through the provision of small commodities at relatively accessible locations. However, they later began to serve the desires of the government too. For instance they implemented an unpopular, quota-based grain purchasing system that was operated by a government organisation called the Agricultural Marketing Co-operation (AMC). Apart from that, they embezzled millions of poor peasants' capital in the process. The AMC has long been dissolved as a result of market liberalisation measures.

As the *Derg* Regime consolidated its power, it entered into the mainstream socialist economy. In 1979, it began what it called the *Arenguade Yemirt Zemech*, which means, 'campaign for the Green Revolution'. According to the appraisal of the *Derg* policy-makers, their dream of social transformation could not be realised using the peasant economy, which uses 'inefficient technologies.' As a result, the state was committed to initiate Producers' Co-operatives (PC) and to support them with modern technology, credit and extension. Thereafter, PCs began to emerge here and there in the country after a series of agitation measures by the experts of the MoA and a special cadre who were trained in politics and technical fields, namely the Political and Production Cadre. PCs were established under the jurisdiction of the PAs. A minimum of five farmers could form a PC. Members joined all their means of production, including land and oxen. Distribution was based on work points according to the socialist principle, 'from each according to his ability, to each according to his work'. For this purpose, activities were classified and work points assigned, which later served as a basis for distribution of benefits.

Inputs such as fertiliser, improved seeds and machinery were channelled into the co-operatives. Paradoxically, good land in particular irrigable land was automatically allocated to the co-operative organisation. This created deep resentment among the peasants who did not see the benefit of co-operatives and were not willing to join them. This development began to cast doubt and uncertainty that replaced the jubilation and joy of the early days of the land reforms.

PCs were disbanded soon after the May 1990 reforms. The Service Co-operatives met the same fate almost within a year after the downfall of the military regime in May 1991.

The PAs were reorganised immediately after the new government maintained law and order. Reorganisation of the PAs in the rural areas was part and parcel of the peace and stability maintenance plan of the new government.

A similar effort was made to reorganise Service Co-operatives, but the impact was not uniform like that of the PAs. New legislation to reintroduce Producers' Co-operatives was promulgated in January 1994. Recently, a separate body that organises co-operatives has been established. However, progress in this regard is negligible and continues to be so until farmers see the benefit of joining hands for their own development. It should be noted that the rural people are not against co-operation per se, which they have known throughout their lives. The resistance emanates from the manner in which these rural organisations were politicised and how they served the state at the expense of the rural people.

From the foregoing discussion, it is clear that there is a lack of genuine popular participation in the development processes. Rural people were plagued by a multitude of institutional problems that retarded, the installment of more adaptive resource management.

2.5 Farming systems and technology

The development of agriculture in Ethiopia has followed different patterns. In some regions, mixed crop and livestock production is followed while in others pastoralism dominates.

The northern highlands of Ethiopia had developed into a mixed crop-livestock production system well before the Axumite Kingdom (100BC-1000AD). Cattle production preceded crop cultivation (de Contesion, 1981, cited in Tewelde Brehan, 1989). Development of the ox-plow is central to the mixed crop and livestock production systems in Ethiopia. According to archaeological evidence (McCann, 1995), the likely time for the introduction of ox-plough based agriculture in northern Ethiopia is the first millennium B.C.

For centuries, Ethiopian farmers have conserved (*in situ*) several crop varieties that they identified and domesticated. Owing to their efforts, the country is now one of the 12 Vavilov centres of crop genetic diversity in the world (Dole, 1985; cited in Towelde Brehan, 1989). This successful history includes a few crops that are used as food crops only in Ethiopia; i.e., teff (*Ergrostis tef*), enset (*Ensete ventricosum*) and the root crop, anchote (*Coccinia abyssinica*).

The present landscape of Ethiopia is the result of farming systems developed in different parts of the country. A farming system and how people manage their natural resources are determined by: their principal means of livelihood; biophysical conditions; the degree of integration between crop and livestock production systems; the level of technology in crop production; types of crops grown; species of animals raised; customs and culture of people; settlement pattern; values and belief systems (religious/spiritual); social status and stratification; political system, etc. These factors may have positive or negative impacts on the natural resources that need close examination based on historical events. The major features of the farming systems in Ethiopia are discussed below.

2.5.1 Farming systems of Ethiopia

According to Westphal (1975), the agricultural system of Ethiopia can be broadly classified into four types: the seed-farming complex, the enset-planting complex, shifting cultivation, and the pastoral complex. Agro-ecological distributions, main crops, tools and farming techniques in each of these systems are briefly discussed below.

The seed-farming complex

The seed-farming complex covers the eastern, central and northern highlands, as well as Konso and adjacent *Weredas*. After the work of the Ethiopian Highlands Reclamation Study (EHRS), the seed-farming complex was classified into two zones: the low-potential cereal zone (LPC) and the high-potential cereal zone (HPC). Most crops are grown from seed. Cereals, pulses, oil crops and, to a much lesser extent, tubers are important crops. The northern and central highlands are ox-plough dominated, whereas the eastern highlands and Konso use a combination of plough and hoe cultivation. The use of oxen is limited to the gently sloping area of Konso.

One remarkable issue in this farming system is a lack of attention to tuber crops, vegetables, trees and shrubs, including fruit trees on the farm, mainly in the central and northern highlands (e.g., Wello, Gojjam, Gondar, Shoa and Tigray). As compared to the time of Westphal (1975), vegetable production is expanding into regions that have access to markets for both inputs and outputs. In the Eastern and Konso-sorghum complex, trees are well integrated with cereal production. In addition, root crops came to be widespread in Konso, whereas vegetables are a typical feature of eastern Harargie. Owing to this, the farming system in this sub-complex evolved to controlled livestock production. Thus, livestock either grazes on a controlled basis or is stall-feed. This stage of crop-livestock integration is very favourable for soil and water conservation measures. Unlike other parts of the farming system, biological or physical conservation structures in these systems are not ruined by roaming animals during aftermath grazing. The north and central highlands lack fencing in the outer fields. After harvesting, all farmlands turn into common property as far as grazing and collection of dung is concerned.

Enset-planting complex

The Enset-planting (*Ensete ventricosum*) complex is located in the southwest of the country, between 1,600-3,000 masl (Westphal, 1975). Nowadays, coverage of enset is increasing its geographical range. This farming system includes perennial crops such as coffee and chat (*Catha edulis*) in addition to root crops. Enset is cultivated as a staple food or as a supplement to cereals and tuber crops. In some regions, it occurs in dense forest where tuber crops dominate, with of secondary importance, cereal production practised as shifting cultivation. According to Constable (1985), the HPP zone and the HPP zone-forest areas are located in this complex. Hoes and similar hand tools are common in this farming system. However, the ox-plough is also widespread in this zone, used in cereal and pulse plots. Exclusion of livestock from the crop field is stricter in this system.

Shifting cultivation

Westphal (1975) classified a few areas of the country under shifting cultivation. These areas are now located in the Benshangul-Gumuz Regional State in the west and in the Southern Region. Nowadays, shifting cultivation is practised in the Gambella Region and a few pockets in the southwestern enset-planting complex. Apart from this, there is hardly any room for shifting cultivation in the country. Crops grown vary slightly from region to region, depending on food habits and the climate. In general, cereals, pulses, tubers, oil crops and spices are grown in this system. The major tools are stick and hoe. According to Constable (1985), shifting cultivators practise an agro-pastoral production system.

The pastoral complex

Livestock is essential to all farming systems. In the seed-farming complex, cattle are raised mainly to ensure the availability of draught power. In the enset-planting complex, cattle are raised to ensure the availability of manure.

In some communities combinations of socio-political and agro-ecological factors forced them to add crop production. Those who see their comparative advantage in livestock have continued with a pastoralist mode of production. Thus, both agro-pastoral and pastoral systems dominate different altitude zones of the country, mainly in the lowlands. Expanding croplands have a limited mobility of livestock between different altitudinal pastoral zones (Westphal, 1974). Socio-political, institutional and technological changes that took place during the last three decades, since the study by Westphal (1974,75) only mean the worsening of the mobility situation for pastoralists, which intensifies degradation of grazing lands.

2.5.2 The technology

Technology is not always a product of scientific institutions. Human beings are inherently capable of modifying their environment in the process of adaptation, whereby technology is created and subsequently utilised. The struggle between the environment and people never stops, though under some circumstances, a long time may pass before intended changes are realised. For various reasons, some societies adhere to certain technology for centuries whereas others pass a comparable level of technology in a relatively shorter period of time. For instance, the revolution of farming tools for different operations in developed countries such as The Netherlands and the stagnation of the same in a developing country such as Ethiopia explains this observation.

Livestock and crop production techniques of Ethiopian peasants within the four farming systems exhibit an enormous amount of technology. Key features of each farming system are the result of continuous adaptation by the people. The selected tools and techniques of farming are in accordance with the biophysical, socio-economic and institutional environments in which they operate (topography, climate, land size, market, and land tenure).

Livestock production has not shown any appreciable degree of innovation. However, continuous change was observed in crop production systems in both north and south. The major breakthrough was the expansion of the ox-plough over 2,000 years ago. The conversion of pasture and forested lands to crop production, induced by population growth, resulted in a decline of wetlands and natural forest.

Agriculture in Ethiopia is a rainfed system. Water harvesting techniques are limited to the use of ponds for livestock drinking during part of the dry period. Crop failures in some areas occur in spite of very accessible rivers or lakes. It is paradoxical that there is very limited irrigated agriculture in a country with abundant water resources. Irrigation is limited to riverbanks and on a very small scale. However limited that may be, irrigation structures in the Hararghie highlands and Konso are very impressive. After the 1960s, expansion of small-scale commercial farms in the Rift Valley made the extensive utilisation of the Awash River as compared to other rivers of the country, possible. Nowadays, better practices of irrigated agriculture have developed in many parts of the country due to the increasing opportunities for fruit and vegetable cultivation.

In summary, this study attempts to provide the dynamics of the farming system with a focus on the current land-management practices, more specifically with respect to soil and water conservation.

2.6 Land tenure

Land tenure can be conceptualised as a mode of institutionalisation of claims by human agency - in terms of private, common and public - on land and its embodied resources (Sfeir-Younis and Dragun, 1993). A land claim witnesses far-reaching consequences at various levels, ranging from family to country to continental levels.

In Ethiopia, land tenure has been a contested issue for successive generations under different political systems. While the land question is as old as the country's civilisation itself, the predominant analytical approach adopted in studying land tenure is an economic one. The underpinning theory is the structure of property right regimes, which falls within the domain of institutional economics. According to this theory, property rights create ranges of incentives for efficient land resource utilisation (Feder and Feeny, 1991; Eggertsson 1990:125-128). This debate fails to appreciate the dynamics of the issue that has evolved from social, economic, institutional and political environments. Land-tenure systems should be viewed within the historical context of each society, showing specific stages of societal development.

In Ethiopia, land continues to play a crucial role in the society's spiritual, economic, political and institutional development. During the time of the monarchy, land was a centre for power relations between the citizens and their leaders, governors and the kings. In short, it was a vital political instrument. Different nationalities in Ethiopia had their own land-tenure system. It can be said that land was and still is both the foundation and the pillar of the economy. It has served as a means of transaction in power relations in the community. During the *Derg* Regime, the use of land as a political instrument has by and large shifted to its use as an instrument of economic development based on socialist principles. Thus, the tenant-landlord relationship was replaced by a state-peasant relationship. Peasants were then confronted with socialist economic principles and their auxiliary problems. Most of the inhibiting policies that prevailed during the *Derg* period were removed after 1991, when a democratic government came into power, even though state-peasant relations continued.

Thus, an understanding of the land-tenure issue in Ethiopia and its role in the economy requires a retrospective analysis. Assuming the same role for land tenure during the monarchy, the *Derg* and *post-Derg* Regimes, imposes a barrier to a better understanding of the concept. Examining this perspective is increasingly important in view of the disproportionate significance given to land tenure in agricultural production and resource degradation in Ethiopia by many scholars (Merid, 1986; Amare, 1977; Dessaglegn, 1994; Zemenfes, 1995; Yigremew, 1999; Dejene, 1999). Among them, Merid and Zemenfes in particular make a direct link between land tenure and land degradation. For instance, Zemenfes (1995) writes:

'... Land degradation in Ethiopia, therefore, has its roots in the power structure and political economic processes that created exploitative forms of property relations, governed the distribution of produce, and regulated access to resources, specially land.'

The unique way in which the Ethiopian Empire was built by itself leaves much to be desired in understanding the nature of farming systems in different parts of the present Ethiopia. This entails an assessment of the indigenous farming system in the north and among different nationalities in the south before formation of present-day Ethiopia. With the exception of a few (e.g., Sandford, 1994; Takele, *et al.*, 1994; Watson, 1998; Terefe, 2001), many studies on land tenure do not give enough attention to the fact that there were independent land-tenure systems in different parts of the country.

In what follows, an overview of land-tenure systems in the country is presented in four different periods. These are: pre-incorporation of the south; post-incorporation; during the *Derg* Regime; and *post-Derg*. These periods are used in the case studies to show the dynamics of tenure relations in Ethiopia. Moreover, it is intended to examine the constraints and opportunities of intensive land management in relation to the general political climate and the main features of the land-tenure system.

2.6.1 Pre-incorporation period (before 1875)

During the pre-incorporation period, land tenure in northern Ethiopia and the newly incorporated regions was different. Therefore, the pre-incorporation phase is discussed separately.

Land tenure in the north during the pre-incorporation period

During the Axumite kingdom (100 BC-1000AD), the tradition was to subjugate any encountered society by war and to impose a tribute on their resources or other valuable items of the time such as ivory, incense, cattle, etc.

Even though there was no evidence for a clear land-tenure system during the Axumite kingdom, after the adoption of Christianity in the fourth century A.D., different monasteries were granted land from the state (Pankhurst, 1966). This form of land grant which continued until the 20th century, marked the association of state and church, and thereby religion and people. Kings and rulers of different times have exploited their association with the church through grants and gifts to legitimise their kingdom. Thus, people who believed in the doctrine earnestly accepted the absolute power of kings over the land and people. Owing to this, the church and more specifically, the ecclesiastics formed an important land-holding class until 1974.

In the course of societal development, consistent structures of property rights emerged in the north. These are the *Rist* and *Gult* land-tenure systems. The traditional form of *Rist* was established through the pioneer cultivation of certain territory. It was institutionalised as a result of handing down of land from father to son on a successive basis. The second form of *Rist* was based on a grant from the sovereign. This necessarily involved some kind of specific reciprocation to the sovereign, either on a temporary or regular basis. This commitment could also occur in the original form of *Rist* if deemed necessary by the sovereign, but in most cases, it was a matter of outlook; i.e., a position given to the kings in relation to land over which he is said to hold the ultimate power.

Traditional *Rist* land is usually associated with graveyards of one's ancestors (Atseme rist). This hints that the term *Rist* was in use well before the introduction of Christianity in the north, where every family used its own land as a graveyard as does the non-Christian south to date. Under this system, kinship members hold the ownership of land while individuals have independent user rights. Thus, in terms of property rights, individuals have exclusive rights to their farms. However, exchange and transfer to non-members was restricted. When a need to sell arises, selling to non-members may only be accepted if anyone in the group fails to buy or satisfy the needs of the person who intends to sell the land. The final sale of the land, however, needs approval by the state or its representatives. Under the *Rist* system, there is security of land within the group, but there is no individual land transfer right. In this way, the traditional system of land tenure protects against total landlessness, while also being responsive to members' needs.

The other form of land tenure that developed with more differentiation of state functions was the *Gult* system. The state found it increasingly necessary to compensate the citizens it had mobilised for peace or war efforts. The recipients were local rulers, members of the royal family, the nobility or priests. To that extent, *Gult* is an individual right as opposed to *Rist*, which is a collective right. With the approval of the sovereign, *Gult* rights can be converted to permanent and thereby, hereditary rights. This type of *Gult* is called Ristegult.

The *Gult* system gives the holders the right to appropriate dues, which would otherwise have been collected for the state. The *Gult* holder may or may not directly participate in the production process. This distinction is important when the form of due involved could be part of the primary products of the land. No physical removal of the land operator is involved, though this phenomenon was observed in the second half of the twentieth century with the improvement of markets. The right of the *Gult* holder was temporary, lasting as long as he maintained his relationship with the ruling class. Peasant-military, peasant-priests, and a range of other people receive land from the government in return for different forms of obligations directly related to working the land. These forms of land-based relationships include: *gindebel meret*, *milimil meret, bernos* or *zitet meret*, etc., (Gebr-wold, 1962) which are differentiated according to the forms of payments involved.

The *Rist* and *Gult* systems in the north were applicable only to the cultivated land (Merid, 1986; Tewolde Brehan, 1989). Mountains, valleys and rivers were therefore open access property. Also, trees could be chopped for fuelwood and construction purposes from the allocated areas, irrespective of their status.

In spite of their potential or actual shortcomings, the *Rist*, *Gult* and their modified form of *Ristegult* systems all exhibit how society adjusted to the emerging social, political and institutional environments. This is a good indicator for the need to adopt a flexible land-tenure arrangement.

Land tenure in the south during the pre-incorporation period

There is a lack of a recorded history on the economic, social and political life of people in the south. However, conflicts over resources for crop production, grazing, hunting, fishing and trade routes were common. Like in the north, the accumulation of wealth in the form of land and livestock replaced hunting and gathering practices. In the process, the original settlers who came to claim the land evolved as spiritual, political and economic figures. Land and livestock were the two common properties that were used in reward and punishment systems of the different communities.

In some societies, land in totality belongs to the ruling body. Use of land has 'costs' that must be borne by the users. For example, in the old Gibe State of the *Oromo* people, all land belonged to the king. Similarly, in the Kingdom of Keffa, the king owned the land. In both cases, the members of the society had access to land following different patterns of relations with the king and his administration. They could use the tribal or village grazing land and own livestock (Huntingford, 1955; Cerulli, 1956). In his recent work, Terefe (2001) indicates that the available information on pre-class *Oromo* society shows that land was controlled by the *Qomo* (clan) during the *Gadaa* system where equality was pursued. As Terefe also indicated, there is every reason to expect diversity of land tenure among Oromo people who live in a vast geographic area, involving a sedentary agriculture and pastoralism.

In Konso, the early settlers who established ownership by lighting fires emerged as political figures, landlords and religious leaders (Hallpike, 1972; Ambron, 1984; Watson, 1998). A detailed discussion on land tenure in Konso is presented in Chapter 5.

Similarly, the *Wolita* people also had a very strong kingdom, which had its own system of governance and land administration. In Wolita, the land belonged to the king and the citizens had access to land through inheritance, different social arrangements and military service, which was very rewarding in the kingdom (see also Data, 1998).

2.6.2 Post-incorporation until the downfall of the monarchy (1875-1974)

This period, though it covers only one century of a country of people with a long history, brought far-reaching changes to the country's social, economic, political and institutional aspects. The previous centuries were very important in shaping the country up until this period. Land tenure itself is the interplay of these complex phenomena during the monarchy.

At the beginning of this period, *Rist* was the dominant land-tenure system in the north, whereas *Gult* dominated in the south. These trends created a dual land-tenure system in the two major regions, which caused a heated debate during the monarchy.

Several operational names were given to *Gult* in the south, where three forms of obligations were applied. These were *Siso arash* (one-third), *Erbo arash* (one-fourth) and *Ekul arash* (one-half). These calculations were made after the tithe (one-tenth) was deducted. In the case of *Ekul arash*, the tenant received oxen and seed from the *Gult* holder (Pankhurst, 1966; Cohen and Weintraub, 1975). In addition, people in the south with the exception of local power holders (chiefs, kings and their associates), were reduced to *Gabbar* (tax) payers. It should be noted that the same name, *Gabbar*, was applied to all taxpayers in the north. However, the forms of rights held by the two *Gabbars* were different. In the north, a *Gabbar* had both physical property (land) and rights, with the exception of those on *Gult* land, whose fate was technically similar to the south, but who socially identified themselves with landlords or the church. In the south, a *Gabbar* was patronised because he was made to pay a tribute on what had been his own land.

All in all, before 1974, land tenure in Ethiopia consisted of semi-feudal tenant-landlord relations. Tenancy was, however, a typical feature in the south after incorporation into the north.

Lack of land security was one of the major bottlenecks to improving land management and production during the monarchy. In this connection, Terefe (2001:300) reports that farmers in the western Shoa zone of the Oromia Region refused to engage in soil conservation efforts such as contour ploughing, drainage, crop rotation, applying manure/ash on farmland and leaving crop residues/stubble after the harvest, even though the landlords were pressing tenants for such conservation measures. Such location-specific evidence is useful to understand the link between land-tenure security and land-management practices among farmers at different periods in history.

2.6.3 During the 'Derg' Regime

One of the radical steps taken by the *Derg* Regime upon seizing power from the monarchy was to institute land reforms (Negarit Gazette, 75). The intellegentsia had been struggling for this movement under the slogan *Meret larashu!* ('land for the tillers!').

Land reforms broke the relationship between the tenants and the landlords. The land reforms proclaimed that a maximum of ten hectares of land should be provided to each farming family. Any person who owned more than ten hectares was obliged to surrender the extra land to the PAs for redistribution to other peasants who were short of land.

The proclamation made it clear that land belonged to the state. Peasants were entitled to a usufruct right. One could not transfer the land in the form of lease or sale. But, one's family members could continue to use the land under the same regulation.

The fact that land was designated as state property, the state machinery at the grassroots level, comprising the PAs and the *Wereda* administration, was redistributing land as it saw fit. Furthermore, the PAs had been allocating land for public facilities without any compensation. Any attempt to compensate one farmer hardly materialised without affecting others. At best, grazing areas or hillsides were allocated, still violating a claim over the land, collective or individual. In some regions, no less than four land distributions were carried out. The cumulative effects eroded the peasants' emotional acceptance of the government's land reforms. This phenomenon may have affected the farmers' land-improvement practices. But, what was the nature of farmers' responses as a result of this disincentive regarding specific land-management practices? And how does this relate to the farming systems in each region? These questions and related issues will be examined in this study.

Shortly before its downfall, the *Derg* Regime introduced socio-economic reforms in May 1990. The reform, among others, included: the use of hired labour, removal of the grain purchase quota, cancellation of villagisation, which inflicted a serious loss of assets among peasants, and the dissolution of Producers' Co-operatives if members so wished.

2.6.4 After the 'Derg'

The *Derg* Regime was overthrown in May 1991 and replaced by a Tigrian-led coalition force, called the Ethiopian People's Revolutionary Democratic Front (EPRDF). The constitution of the new government stipulated that 'the right to ownership of land is exclusively vested in the state and people of Ethiopia and shall not be subject to sale or other means of exchange.' (Ethiopia, 1995). As far as the fundamental land policy is concerned, no change has occurred since 1974.

Unlike that of the *Derg* Regime, however, the new constitution acknowledged the right of compensation for loss of immovable building property and permanent improvements made on the land. In addition, unlike the 1975 land reforms, the new land policy allowed for the lease of land and use of hired labour. It was stated that citizens had the right to obtain land freely for farming purposes, with the right to remain on their holding without eviction or displacement. This study examines to what extent land tenure enters into the farmers' decision-making equation, in tacit or explicit ways and the relationship between land tenure and other policy environments. The fact that the study was carried out in different agro-ecological and socio-economic environments makes the results even more relevant for policy information in this regard.

2.7 An overview of agricultural research

Agricultural research in Ethiopia was initiated and institutionalised within educational agricultural institutions. The pioneering institutions were Ambo and Jimma, established in 1947 and 1952, respectively. When the College of Agriculture at Alemaya began its operation in 1953, based on the USA's Land-Grant College model, it became the national co-ordinator for research and extension. In 1963, the college administration was transferred from the Ministry of Agriculture (MoA) to the Addis Ababa University. Consequently, the administration of the national extension service was transferred to the MoA. On this development, the Institute of Agricultural Research (IAR) was established in 1966, being mandated with agricultural research. All in all by the mid-1960s, agricultural education, research and extension that were under one umbrella were separated (Nichola, 1985). This institutional modality still prevails.

IAR was organised as a semi-autonomous organisation accountable to the Board of Directors. The main research areas of the institute were crop and livestock production, with an emphasis on the former. In the course of its periodic restructuring, additional mandate areas were included. These include: agricultural mechanisation, socio-economics and farming systems research. Soil and water conservation research is one of the less developed research areas (EARO, 2000a). The bulk of the research in SWC was carried out under the SCRP. The IAR has been operational for three decades, executing its responsibilities in these areas.

Besides the IAR, there were and still are many organisations that contributed to the National Agricultural Research System (NARS) that carries out research in agriculture and natural resources as its auxiliary or major task. These include: universities and colleges, various agencies and authorities (the National Seed Industry Agency, Tea and Coffee Authority, Environmental Protection Agency) and the CGIAR Centres (ILRI, CIMMYT).

The IAR has also been working towards ensuring the utilisation of the technologies it developed. Apart from its collaborative work with the MoA that began in the mid-1970s (see below), the IAR has created an internal mechanism to pursue technology validation and dissemination. These efforts began with the initiation of farming systems research in the late 1970s. In 1985, the Research and Extension Division (RED) was established within the IAR to further improve the relevance of its research programmes.

The establishment of the federal system of administration in 1991 resulted in the decentralisation of the research system as well. Thus, the regional agricultural research institutes were established, which so far number five. This necessitated the transfer of the IAR's former stations in respective regions to the newly promulgated regional research institutes. This process has created duality in the country's research system, the federal and the regional research centres. The IAR with its federal centres was reorganised as the Ethiopian Agricultural Research Organisation (EARO) according to proclamation No.79.1997 (FDRE, 1997b). This proclamation enforced a transfer of research functions from other organisations in part or in full. These include: the Debre-ziet Research Centre, the National Soil Research Laboratory, Fishery Research Institute, National Animal Health Research Institute, Wood Utilisation Research and Forestry Research Centre.

The EARO's strategy to bridge the gap between research, extension and farmers is through research-extension advisory councils at various levels, following the federal system of administration. These are: federal, regional and zonal levels, each with their specific organisation and management functions (EARO, 2000b). The effectiveness of this strategy remains to be seen after it is adequately tested in the real-life situation. In the next section, an overview of the extension system is presented.

2.8 An overview of agricultural extension

Like that of agricultural research, the birth of the formal agricultural extension system in Ethiopia was in the educational institutions that began in 1953 with the Point Four Programme at the then Imperial Ethiopian College of Agriculture and Mechanical Arts, now Alemaya University. As mentioned earlier, the College coordinated the national extension system until 1963.

The extension system has passed through different approaches, to some extent influenced by the rural development approaches followed in the country (for details see Tesfaye, 1997, 1999). These are:

1930-50	Limited activities by religious organisations and national institutions with mandates in the agricultural sector.
1953	The Land-Grant College approach based at the then College of Agriculture.
1958	Community Development approach that used the general agricultural extension model.
1968	Maximum Package such as the Chilalo Agricultural Development Unit, Ada District Development Project, Wolaita Agricultural Development Unit, all

	using the general agricultural extension model.
1971	The Minimum Package Projects that have covered considerable parts of the country. These also followed the general agricultural extension model.
1986	Peasant Agricultural Development Project, introducing the Training & Visit system.
1993	Peasant Agricultural Development Project, using the Sasakawa-Global 2000 extension approach.
1994	Peasant Agricultural Development Approach, following the Participatory Demonstration and Training Extension System (PADETES).
1995 to date	Rural Centreed Development, using the PADETES and modified Sasakawa-Global 2000 approaches, commonly called the New Extension Intervention Programme.

Since its initiation and to the present day, the focus of the extension system in the country was to introduce new technologies to the farming communities, mainly fertilisers, but also improved seeds and other agrochemicals. The pace of the extension service since 1994 has shown a great leap in the provision of these inputs to farmers. For instance, 'annual sales of chemical fertilisers have grown from 32,000 tonnes in 1982 to 280,000 tonnes during 1998' (Setotaw *et al.*, 2000). Even then, fertiliser coverage of arable land in the 1994/95 cropping season was only 28% (CSA, 1995; cited in Setotaw *et al.*, 2000).

The extension system of the country operates without a concrete extension policy. The focus of periodic restructuring was on approaches and methods. One important development in extension was the effort made to collaborate with research in the country. In this connection, the outreach programme initiated in 1974 between the IAR and the MoA's Extension Projects' Implementation Department (EPID), commonly known as IAR/EPID was the turning point in research and extension linkage following their separation in the early 1960s. This programme was discontinued in 1977 and reinitiated in 1980/81. The new linkage mechanism was created between the IAR and the Agricultural Development Department (ADD) of the MoA, thus known as IAR/ADD. These experiences paved way for a more articulated Research and Extension Liaison Committee (RELC) in 1986 (EARO, 2000b). The RELC was initiated with a Training and Visit system under the PADEP approach. The replacement of the rural development approach and adopted extension approaches shown above coupled with the lack of defined responsibilities and logistical support of the RELC weakened its operation after 1993.

The reorganisation of the IAR into the EARO lead to the establishment of Research and Extension Advisory Councils at various levels. The MoA is an active partner in these councils. The ups and downs of the research and extension linkages in Ethiopia have raised many concerns and curiosity as to how these councils would fare in this matter, given the poor training opportunity of the extension staff, the composition of the council and its working modalities, to mention a few.

2.9 Environmental policies

The environmental movement in Ethiopia began during the monarchy and was intensified during *Derg* periods and continued since then. The state's focus during the *Derg* periods was on wildlife protection. This policy direction led to the establishment of a number of parks and sanctuaries in different parts of the country and the delineation of hundreds of hectares of forestland. The drive for this initiative was to improve the tourist industry that also involves protection of historical places with their cultural heritage. To that end, much legislation concerning natural resources has been issued since the mid-1960s (Dessalegn, 1998).

The turning point in the environmental movement took place during the *Derg* Regime, prompted by the famine of 1973/74 and the socialist principles adopted by the *Derg*. The degraded landscapes of the northern (particularly, Wello), central and eastern provinces became the testimony for the expatriate experts who have long been ringing the warning bell for the environmental crisis in Ethiopia. Thus, unlike the pre-*Derg* period where the state was rather reluctant to address environmental problems, and thus limited its activities to forestry and tourist developments, the *Derg* government entered mainstream natural resource management that included the introduction of soil and water conservation practices on arable and non-arable lands. In addition, socialist oriented collectivisation and politically motivated resettlements took place in an attempt to overcome technological gaps and to ease land pressures. The environmental discourse followed by the state was founded on the Malthusian concept of crisis: '...land degradation ... was caused by backward agricultural practices, a 'primitive' system of land use, and high population pressure (RRC, 1985; cited in Dessaglegn, 1998).

The soil and water conservation division was established within the Ministry of Agriculture in 1970 with one senior and six junior Ethiopians, supported by an expatriate expert (Berhe, 1996). The work of this division began with routine activities in an around the capital. The outbreak of famine in 1973 led to the joint operation of the then Relief and Rehabilitation Commission. As a result of this collaboration field activities in the famine affected regions began, where the food-for-work (FFW) scheme was initiated in the country. FFW based conservation activities increased over the years after the 1973 famine, which was followed by that of the 1984/85 famine. This phenomenon intensified the state's environmental activities. In the process, the work of the Ministry of Agriculture was split into two. The drought-prone regions (Tigray, Wello, Gonder, Shoa, Hararghie, Gamugofa and Sidamo) were put under FFW project, while the rest of the country was left under the public extension system that followed the path outlined earlier. The watershed approach was followed in the entire conservation activities in the FFW regions (*ibid.*). According to Berhe, the former senior MoA staff indicated that the watershed approach failed to include the socio-economic factors and operated on technical parameters only. Technical support of conservation activities was given by the former Soil Conservation Research Project (SCRP) that was jointly financed by the Ethiopian and Swiss governments. The national research system did not take part in these activities. In addition to the SCRP, the Ethiopian Highlands Reclamation Study has substantially influenced the government actions.

The financial estimate of environmental protection in Ethiopia from 1974-1993 was 900 million US dollars (Dessalegn, 1998). The largest donor of this fund was the World Food Programme.

Conservation movements during the *Derg* Regime were based on mass mobilisation without legislative backing (Dessaglegn, 1998). A formal conservation policy in recent times came into the picture after the project agreement signed between the World Conservation Union (IUCN) and the government on March 15th, 1990 (FDRE, 1997a). The result of the agreement was what became the Conservation Strategy of Ethiopia (CSE) that was conceived during the *Derg* and realised during the tenure of the new government that fully endorsed the initiatives. The strategy documents were released in early 1997 and have since then come into force. Following the federal conservation policy, few regions have prepared a regional conservation policy, while others are in the process of being written.

3 Theoretical and Analytical Frameworks

3.1 Introduction

This study is about understanding farmers' land-management practices. Its major aims are to understand how farmers make decisions and to identify the determinants of their decisions. It draws its conceptual framework from the theoretical perspectives on land degradation and intensification, planned change and development intervention, farming systems, indigenous knowledge, social learning, and an attitude-behaviour model.

The study was motivated by field observations of symptoms of land degradation. Therefore, an examination of the debate on land degradation and on its alternative, intensification, creates an appropriate entry point into the discourse (section 3.2). Following that, section 3.3 presents a brief discussion of planned change and development interventions that underpin interventionism and its drawbacks. From there, a discussion along theoretical lines leads to the need to understand farmers' decision-making processes, with special reference to soil and water conservation. At this juncture (section 3.4), a discussion of the farming systems perspective provides the setting for analysing why farmers' practices differ in different agro-ecological and socio-economic situations. Unlike the traditional farming systems that focus on the analysis of the components of the farming system from a 'hard' systems perspective, this study carries out a farming systems analysis in line with 'soft' systems thinking. This helps us to compare the similarities and differences of each farming system in relation to land-management practices and related subsystems. Farming systems are the making of people as they try to interact with their natural environment. The inevitable result of such an interaction is *learning*, which is the basis of all indigenous knowledge. With this logic, the discussion of the farming system naturally progresses into outlooks on indigenous knowledge, farmers' and scientists' knowledge and the nature of farmers' soil and water conservation (as discussed in section 3.5).

The learning that takes place as a result of the human environment is predominantly social. Social learning underpins the knowledge and practices people develop, forming the basis of indigenous knowledge. Without learning, the adaptive capacity of the community is finite. Therefore, a brief review on social learning underlining its importance in this study is presented in section 3.6. Notwithstanding the importance of social learning, individual decision-making processes are also important. Therefore, a typical model dealing with individual decision-making is reviewed; that is, the 'attitude-behaviour' model (in section 3.7). This model is used for its ability to provide structure and for its theoretical rationale rather than its measurement approach. Thus, the conceptual framework of the model is used to analyse the relationship between farmers' practices and potential determinants from within the household and the environment. Following these theoretical lines, the chapter goes on to present empirical studies on the determinants of soil and water conservation in section 3.8. Finally, the overall analytical framework of the study is presented in section 3.9.

3.2 Perspectives and approaches to land degradation and intensification

Land degradation is defined as 'the temporary or permanent lowering of the productivity of land.' (Young, 1997). Young indicates different types of land degradation that include, soil erosion, soil fertility decline, salinisation, water-resource degradation, forest clearance and degradation, pasture-resource degradation, and loss of biodiversity.

Land degradation studies in developing countries have used at least three approaches: the classic (technical), populist and neo-liberal approaches. The classic approach takes for granted that the extent of and solutions to the problems of land degradation are well known, but the problem is to get people to implement them. Contrary to the classic approach, the populist approach argues that the nature and extent of land degradation are imperfectly understood, that local peoples often reject conservation technologies for good reason and resort to their own practices and adaptations. The neo-liberal approach shares some views with the classic approach, with regard to soil and water conservation technology. While assuming problem definition to be unproblematic, this approach claims that incentive structures motivate farmers to adopt these technologies, through extension (Biot, *et al.*, 1995).

These approaches have influenced a number of projects in several countries, including Ethiopia, by laying the foundation for soil and water conservation interventions (*ibid.*). Nowadays, rural development projects and soil and water conservation projects are mostly guided by the populist approach, with some elements of the neo-liberal approach appearing in the process.

The following section presents an overview of the salient issues of the debates on land degradation and intensification. Thereafter, the historical and epistemological background of interventionist policies in the developing world is given, along with relevant critiques.

3.2.1 Land degradation: assumption or reality?

In the 1990s, assumptions about land degradation widely held by the classic and neo-liberal approaches faced challenges on-the-ground stating that degradation cannot be defined and measured unequivocally, nor taken to be straightforward. The definition of land degradation cited above also indicates the difficulty it poses to measuring land degradation.

The complexity of land degradation leaves much to be desired when specifying the relationship between soil erosion and decline in productivity on one hand, and soil conservation and increase in productivity, on the other (see Mazzucato and Niemeijer, 2000; Sonneveld, 2002; Eswaran, *et al.*, 2001). In this connection, Bie (1990, cited in Biot, *et al.*, 1995) suggests that the views of different actors in land management should be considered in the definition for land degradation as all have their own perceptions on land degradation and the criteria to be used for it. This view is consistent with the 'social learning' perspective which claims that different actors perceive different things according to their engagement with their immediate environment. Therefore, resource-users have their own reasons for what they do with their resources, their perception of the process and whether they see any problem or not. Without the participation of the resource-users themselves, the perception of outsiders on degradation will not guarantee that conservation measures will be implemented (see chapters 6 and 7).

The lack of clarity on land degradation has created two schools of thought on this subject. One school of thought acknowledges the occurrence of land degradation as threatening the ecosystem and the future of people on planet Earth. This group may be called the 'land degradation' school. This school follows the Malthusian thesis of population and environment which posits that high population growth is detrimental to the environment due to excessive pressure on the natural resources to meet diverse human needs, food, shelter, energy, infrastructure, etc. This viewpoint is subscribed to by several scientists and international organisations (Hurni, 1993; Smaling, *et al.*, 1997, Eswaran, *et al.*, 2001; Pinstrup-Andersen and Pandya-Lorch, 2001; World Bank, 1992). Among these, the World Bank (1992) considers population growth as both the cause and effect of environmental problems. This is assumed under similar land–management practices. The vicious circle of environmental crisis is explained in Box 3.4 (World Bank, 1991:61), which states that: 'rapid population growth, agricultural stagnation, and environmental degradation are closely interrelated and mutually reinforcing.'

Productivity decline due to soil erosion and desertification is estimated to have reached up to 50%. Yield decline in African soils due to past soil erosion is estimated to range from 2 to 40%, with a mean loss of 8.2% for the continent (Eswaran, *et al.*, 2001). Recent studies scale down the extent of land degradation and its environmental costs to a nation on the grounds that much of the removed soil is deposited further down the slope, valley or plain, and that the yield loss in one area could be compensated by yield gains elsewhere (FAO cited in Lomborg, 2001; Bojo, 1995).

The second school of thought describes the ongoing process of natural resource development and utilisation as a normal phase within the dynamic process through which people adapt their environment without necessarily degrading it. This group can be called the 'Ecodynamics' school, represented by the thesis of Ester Boserup (1965), and includes: Tiffen 1994; Leach and Mearns, 1996; Dessalegn, 1998; Mazzucato and Niemeijer, 2000; and Rasmussen, *et al.*, 2001) (see Section 3.2.2 below).

Some scholars view the two schools of thought as complementary rather than contradictory (Netting, 1993).

In view of its recent popularity, the next section deals with the arguments of the 'Ecodynamics' school, with a focus on agricultural intensification.

3.2.2 The path to agricultural intensification

Agricultural intensification involves the technological progression from previous methods of production to another method. According to Boserup (1965), agricultural intensification is considered to be an outcome of the stage within agricultural production processes triggered by population growth. An increase in population density leads to, first, expanding the area under cultivation, or when that is no longer possible, shortening fallow periods. Shortening the fallow period initially leads to a decline in soil fertility. Being rational [3] enough, the society changes its farming practices by using the relatively abundant resources, often labour, to satisfy the higher demand for food. The change in farming practices may involve an increased frequency of cropping, a shift from hoe to plough, application of manure, irrigation and possibly industrial inputs such as fertiliser and machinery. Thus, factor substitutions and technological changes play an important role in the Boserupian theory.

Hayami and Ruttan (1985) advance a similar view in their 'theory of induced innovation'. They advocate that the ability of a country to take on rapid growth in agricultural productivity and output seems to hinge on its ability to make choices among the alternatives [4] to solve the limiting factor of endowment. According to these authors, the market [5] plays a decisive role in achieving intended growth (See also Scherr and Hazell, 1994).

On the whole, the Eco-dynamics school of thought promotes the assumption that intensive labour investment will generate a surplus to be reinvested, which would offset the opportunity cost of a long fallow period, and also contribute to growth in other sectors through linkage effects and induced institutions. The driving forces behind these institutions and linkage mechanisms are markets. However, Boserup (1965:118) warns that the positive contribution of population to economic development may not be fulfilled in densely populated communities if rates of population growth are high. She does not go on to provide an indication of how high a 'high population growth rate' [6] is, that will deter agricultural intensification, however. Evidently, providing a standard cut-off point would be complex, and hence room is left, for the variability of outcomes and the relationships among the variables involved.

What this school seems to overlook is the time span between the appearance of the negative effects due to overpopulation and the time when the expected intensification takes effect. In developing countries where there is a massive dependence on biomass by a large majority of the population, the expected effects that trigger a high population towards intensification are likely to create even further negative effects on the environment.

Tiffen, *et al.* (1994) came up with a study that backs up the Boserupian theory in Africa, by providing evidence that negates the Malthusian crisis relating to increased population in the 21st century. The study shows how more people can lead to more output and less erosion. These conclusions were drawn from changes in land use in the Machakos District (Kenya) from 1930-1990. The authors argue that the success in Machakos is mainly due to a conducive policy environment in Kenya rather than to other unique situations. To that extent, they expect a replication of the Machakos trajectory elsewhere. However, this optimism cannot be generalised even for Kenya itself. For instance, a study by Ovuka in the nearby District of Murang'a claims the opposite; i.e., 'more people, more erosion ...'. His study covers the period between 1960 to 1996. The author ascribes the difference between the two districts to different enforcement of SWC practices, steeper slopes, and legal land consolidation in Murang'a District (Ovuka, 2000:122). Scoones and Toulmin (1999) also doubt that high population growth in

3 Note that this rationality explains the major difference of this school with that of classic Malthusian theory that considers a doomsday scenario as an inevitable outcome of population pressure.

4 Biological technology offsets the limitations of land while mechanical technology offsets shortage of labour.

5 They hypothesise that technical change is guided along an efficient pathway, by price signals in the market, provided that the prices efficiently reflect changes in the demand and supply of products and factors, and that there exists effective interaction among farmers, public research institutions, and private agricultural supply firms (Hayami and Ruttan, 1985:88).

6 Note that population growth, besides increasing land productivity through management, also gives incentives to agriculture through the rural-urban migration that is expected to follow, due to stern working conditions in agriculture by raising the price of food (Boserup, 1965:118-119). Of course, cheap food imports could nullify this effect.

some African countries would lead to further intensification under the current market conditions.

Recent findings in Burkina Faso take the argument of 'more people, less erosion' even further by illustrating how African farmers are capable of making more adjustments than presented by the population pressure theory (Mazzucato and Niemeijer, 2000). This study emphasises that changes in agriculture occur not only because of population pressure, but also in response to changes in the social, economic and environmental contexts in which agriculture takes place. It therefore rings a bell to re-think soil and water conservation according to changes in the society. The message of this study, in a nutshell, is that we have to be aware of the fact that farmers never sit still, twiddling their thumbs, while the context of their agriculture changes. The study further shows that productivity increases have sustained a rapidly growing population while maintaining environmental sustainability. These authors, while endorsing Boserup's warning that a high population does not always coincide with technological change, strongly advise that imposing a particular path will not help to achieve conditions of productivity growth and environmental sustainability, but rather make these paths the subject of scientific inquiry (op.cit., p. 305).

Development policy in developing countries is highly influenced by what Lele and Stone (1989) call 'policy-led intervention'. This policy direction goes against the Boserupian development model, or as they call it, 'autonomous intensification'. Their recommendation of a policy-led intervention model is based on inconsistencies [7] with the assumptions of the autonomous–intensification model, particularly referring to Africa.

In connection to agricultural intensification, it is worth noting that a positive relationship between intensification and environmental quality is not always expected, as intensification processes [8] are likely to bring some negative effects on environmental quality. Hence, the question of tradeoffs or synergy comes into the picture (Lee, *et al.*, 2001). This is so because the different views on what is meant by environmental quality are value-laden (Pretty, 1995).

What is the implication of the foregoing discussion for the Ethiopian case studies? Do they reflect a Malthusian or a Boserupian footprint? Chapter 8 addresses this question based on the three case studies from Ethiopia. For now, let us look at an overview of interventions in a broader development perspective.

3.3 Planned change and development intervention

The concept of intervention found its birth in a world outlook that originates from the dominant 'western' culture and the economic standardisation of western and non-western cultures. The economic gaps perceived by western countries' institutions and multilateral organisations such as the World Bank between the West, and the poor countries in Africa, Asia and Latin America, have led to an interventionist policy in the poor continents by western institutions that triumphs to date (Escobar, 1995). The motto for intervention was coined as 'poverty alleviation', which is nowadays addressed as 'poverty reduction'. The start of this movement was the Marshall Plan for Europe after World War II. The interventionism was ushered in by multitudes of agencies, consultancy firms, programmes and projects commissioned through

7 These are: 1) the negative effects of extremely rapid population growth as compared to the slowly rising densities envisaged in the hypothesis; 2) the substantial concentration of population, even in land-abundant countries; 3) the conflict between the social and private gain of a large family size at low levels of labour productivity for poor households; 4) the tendency to 'mine' the land for immediate survival versus the social need to protect soils as a productive resources; and 5) unequal access to land and even expropriation from smallholders as land value increases.

8 These include: depletion of water resources, salinisation and micro-nutrient depletion in soils, chemical contamination of groundwater, and reduced genetic diversity.

the foreign agencies of the western countries and scientific organisations, and the United Nations. Replicas of these agencies formed in developing countries, including their state machinery, promoting the same principles of interventionism at the grassroots level.

Born out of a paternalistic view, their interventionism aimed at creating more and more 'consumers' by turning them into objects of knowledge and management (Escobar, 1995). Thus, interventions took place in a range of sectors in the economy, from infrastructural developments, and policies of education, agriculture, health, etc., These support measures often result in what is commonly called a 'cargo' image among the recipient community (Röling, 1981; Long, 2001). The interventions are assumed to be blessed and appropriate for the recipient cultures, as they had proved to be appropriate in the donor cultures. In the words of Escobar (1995), they are assumed to be neutral, desirable, and universally applicable. In addition, the solution to the identified, universal problem of poverty/underdevelopment is always a western-defined 'development'. This is in turn believed to be achievable through financial, scientific and technological interventions [9]. Since the 1980s, the concept of development intervention has shifted towards 'sustainable development', by marrying the two old enemies, growth and environment. Development in this equation also targets poverty as both a cause and an effect of environmental problems (Ferguson, 1990; Escobar, 1995).

An analysis of the architecture of development projects is clearly shown in the studies of Ferguson (1990) and Escobar (1995) that focused on the World Bank, in Lesotho (in 1975) and Colombia (in 1949), respectively. The rules of the game for such interventions were created by top international institutions and subsequently picked up and reproduced by others. The fate of most projects at least with respect to the objective of alleviating poverty, whether it was in the 1950s or in the 1990s was the same: i.e., failure. The chief reason for this result, among others, is the basic assumption that it would be possible to reduce and solve a problematic situation in the developing world with a technical fix. In this connection, Ferguson (1990:256) writes that, 'by uncompromisingly reducing poverty to a technical problem, and by promising technical solutions to the sufferings of powerless and oppressed people, the hegemonic problematic of 'development' is the principal means through which the question of poverty is depoliticized in the world today.'

Interventionist policy in the developing world was not limited to the 'American Dream.' The Eastern Bloc's communism has also littered the socio-economic and political landscape of many countries including Ethiopia, where the present study was carried out. For instance, in Ethiopia, socialist interventionism was reflected in state-owned enterprises, centralised planning, collectivisation, villagisation, and the destruction of indigenous institutions, to mention the major ones. Some black spots of the socialist era have not yet been cleared away even a decade after the socialist government was overthrown. These features of socialism have been experienced with varying degrees of severity in many parts of the former Eastern Bloc (Scott, 1998).

Long (2001:30) posits intervention as 'a 'multiple reality' made up of differing cultural perceptions and social interests, and constituted by the ongoing social and political struggles that take place between the various social actors involved.' In this process, the 'recipient' culture or group continuously interacts with the intervening party and the subject of intervention, even long after the formal termination of the project. 'Social learning' in the community not only passes down what has happened in the past, but also helps people to construct knowledge and to store information. In this manner, social learning not only deter-

9 However, the general trend so far shows that the modified Marshall Plan waged against poverty in the developing countries seems to be unsuccessful, unlike its original form in Europe. Is this because of a lack of understanding to do the right thing, or is it a lack of will to do so after half a century? Of course, this question equally applies to the global and local elites, institutions, nation-states, professionals, etc., and the answer also includes non-intervention.

mines the outcome of the present intervention, but also similar interventions in the future, making people's participation crucial for the success of development projects.

In view of the multi-faceted nature of poverty-reduction strategies, the term intervention is used differently in different fields. In this study, however, its use is limited to technological change in agriculture and natural resource management. Interventions in these areas are commonly known as 'Green Revolution' technologies or its successor, 'integrated rural development' projects. The epistemological grounds of the Green Revolution are vividly portrayed by Elizabeth Bird (1984, cited in Escobar, 1995:159):

'The messages [in the Green Revolution literature] are, first, that these development planners know what 'the people' in the 'developing countries' want; second, that what they want is what 'we' have; third, that 'they' are not yet advanced enough to be able to fully indulge themselves without repercussions; and fourth, that discipline, prudence and forbearance are some of the qualities necessary to success.'

The assumptions of the Green Revolution and its offshoots are reproduced overtly or covertly in development projects and programmes even to date, when participation and democratisation are loudly pronounced.

In agriculture and natural resource management, interventionism was realised largely through extension services or integrated rural development projects where extension plays an umbrella role in deploying an intervention. In view of this, huge financial and material resources have been invested in extension in both developed and developing countries. The driving force for its universal acceptance is the theoretical background of extension that attracted policy-makers the world over. The most influential theory underlying extension [intervention] is 'diffusion theory' with its offshoot, 'Transfer of Technology' (ToT), advanced by E.M. Rogers.

Even though ToT contributed substantially to materialising the Green Revolution aims in many countries (mainly in Asia and a few Latin American countries), it has been criticised for its major shortcomings (Chambers and Jiggins, 1987; Röling, 1988, 1992; Rogers, 1995; Leeuwis with Van Den Ban, forthcoming). The key shortcomings of the model are given below (for a detailed discussion on this issue, see Leeuwis with Van Den Ban [forthcoming]:

- It is a sequentially linked linear model. Here science is seen as the major source of new ideas that lead to the neglect of local knowledge;
- It has a pro-innovation bias. Here, what science produces is assumed to be beneficial for users so that its adoption is worthwhile (non-adoption and farmers' own innovation are often considered as negative responses rather than as a conscious choice, a learning process, or otherwise);
- Technology is often perceived as a 'product' and therefore, packaged by research and extension for delivery to farmers. That is in turn assumed to trickle down from model farmers to the followers. In a worst case scenario, which occurs more often than not, technologies are developed under different conditions from those of the end users, and yet their specificity is often neglected; and
- The delivery model proved successful for resource-rich farmers in areas with developed infrastructure, but was highly irrelevant for resource-poor farmers.

The extent to which the interventions assessed in this study reflect the drawbacks indicated in this section will be examined in Chapter 8 when the research questions of the study are revisited.

Notwithstanding the negative side of interventions presented above, the purpose of this discussion is not to pronounce anti-interventionism. Interventions are condemned when they are confrontational, manipulative and abusive. Intervention may be feasible when it is of a catalytic and supportive nature (Wilson and Morren, 1990). These kinds of interventions are well in line with the participatory school tradition that flourished after the 'farmer-first' idea coined by Robert Chambers.

3.4 The farming systems perspective

The notion of a *system* helps us to operationalise the *systems* concept in improving system performance, assuming a system in which human interest is directly or indirectly involved. In my thesis, I have in mind a system of sustainable use of natural resources, more specifically, soil and water conservation.

A system is a mentally constructed entity, whose existence can be configured so far that it is *made* discernible to human minds, as an abstract or concrete system. The common elements in the conceptualisation of a system are shown below (Hurtubise, 1984; Checkland, 1985; Checkland and Scholes, 1990; Röling, 1994; Engel, 1997):

- A set of elements or subsystems within a system which are related in some organised way, not arbitrarily;
- These elements interact in a dynamic way, due to certain patterns evoked by inherent and/or induced interrelationships among them, which may lead to adaptive action;
- A system is more than the sum of its parts;
- The entity we mentally constructed has a certain mentally constructed boundary, which not only distinguishes it from its environment (also a mental map), but also shows the extent of change processes in the form of *transformation* within our system itself and its relationships with other systems;
- The environment, by and large, sets the pace for the adaptive action of our system, while it is also affected by this action and/or at times partially guided by a system;
- Our specific system interacts with one or more systems within this environment in their own contexts; and
- Relationships between and among elements or subsystems of a system show certain patterns in energy/information flow, in the form of input-output, which indicates a kind of *hierarchy* of relationships and that this *emergent property/synergy* is not only discernible within a system (e.g. organism), but also observable between systems within an environment (e.g. food chain, national, regional or international geopolitical relationships).

The very existence of an entity depends on its emergent properties, which change according to the context, to ensure its adaptation to the system. This phenomenon holds true for the mapping in human minds, which is triggered by the experiences in the world to which we are directly or indirectly exposed (Checkland and Scholes, 1990:23; Maturana and Varela, 1992:95-96). Had it not been for the triggering elements in the context that facilitate learning, human adaptation to environment would hardly take place, which would be detrimental to the very existence of people.

The farming systems perspective entered into the arena of systems thinking after the mid-1970s, when researchers began to appreciate the holistic nature of the farming problem that is full of highly interwoven factors. Taken as an entity, farming systems have all the system properties discussed above. The state of a given farming system is shaped by the interaction between the natural and social environments internal and external to each farming system. Natural environments refer to climate, soils, topography, vegetation cover, etc., while the social environments include markets, land tenure, political stability, family size, cash availability, land and livestock owned, labour supply, management capacity, credit and extension services, etc. (Ruthenberg, 1980). Meeting an objective in a given farming system depends on the proper matching of relevant elements from each domain.

The farming systems perspective was initially, however, constructed using a 'hard' systems methodology that very much focused on a system as an aggregation of biophysical factors rather than on the social aspects dealt with by the entities (farming) (Checkland, 1985; 1989). As a result, farming systems research passed through its years of hegemony without much impact on changing the reductionist approach of research and extension organisations in the developing world (van Eijk, 1998). It focused on the understanding of researchers of the farming system rather than on the learning processes of farmers themselves (Lynam, 2002). However, its landmark contribution as a forerunner to the participatory approach goes down in the history of institutional innovations in R&D in agriculture (Farrington, 2000; Collinson and Lightfoot, 2000). The essence of a farming system is not the mere analysis, but the tracing and triggering of the synergy of the system. This gap was created due to a lack of appreciation for 'soft' systems thinking. However, this does not mean that it is not possible to redress the shortcomings of the farming systems approach and to exploit the systemic vision and its appreciation for location-specific knowledge that farmers developed, and the need to fit technological changes into a system (Collinson and Lightfoot, 2000). Soil and water conservation, that seems to be a typical 'hard' systems domain, becomes a 'soft' systems concern when the multitude of social factors that affect a farming system is taken into account. This issue is not only about soil or water, i.e., purely biophysical factors, but also about all other social, economic and institutional aspects. The interests of people and human agency signify the role of the soft systems approach to solving the problem. Had it not been for these elements, only engineers and agronomists would have been enough to solve the problems of soil erosion the world over, which is not the case. The negative consequences of missing this view are illustrated by this study.

The hierarchy of farming systems shows that soil and water conservation falls within the domain of the cropping subsystem (Ruthenberg, 1980). By studying the hierarchy of subsystems of farming systems, we can improve our understanding of the functioning of the farmer's household and land-management practices such as SWC. Households link SWC and the cropping system with several other subsystems to fulfil their needs, rather than focusing only on SWC as outsiders often do. Farmers base their decisions on specific characteristics of their farm plots. To understand the decisions of farmers, one needs to make an analysis at the farm-plot level. Farmers look at specific plot characteristics such as slope, distance from house, soil types, crops grown, tenure, etc. In view of this, key factors related to soil erosion, soil fertility and soil and water conservation were analysed at the plot level in this study.

The farming systems perspective is used in this study to develop a better understanding of land-management practices in the three case study areas. This perspective helps to understand why farmers are doing what they are doing. The study argues that the current farming practices are rooted in the agrarian history of each case study area [10]. While farming systems could be comparable at a higher level, a detailed analysis of their components and functions reveals a multitude of differences that need to be considered for the understanding of land

10 Technologies arise out of particular sets of historical and social circumstances; different people have different attitudes and commitments to them and, because of the dynamic influences over their origin and maintenance, they evolve and change continuously (Scoones, et al., 1996:11).

management (Westphal, 1975; Ruthenberg, 1980). Technical experts tend to focus on crop or livestock systems, even on a single crop or animal species, such as a wheat or dairy production system. These approaches conceal the central role of people as resource managers and decision-makers. The most crucial element of any farming system is the people who shape and in turn change their system (learn) as a result of their interaction with the immediate environment. Tools used for various purposes that play crucial roles in farming systems are developed, adapted or adopted by the people (Netting, 1993).

The next section deals with the knowledge that helps people to adapt their environments.

3.5 Indigenous knowledge

Thanks to the work of many scholars and development experts, the concept of indigenous knowledge has obtained currency in the development literature (Richards, 1985; Warren, 1988, 1991). The term is often used interchangeably with local knowledge, traditional knowledge and indigenous technical knowledge (see below).

Indigenous knowledge has a wide range of roles in a society, which ensures the achievement of livelihoods, including not only technical knowledge in production but also knowledge with respect to institutions, health and security. It is unique to a given community, culture or society inasmuch as the scientific knowledge is unique to the formal institutions such as research institutions, universities and private companies, which are also communities with their own identity and value system (Warren, 1991; Marsden, 1994).

Indigenous knowledge is the result of social learning (see section 3.6 below). It is generated through a social interaction as a person tries to make his/her environment suitable for living. A piece of knowledge on a given social phenomenon is developed, tested, improved upon and stored through utilisation in the community of origin; thus, the knowledge is socially constructed (Scoones and Thompson, 1994; Leeuwis with Van Den Ban, forthcoming). This makes knowledge indigenous to the locality and to its descendants. When knowledge developed in this manner is handed down from generation to generation, it is called traditional knowledge. Nowadays, due to the ease of communication, people's knowledge tends to blend useful components from different sources, changing its indigenous nature. For this reason, some practitioners prefer to use 'rural people's' knowledge instead of 'indigenous' or 'traditional' knowledge (Brouwers, 1993).

There are ample opportunities for cross-fertilisation of indigenous and formal knowledge in development. It is this characteristic that drew the attention of development practitioners to the use of indigenous knowledge in development. Lack of this focus in the past has led to the failure of numerous projects (Richards, 1985; Warren, 1988, 1991; *et al.*, 1996; Critchley, 2000). During the last two decades, particularly in the 1990s, the role of indigenous knowledge is recognised in the International Agricultural Research Centres and multilateral agencies such as the World Bank and the United Nations Agencies (Warren, 1991).

However, how to articulate indigenous knowledge and to use it in promoting sustainable development is not well understood by the formal systems. What has often proved difficult is when and how to integrate the formal and the indigenous knowledge systems and even when to employ only one of the two sources of knowledge. A gap emerges on two sides. On the one hand, some practitioners over-romanticise indigenous knowledge with the view that it should continue without change, and to even support it in spite of the changing internal and external contexts. At the other extreme, indigenous knowledge is totally ignored or at best passively treated in research and extension processes, and other development arenas. Both extremes have detrimental effects on development as seen in many parts of the world.

Shortcomings in the utilisation of indigenous knowledge could be overcome if the ways in which local people learn were well understood and appreciated by the scholars of the modern knowledge system. Local people learn through concrete experience rather than through theory formation and testing. Their theory originates from previous experiences that are subsequently tested through practice rather than from divergence or assimilation, which focus on abstract conceptualisation (Kolb, 1984). Richards (1985), when referring to farmers' experimentation, writes that farmers make their points on the ground, not on paper. The starting point is, therefore, to examine the practices of actors in a given domain of indigenous knowledge. For instance, in the area of soil and water conservation, outsiders need to closely understand the rationale of the decision-making process of farmers before they try to improve their methods.

Farmers have their own way of perceiving things in their farm and community. As they perceive, they shape their practices using their evaluative frames of reference. The way farmers' perceive the agricultural landscape, its problems and solutions sometimes differs, and at times conflicts, with that of outsiders such as scientists and policy-makers. The next section discusses this issue to gain a better understanding and to take necessary precautions in working with farmers.

3.5.1 Scientists' vs farmers' knowledge

The dichotomy between scientists' and farmers' knowledge is linked with the difference between so-called western culture and non-western culture, which are said to be driven by different forms of knowledge (Marglin, 1990): the *'episteme'* and *'techne'* knowledge bases, respectively. Unlike Marglin, Leeuwis (1993:85-86) sees a symbiotic relationship between the two forms of knowledge. Marglin (1990:24) writes that 'in the west, the knowledge system of management (*episteme*), particularly 'scientific management', is characterized by impersonality, logically deduced, analytical, articulate, universal, cerebral, theoretical, verifiable and egalitarian' processes. *Techne*, by contrast is characterised by 'personal, intuitive, non-analytical, implicit, contextual, tactile and emotional, practical and discovery oriented' [11] processes. Even though Marglin like Scott (1998) claims to have based his ideas on the Greek terms, his usage of the terms differs from that of Scott [12]. Scott uses the term *'metis'* in the same way Marglin use the term *techne*, and uses *techne* in the same way Marglin uses the term *episteme*. Unlike Marglin, who views a sharp distinction between *episteme* and *techne*, Scott considers *techne* and *episteme* to be knowledge of the same order and treats them differently from *metis*, which falls on another continuum of knowledge from the other two. *Metis* develops in situations which are 'transient, shifting, disconcerting and ambiguous, none amenable to precise measurement, exact calculation, or rigorous logic.' (op. cit., 320). According to Scott, in a broader sense, *metis* represents a wide array of practical skills and acquired intelligence in responding to a constantly changing natural and human environment. In view of this, he even tends to prefer *metis* to indigenous technical knowledge and its variations.

Over time, this differentiation has narrowed down to scientific and non-scientific knowledge. In this study, non-scientific knowledge is referred to as farmers' knowledge, which Richards (1985) calls the 'people's science'. In this work, Richards has underlined that

---

11 See also Marglin's (1991) work cited by Leeuwis (1993:85) in which more or less similar explanations and definitions are given for episteme and techne.

12 Scott himself has clearly shown their differences in his footnote 17 for chapter 9, page 425.

scientists consistently undermine rural people's discovery and insight owing to their 'formulaic approaches' that worship literature and formalised experiments (Richards, 1985:155-156). He further stresses that farmers are involved in a multitude of experiments in their own ways, to adapt their environment. These processes are enriched through social learning, as was discussed in section 3.6. The other vivid observation about rural people's knowledge is found in the work of Brouwers (1993). Brouwers argues that rural people's knowledge unlike that of scientists focuses on a specific location and functionality, rather than on a universal application. The work of Song (1998) shows that the farmers' breeding strategy is holistic, location-specific, and adaptive to the changing context, unlike that of breeders who follow specialised, wider adaptation and standard approaches. Strategies of rural people's knowledge cannot be exaggerated, as they need to solve the problem they encountered in ways allowed by the social resources, because they act for survival rather than to know, like scientists.

The boundary of a given knowledge base is limited by the scope of the social learning that is behind it. Farmers explain what they perceive, in a similar way to scientists' 'objective' findings. The problem of modern agriculture is the lack of the 'laboratory' situation in real life that has resulted in a mismatch between what scientists produce and what farmers accept. The magnitude of the gap increases with the involvement of human action in the process and less so when it is purely physical or biological, as in the hard system. Owing to the adherence of the scientists to their original design, adaptation by farmers is considered as a rejection or non-adoption whereby farmers are to blame (Ogunfiditimi, 1993; Scoones and Thompson, 1994; Yohannes, 1999; Moser and Barrett, 2002).

Millar and Curtis (1999) argue that the diversity of knowledge in the society is due to differences in the environment such as socio-political-cultural contexts, rather than epistemic differences that create a division between scientific and local knowledge. Stuiver *et al.*, (forthcoming) recognise the 'specificity' of scientific knowledge, which needs specific 'laboratory' conditions to be manifested. In that respect, scientific knowledge does not differ from farmers' knowledge. Thus, they adopt a notion of contextual knowledge rather than 'scientific' and 'local' knowledge as it is conventionally distinguished. Kothari (2002: 229-230), however, prefers local knowledge, which refers to 'the knowledge(s) of rural and indigenous peoples not only in developing countries but also in the developed world.' To that extent, he says that scientific knowledge is also a local knowledge, that shares its 'localness' like any other type of knowledge (see also Millar and Curtis, 1999).

3.5.2 The nature of soil and water conservation by farmers

Scientists and farmers address the soil erosion problem in different ways, even though they have the same goal. This difference has far-reaching consequences for finding the method to achieve the solution. Scientists perceive soil erosion as a process of three steps: the detachment of particles of soil by wind and water from the surface, the transportation of the particles and the deposition of these particles in another place (Sfeir-Younis and Dragun, 1993:22). Richards and Brouwers point out that farmers see the movement of soil from place to place as a result of deposition, and could see small rills. They observe the development of gullies merely by water erosion. The question is whether they credit this process as one of the top production problems and how they minimise erosion. However, like scientists, farmers also know and are concerned about plant nutrients even though they cannot give them chemical names, like scientists whose knowledge systems allow for that level of sophistication.

Unlike outsiders who often maintain a single objective, farmers are faced with multiple objectives in their livelihood. In addition, farmers' indigenous SWC does not aim at merely protecting the soil or improving the moisture level. They make compromises with their multiple objectives, resources, level of the erosion problem, urgency of the household needs, profitability, etc. Therefore, 'the best soil conservation practice from the farmers' perspective is not necessarily that which conserves the most soil' (Kerr and Sanghi, 1993:260). In view of this, farmers often favour SWC practices that give them a quick benefit, while minimising soil erosion. For instance, supplementary fodder, income, and food that is commensurate to the household objectives instead of the off-site benefits that are perceived by the state or its agents, who base their calculation on a public interest point of view rather than on individual households. Farmers' efforts in soil and water conservation are responsive to economic factors. Indigenous SWC methods are often constructed with local labour exchange groups that shift the direct immediate cost to the community. When the practices have to be undertaken individually, they always tend to space the financial and physical burdens over time. Generally, farmers' responses to externally imposed SWC methods are highly shaped by their indigenous practices that are embedded in their local institutions and culture (Kerr and Sanghi, 1993; Yohannes, 1998,1999; Östberg and Reij, 1998; Belay, 1998).

3.6 Social learning

Goldstein (1981:236-240) provides some cogent accounts of social learning. He states that social learning is a form of learning (*what*) occurring in a social context (*where*) for the purpose of adaptation (*why*) of individuals and society (*by whom*). Woodhill and Röling (1998:47) see social learning as the process of social change, cultural transformation and institutional development necessary to achieve these changes. They further add that social learning must address issues of social structure (op. cit., 53), that signify its social nature. This view is further echoed in Woodhill's recent definition of social learning. 'Social learning is a process by which society democratically adapts its core institutions to cope with social and ecological change in ways that will optimize the collective well-being of current and future generations.' (Woodhill, 2002:323). The social context provides a transactional character whereby symbols and values enhance a conducive environment for learning. The quest for learning could be purposive or emergent, in influencing human behaviour. It originates from the very nature of a human being who is goal-directed and a solicitor for change when faced with unfavourable environments.

Social learning helps us to adapt the environment around us in such a way that we prepare ourselves to intentionally face the reality as it unfolds in front of us. Thus, through social learning, people shape their conceptions of the past as they interpret it, the present as they construct it, and the future as they envision it (Goldstein, 1981: 54). Even more important is that social learning takes place in a collective environment (Röling and Jiggins, 2001). The partners in collective learning change according to the issue of deliberation. These include groups, organisations, communities, etc. (Maarleveld and Dangbégnon, 1999). For instance, in soil and water conservation, farmers (individually and collectively), soil scientists, social scientists, policy-makers and administrators need to be involved for better watershed management. Breaking institutional barriers that separate farmers and other stakeholders from each other makes it possible for the long-term exchange of knowledge and information between them (Millar and Curtis, 1999). The barriers include culture and attitudes, financial resources, centralisation of research, lack of training in participatory approaches, and top-down extension services. Learning among the stakeholders can be facilitated by a variety of facilitation tools and concepts developed since the 1980s, and pioneered by the 'farmer–first' school (Chambers, *et al.*, 1989). These range from rapid rural appraisal to experiential learning, to PRA, to PLAR, to RAAKS, to social learning, to mention a few. It is worthwhile to note that these facilitation methods and concepts, though they appear with different names, share the same epistemological and ontological backgrounds, which is the constructivist paradigm (Guba and Lincon, 1989). King and Jiggins (2002) suggest that the most opportunistic learning venue is at the interface between people and their environment. They warn that dealing with only people or the environment would be ineffective.

Understanding contexts for social learning merits special attention in order to fully achieve learning in the real-life situation, not only to a 'person' as learner, but more importantly to a 'person as resource manager'. Learning to solve problems requires not only perception but also resources from the environment. The household or the community cannot just learn without the availability of the complementary resources for the learning to take place because they learn for immediate use.

More importantly, social learning is not learning among a few individuals in the community that is observed by outsiders. The learning process should spread sooner or later. In this connection, Woodhill and Röling (1998:54) argue that 'social learning should be thought of as a society-wide process. It is not an exclusive or elite task for 'scientists', 'experts' or 'intellectuals.' Their observation is a very useful precaution in view of the booming studies on innovation and innovators.

The interrelationship between the individual and society facilitates social learning in a community. Whether the quest for an alternative originates from an individual or group or the entire society, practices that are consistent with the social system are likely to spread in the community. When more people are involved in the practice, it is likely that it will be modified and developed to fit different members of the community. To realise learning opportunities, one needs a conducive policy environment. This is particularly important in resource management such as in soil and water conservation that is affected by a multitude of social, economic and institutional factors.

Another issue is: Who perceives social learning? Outsiders, the community itself or both? What outsiders call learning could emerge from a painful process of crisis management or from a gradual adaptation process without a severe alteration to livelihood practices. Care should be taken not to romanticise the life struggle of the poor community as 'learning' and 'adaptation'. The interpretation or labelling of processes in the society deserves an appropriate meaning, not always learning as perceived by the outsiders. Learning could also lead to socially undesirable outcomes. That is, people could learn what is bad according to the existing social norms.

In this section, I have discussed social learning and how people construct knowledge collectively. The following section deals with the individual decision-making model based on the traditions of social psychology.

3.7 The attitude-behaviour model

The relationship between attitude and behaviour has been one of the crucial issues in social science research. 'Attitude is a disposition to respond favourably or unfavourably to an object, person or institution or event.' (Ajzen, 1988:4). He adds that the characteristic attribute of attitude is its evaluation that must reflect a positive or negative evaluation of the attribute object. Attitude is a non-overt attribute that can only be inferred from verbal or non-verbal responses.

Ajzen identifies three response categories that help us to infer about attitude. These are *cognitive*, *affective* and *conative* responses. These notions help us to better understand the cognitive side of the human behaviour that underlies every decision, even though its impact and effects are mediated by non-cognitive elements such as socio-economic status and external environments, as will be shown in the subsequent theoretical discussions and the empirical studies.

Cognitive responses are responses that reflect the perception of, and information about the attitude object. Taking the example connected to this study, the information and knowledge that farmers have on land management show their beliefs. For instance, the perceptions that soil erosion reduces soil fertility and that steep land is prone to erosion are likely to result in a positive attitude towards measures of erosion control. This indicates that more information on the object of attitude is helpful to shape the attitude of people towards the object.

Affective responses are related to the evaluation of, and feelings towards, the attitude object. Farmers who think that soil and water conservation increases crop production and who think that soil and water conservation is the farmers' responsibility hold a more favourable attitude towards soil and water conservation than those who think that farmers should be paid for such work or that it is the responsibility of some other agency.

Conative responses are near behavioural responses that show inclinations, intentions, commitments and actions to the attitude object. These stem from the notions of what people say they do, plan to do or would do under appropriate circumstances. Farmers who appreciate farmers who have strong terraces in their farms and wish to strengthen their own as well are more likely to take action in that line than those who emphasise the negative side effects of terracing.

The causal link between attitude and behaviour was later conceptualised through what is called the 'theory of reasoned action' (Ajzen and Fishbein, 1980), where intention determines behaviour and is in turn affected by the attitude towards behavioural and subjective norms. The model was developed on the basis of observation and pattern of volitional[13] behaviour whereby an individual is able to accomplish what s/he intends to do. Through time, it was realised that these behaviours face a limitation in their translation into action. This limitation was termed as 'perceived behavioural control' (Ajzen, 1988). When an individual perceives (s)he lacks control, he or she will not be able to perform the action because of a lack of opportunities to perform the intended act. Understanding incomplete volitional control led to Ajzen's theory of planned behaviour that was developed from its precursor, the theory of reasoned action (Ajzen, 1985, cited in Ajzen, 1988). The latter theory makes a special case of the former when perceived behavioural control is not important to predict the behaviour.

Ajzen's model predicts behaviour, with *intention* as an intervening variable. Attitudes towards the behaviour, subjective norms and perceived behavioural control interact with each other as antecedent variables to influence the intention to yield the expected behaviour. The second possibility to predict behaviour is a direct link between perceived behavioural control and behaviour (Ajzen, 1988: 132-136). In the latter case, strength of intention is not important.

I disagree with Ajzen's second trajectory of behaviour, which emphasises perceived behavioural control. This option of the model seems to undermine the importance of belief. I argue that every behaviour has an underlying belief, whether the belief has or does not have a major effect on its taking place. That means that belief alone is not sufficient to take action, as the shift from the theory of reasoned action to the theory of planned behaviour made clear. By the same token, the availability of opportunities, i.e., perceived behavioural control, without a firm belief and desire to take action does not guarantee a continuation of a behaviour even

13 This includes actions such as reading or not reading a newspaper, going to church, losing weight, raising your arm, quitting smoking, having an abortion, voting for one party or another, etc.

if it takes place at one point or another. This has a direct implication as to where we apply the model in a field such as agriculture and natural resource management or in a context such as urbanised life in which the model has been tested widely. Barels (2002) states that behaviour is a function of the individual and the situation (environment). In view of this, one can hardly talk of a planned behaviour, because there are several intervening variables that are not amenable for planning. In addition, I consider intention as a general state of mind that results from the cognition and affect rather than as a separate state. The theory of planned behaviour shares its epistemological shortcomings with intervention theory.

As indicated above, most behaviours cannot take place in the absence of the control belief, which ensures the practicality of the behaviour, whereas the converse is not always true; that is, fulfilment of the control belief when the behavioural belief is negative. Such a broader look into the determinants of behaviour is helpful to better understand why people do what they are doing, though it is not always achievable with certainty.

Leeuwis with Van Den Ban (forthcoming) introduced a model for understanding farmers' responses, by adapting the works of Ajzen and Fishbein and others. In this model they emphasise evaluative frames of reference, perceived environmental effectiveness, social relations and perceived social pressure and perceived self-efficacy from the domain of social psychology, while showing the feedback side of the model from the practices of social actors (see also Leeuwis, 2002). This model is cyclical rather than linear, unlike that of the theory of planned behaviour.

According to Röling and Jiggins (2001:159-160), 'the theory of reasoned action establishes levers for changing the human cognitive agent, such as anticipated feedback, 'desirability,' and self-confidence. They further add that, '... the theory emphasizes the socially constructed nature of the human cognitive agent'. In view of this, the structure and theoretical rationale of the theory of planned behaviour is useful to study farmers' soil and water conservation practices, particularly with respect to the role of the underlying beliefs and the notion of a perceived behavioural control (Beedell and Rehman, 2000). However, unlike attitude, that could be either negative, neutral or positive, perceived behavioural control involves wider possibilities that are subject to many influences even for the same level of control from one respondent to another. Therefore, it is not convenient to apply a scale for mathematical application. On the other hand, applying the model in rural communities where illiteracy dominates and where criteria for measurement of belief levels widely vary such as in agriculture and natural resource management, is likely to lead to substantial bias. Therefore, this study limited the application of the model to the conceptual link between behaviour, the underlying beliefs, and environmental factors without using the mathematical relations between the behaviour and composite explanatory variables. These are the attitude towards behaviour, perceived social norm, perceived behaviour control and intention (intervening).

Considering soil and water conservation as a desired behaviour, farmers should first and foremost know and perceive the erosion problem. Information on these subjects is likely to shape their attitude towards erosion and its control measures. The cognitive base could be obtained from outside or from the community or personal experience. The farming system sets the norm for land-management practices. A favourable outcome from the cognitive base and the normative belief are not sufficient to warrant implementation of a conservation practice in the absence of perceived behavioural control; that is, the resources. Put in another way, availability of the necessary materials alone does not guarantee that farmers will implement or maintain the conservation structure without the cognitive base. This study examines the relative importance of these pillars in the assessment of determinants of soil and water conservation in selected regions of Ethiopia. More specifically, it examines to what extent knowledge and attitude towards erosion and soil and water conservation affect farmers' behaviour regarding SWC practices.

The preceding sections of this chapter have dealt with some theoretical lines that are relevant to the research area. In the next section, reviews of empirical cases are briefly presented.

3.8 Empirical studies on determinants of soil and water conservation

Determinants of soil and water conservation have been studied together with thousands of agricultural interventions deployed by projects and mainly the public extension services. Determinants of soil and water conservation can be analysed at four levels. These are: the household, focusing on personal attributes and household characteristics; the farming system; characteristics of technology; and external institutional factors. The farming system includes the social, institutional and natural environments, whereas the external factors mainly deal with macro-economic policies, institutional services and rules and regulations. Even though they are separately treated for ease of presentation, all of these factors are highly interwoven at different levels of analysis. The body of literature dealing with these factors is too vast to be canvassed here. In view of this, a few empirical studies are reviewed to show the salient issues determining farmers' decisions regarding soil and water conservation practices.

3.8.1 Household variables

Since the 'diffusion of innovation' school (Rogers, 1983; 1995) opened up a host of studies in the area of adoption and human behaviour, a number of socio-economic studies have been carried out to identify factors affecting the adoption of SWC among farmers. These include: age, gender, education, family size, farm size, labour availability, income, risk perception, perception of erosion, perception of soil and water conservation technologies, off-farm employment, etc.

Cramb, *et al.* (1999) have studied factors affecting soil and water conservation technologies (terrace and hedgerows) in the upland areas of the Philippines. The study concluded that the personal attributes such as age [14] and education were not important in explaining adoption. Out of seven sites, age of the household was found to be a significant factor in only one location where laborious work of stone wall construction was involved. Better education was expected to influence farmers' comprehension of the training materials. Like old age, heavy tasks were not suitable for female-headed households. Adopters and non-adopters did not differ much with respect to their family size. The study by Semgalawe (1998) in the Tanzanian Mountains did not show any relationship either, between farmer age and education on their decisions about SWC measures. In the results of the study on '*tassa* and earthen mounds' in the Sahel by Baidu-Forson (1999), age did not show a significant effect on the adoption of these practices. However, Bekele (1998) in his study of resource degradation and adoption of land-conservation technologies in the Ethiopian highlands, found age and family size to be negatively and significantly related to the farmers' decision to retain conservation structures, whereas education was not significant in this relationship, because most farmers were

14 Rogers (1995: 269) indicated that responses of adopters show inconsistent evidence about the relationship of age and innovativeness; about half of the same 228 studies shows no relationship, a few show that earlier adopters are younger, and some indicate that they are older.

illiterate. In another study in northern Ethiopia, Ludi (2002) found that with increasing age, the probability that SWC structures are maintained slightly decreases. Lapar and Pandey (1999) found a positive correlation between farmers' years of education and their adoption of SWC measures.

Farmers' perception of soil erosion and their subsequent conservation behaviour have mixed results. In some studies, there was no substantial relationship between soil erosion perception and farmers' conservation behaviour, whereas in others, there were direct links. For instance, the perception of erosion was found to be important to the adoption behaviour of SWC in the Philippines (Cramb, *et al.*, 1999) and at Andit Tid, Ethiopia (Bekele, 1998). Bekele particularly showed that farmers' decisions to retain conservation structures are positively and significantly related to soil erosion perceptions, attitude towards new technology and exposure to new practices. Such was not the case in Tanzania where farmers' perception of the soil erosion problems fails to explain household behaviour towards adoption of improved SWC practices. And even more, the Tanzanian study found that non-perception of the soil erosion problem does not always translate to households being unwilling and/or unable to use improved soil conservation measures. Summing up such observations, Napier and Sommers (1993:10) state that: 'positive environmental attitudes towards the protection of soil and water resources are a necessary but not sufficient condition to bringing about the adoption of conservation programmes at the farm level'.

The farmers' decisions on SWC technologies are highly influenced by risk perceptions (Ruthenberg, 1985; Baidu-Forson, 1999). The study by Baidu-Forson (1999) suggests that farmers exhibit reluctance to adopt technologies that expose the farm enterprises to greater risk and must be convinced that technical change will indeed bring about greater rewards than existing practices.

Farm size is one of the crucial household variables that enter into the decision-making by households with respect to soil and water conservation technologies (Kerr and Sanghi, 1993; Sain and Barreto, 1996; Cramb, *et al.*, 1999; Bekele, 1998; Semgalawe, 1998). In the Philippines (Cramb, *et al.*, 1999), farm size affected the adoption of soil and water conservation methods in two of seven sites where the technology was introduced. The study found that a larger farm size enabled adopters to increase the maize area to offset the area lost to hedgerows, thereby, among others, maintaining total food production. Comparable to that of farmers in the Philippines, farmers in Tanzania, tend to be willing and able to use improved soil and water conservation techniques when their farm size is larger (Semgalawe, 1998). Bekele (1998) also found that per capita availability of cultivated land, parcel area and productivity of the technology positively and significantly affected farmers' decisions to retain conservation structures. Baidu-Forson (1999) takes this issue even further by linking his finding of a negative correlation between the adoption of improved '*tassa*' and earthen mounds and the land-to-labour ratio with the hypothesis of adoption of intensification as population grows relative to land resources.

Researchers who emphasise soil fertility management closely link livestock ownership with the use of organic matter (Eyasu, 1997; Alemayehu, *et al.*, 2001). Others try to find out the probability of ownership of livestock or specific animals (e.g., oxen) affecting farmers' decision-making regarding SWC technologies (Bekele, 1998; Ludi, 2002). The common observation is that livestock serves as insurance for family food security, settlement of financial commitments, provision of manure and traction power.

Labour is one of the few crucial inputs in soil and water conservation practices. Given a relevant technology, studies have reported varying responses to labour in SWC decisions. Cramb, *et al.* (1999) found that labour requirements for the technologies were an important consideration, but the household's labour supply was not a major factor in itself. Rather, it was related to cash flow concerns and the need to use spare labour off-farm in preference to carrying out SWC. Therefore, access to cash was more important in giving them access to labour and the use of other inputs to improve production, such as fertilisers. This was clearly shown by higher cash income of adopters in all the sites compared to the non-adopters in their study. Semgalawe (1998) in a similar study in Tanzania, found that households with cash crops were more likely to adopt improved soil conservation measures than those who did not grow at least one cash crop. On the other hand, off-farm income had a negative effect on the use of improved SWC measures. Moreover, she also found that farmers who were members of a labour-sharing group were more likely to adopt improved SWC measures than those who were not. Interestingly, the result indicates that family labour does not influence the decision to establish improved soil conservation structures, which implies the importance of the labour-sharing group in SWC practices. Lapar and Pandey (1999) reported a similar result regarding local labour exchange groups in the highland Philippines. In Thailand, labour demand was more pronounced due to agronomic practices that need continuous attention from planting to tending (Renaud, *et al.*, 1998). Similarly, Pender and Kerr (1999) found that labour market imperfections in India resulted in significantly more conservation investment in households with more adult males, fewer adult females (an unexpected result), low caste households, and on smaller farms.

3.8.2 Farming system

Physical factors

Biophysical factors and climate, mainly rainfall characteristics, play an important role in farmers' decisions regarding soil and water conservation practices (Sain and Barreto, 1996; Semgalawe, 1998; Bekele, 1998, Cramb, *et al.*, 1999; Lapar and Pandey, 1999). Farm attributes such as distance from the homestead and its physical conditions such as its slope, soil type, topsoil depth, stoniness, etc., were found to discriminate between adopters and non-adopters of SWC in different parts of the world. These features may also lead to different decisions by the same farmers with respect to different plots owned, which vary in these physical features, let alone by different farmers. The study by Cramb, *et al.*, (1999) showed that the adoption of hedgerows in particular was more likely on fields, which were larger, steeper, had more erodible soils, and were located close to homestead areas. Bekele (1998) who studied 452 plots in the highlands of Ethiopia, found that the higher the slope category of the plot, the higher the probability that recognition of soil erosion would be above any fixed level.

Local institutions

Note that the 'diffusion of innovation' school of thought hardly addresses the importance of local institutions as an important contributor to the adoption of suitable land-management practices. Instead, subscribers of the school often consider local institutions to be a barrier to diffusion of innovation, or at best overlook it as an irrelevant force. The role of local institutions and the embedding culture became important in land management studies that looked at 'the soft-side of land' (Röling, 1997). The importance of the soft side of land management has been demonstrated in a number of studies; for instance, Gonzalez (2000), and Mazzucato and Niemeijer (2000). Mazzucato and Niemeijer (2000) illuminate the role of local institutions in adaptive land management. Their study underlines the role of the cultural economy that operates on the basis of a mixture of principles emerging from both the local and cultural contexts and the external market economy. In Katheka, Kenya, the local self-help group helped to promote bench terracing which was successfully reinforced in the early 1980s while it had not been adopted under colonial rule (Laing and Ashby, 1993). This case was also able to report on the exemplary collaboration between a local self-help group and the government extension service in land improvement. Local self-help groups pursuing wider local development issues or those organised for specific functions such as labour exchange develop their own rules of the game, which are of vital importance when development interventions of any sort are envisaged (Herweg, 1993; Tsehai, 1994; Hounkonnou, 2001).

3.8.3 Characteristics of technology

The 'diffusion of innovation' school has always paid attention to the characteristics of innovation itself in addition to its traditional focus on the 'innovators' in trying to determine the rate of adoption of an innovation (Rogers, 1995). According to Rogers, 49 to 87 percent of the variance in rate of adoption is explained by five attributes of the innovation: relative advantage, compatibility, complexity, trialability, and observability. This characterisation of technology is one of the best achievements of the school. To this, he adds other factors that affect an innovation's rate of adoption. These are: (1) the type of innovation decision (optional, collective, authority-related); (2) the nature of communication channels; (3) the nature of the social system; and (4) the extent of change agents' promotion efforts. According to Rogers, five perceived attributes of technology together with the four agent-channel components determine the rate of adoption. Generally speaking, Rogers' model is complementary to the theory of planned behaviour as discussed earlier, by providing clarity in terms of decision-making processes. In addition, among the five attributes of technology, the relative advantage reflects what other studies present as economic factors. Compatibility reflects adaptability of the technology/innovation to the cultural, institutional and technological settings of the adopting society, while other attributes manifest the adopters' personal characteristics with respect to the innovation, including their socio-psychological characteristics.

Like any other technology, characteristics of technology also affect soil and water conservation decisions. Farmers do not accept practices that merely reduce erosion rates from a purely agronomic point of view unless they also address the soil-fertility problem. This often brings a choice between the physical measures that are known to control erosion rates, and the biological measures that have a quick response to soil fertility objectives, while also preventing erosion and being easy to install or manage. However, this does not mean that farmers do not refrain from adopting biological conservation technologies, as these too have their own disadvantages depending on who has tried to adopt them (Hudson, 1993; Renaud, *et al.*, 1998). For instance, competition with annual crops for nutrients, water, and light; high labour demand that often coincides with routine farm operations; serving as alternate hosts to disease and pests. From the technological characteristic point of view, farmers go into all these details based on their day–to-day observation of each technology. When they are new to the technology, their reservation may be due to complexity, observability, which also prohibits farmers' evaluation of the relative advantages and compatibility of the technology. In crop-management techniques, farmers may continue to grow an erosive crop, with the knowledge of its disadvantage when it fetches a high price. The same consideration goes when farmers remove crop residues for animal feed or home consumption in different forms. They do this not because they do not understand the contribution of crop residues to soil fertility, but because they are constrained in the supply of alternative materials. Added to this farmers' economics is the livestock management system. Where there is open grazing after harvesting, farmers try to collect their residues for alternative uses (Sain and Barreto, 1996). These considerations are important when one thinks of biological conservation measures and minimum tillage practices where crop residue management is crucial. The relative advantage issue also raises the need to incorporate SWC practices that give quick benefits to offset the side effects of the technology, with low cost and low labour demands (Renaud, *et al.*, 1998). This issue is vividly presented in the study by Lapar and Pandey (1999): 'engineering solutions such as rock walls, check dams, and terraces have had very little success in generating a wider impact due to their high costs. Other less costly technologies such as contour hedgerows, contour ploughing, and cover management have also been adopted but sporadically.' This observation underlines the danger of generalising farmers' decisions regarding SWC in different parts of the world, without taking into account the specific context. SWC technologies also involve side effects that increase farmers' risk of crop loss (Belay, 1992; Herweg, 1993). These side effects include: waterlogging, rodents, weeds, land occupied by conservation structures, obstacles to routine farm operations. These features highly reduce the adoption of SWC technologies among small farmers.

3.8.4 External institutional factors

External factors could enhance or inhibit farmers' decisions on soil and water conservation. These factors include: land tenure, access to credit, subsidy, extension services and infrastructure (Napier and Sommers, 1993; Sain and Barreto, 1996; Cramb, *et al.*, 1999; Bekele, 1998; Renaud, *et al.*, 1998; Pender and Kerr, 1998; Samgalawe, 1998). The impact of land tenure in the Cramb, *et al.* study (1999) varied from tenure system to tenure system. While there was no significant impact of the official classification whereby land was under different public categories, tenancy was found to be the main tenure issue that affected adoption of SWC practices. In this case, the absentee landowners did not allow the tenants to adopt the SALT (Sloping Agricultural Land Technology) recommendation. In another study in the Philippines which included one of the villages that was covered in the study by Cramb *et al.*, tenure security was highly valued, without which farmers would resort to a 'mining' strategy based on the rapid exhaustion of soil fertility (Lapar and Pandey, 1999). However, they indicated that a legal title to land was not necessary for ensuring the security of land tenure. Bekele (1998) suggests a possible association of farmers' perceptions of the security of user rights to land with a higher level of use of conservation structures, but his results were not statistically significant. Given that the state ownership of land prohibits land markets, he indicated the limitations to undertaking conservation investments with a long payback period, including conservation structures considered in his study. In a study carried out in three Indian villages, imperfect land markets caused lower conservation investment on leased land (Pender and Kerr, 1998). Sain and Barreto (1996) reported the absence of a relationship between land conservation and land tenure.

Extension is generally expected to show a positive impact on the adoption of external technologies (Rogers, 1995). This view has been testified in a number of studies including those involving SWC (Bekele, 1998; Semgalawe, 1998; Baidu-Forson, 1999). According to Bekele (1998), access to information about technological options for soil conservation had a significant effect on perceptions of the erosion problem and on retaining the conservation structures, whereby he considers a positive role of extension on adoption. Similarly, Semgalawe (1998) reported that farmers' participation in promotional activities of SWC programmes increases the probability for the household to use improved SWC measures. However, top-down extension approaches that heavily depend on incentives rather than on educational processes hardly help to change land-management practices of farmers (Renaud, *et al.*, 1998).

The other variable that has been synonymous with soil and water conservation, particularly in Africa, is the incentive that is mostly stimulated in the form of food-for-work programmes. The literature on the diffusion of innovation regards the provision of incentives as an attempt to increase the degree of relative advantage of the new idea or practice, but also as having other functions such as increasing observability and trialability which enables the testing of compatibility (Rogers, 1995: 219).

Incentives can be provided in a variety of ways, including credit, subsidies, grants and infrastructure. Reij (1998:1417-1418) sees incentives as a triggering mechanism for the adoption of SWC technologies. This is shown in the case studies on which he reported from Burkina Faso and Indonesia (Java). In Burkina Faso, he reported on a new initiative to provide a donkey cart for the transportation of stones, manure, water, firewood, etc., which directly or indirectly contributed to land management, instead of the expensive option such as a lorry that would not be sustainable after the project terminated. His example from Java shows how livestock credit to attract farmers to plant grass on terrace risers and terrace lips failed as this was not attractive to resource-poor farmers who are hardly affected by soil erosion, because their soils are deep and fertile. Eligibility for these provisions required the adoption of SWC practices in the form of a cross-compliance incentive [15]. The most crucial issue to be considered before deploying incentives, however, is acceptability of the new practices in the face of the evaluative frames of reference of farmers envisaged in the incentive. The reason for this condition is that the farmers are expected to continue the new practice after the phasing out of the incentive. That means that the incentive was deployed merely to overcome risk-aversion by farmers and to increase their relative advantage. This phenomenon is termed as 'dynamic dis-equilibrium' where the use of incentives in the form of a subsidy could be considered as economically justified (Giger, 1998). Deploying incentives without winning farmers' acceptance risks the destruction of previous investments and the absence of maintenance as demonstrated by hundreds of projects around the world.

The study by Pender and Kerr (1996) reported that credit-market imperfections are affecting investment in each of the villages included, though the evidence was not completely conclusive. The most important issue with respect to access to credit is its link with land management; i.e., is credit used for hiring extra labour, purchasing fertilisers or other inputs? Otherwise, mere access to credit does not guarantee proper land management as credit could be used for consumption. In this connection, Ludi (2002) reported that increasing the amount of credit brought on a slightly to medium significant negative effect on the willingness to maintain SWC structures. She noted that such unusual results regarding credit occurred because the conservation technology was labour intensive rather than capital intensive, whereby cash constraint plays a minor role.

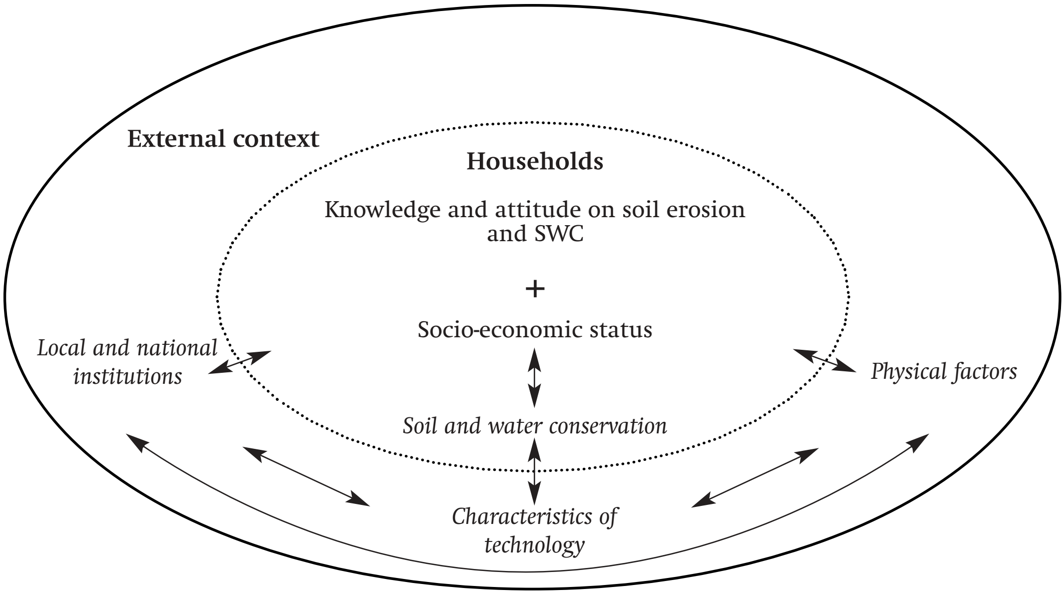
3.9 Analytical framework

As illustrated in the empirical studies, land-management as a complex process is not only the result of the will or an act of land users. Its problems and achievements go way beyond the household domain of operation, to include actors in the surrounding environment who also

15 For the detailed policy implications of cross-compliance for targeting economic incentives, see Bekele, 1998.

affect their decisions. These actors operate at various levels and affect farmers' land-management decisions and thereby their behaviour. At the macro level, policies of the national government are formulated. The global economy and political systems in turn affect these policies. Macro-level policies affect policies of the regional governments at the meso level. National and regional government policies become operational at the micro level. At this level, household characteristics, institutional factors, technical factors and physical factors affect farmers' decisions on land management. The interrelationships among these factors and how they affect soil and water conservation are shown in Figure 3.1. In the subsequent paragraphs, the perspectives of the study with respect to these factors are outlined. Note that the households are embedded in their biophysical and institutional environments. The latter one encompasses a range of human agencies.

Figure 3.1: Analytical framework with the determinants of soil and water conservation



Household characteristics

Households in developing countries like Ethiopia are both production and consumption units where both functions are closely linked (Ruthenberg, 1985). Therefore, the primary source of inputs for production emanates from within the household and the local institutions and family networks. Household goals are dependent on its resources that include both physical and social capital.

With respect to soil and water conservation, the first issue is the state of soil erosion and the level of soil fertility. When the household feels the impact of soil erosion in its farm, it is expected to take the necessary measures. Its response to soil erosion depends primarily on the level of its knowledge on soil erosion and the resulting attitude. If the household is aware of the side effects of erosion on its livelihood, it is likely to take the known control measures against soil erosion. After all, it is threatening its means of livelihood. However, soil and water conservation does not fall within the domain of behaviours in which one can easily do what one intends, as posited in the theory of reasoned action (Ajzen and Fishbein, 1980). Therefore, it requires other factors in addition to knowledge and attitude. These are: household resource base (land, labour, capital), education, risk perception; institutional factors (extension services, credit availability, labour organisation, markets, land tenure, etc.); physical factors (topography, rainfall and soil factors); and the characteristics of the technology or practice perceived to solve the problem.

Institutional factors

Farmers make decisions within a broader environment or context. One of the elements in the environment consists of institutions. These can be seen at the local and national levels. The national institutions in agriculture are often linked to research and extension services. They are typical routes for external intervention in rural communities. Extension in particular provides farmers with information on soil erosion and methods to combat it. In collaboration with other organisations, it could channel credits and other incentives to the farming community to improve its production through proper land management techniques. The type of information provided by research and extension institutions affects farmers' knowledge and their attitude towards soil and water conservation. External organisations can also exert pressure on local people through persuasive incentives such as food-for-work. In addition, land-tenure patterns play their role in the farmers' land-management decisions.

Farmers' risk perception on the options for soil and water conservation depends on their perception of the institutional environment, i.e., the degree to which it may support or impede the practice. With respect to indigenous knowledge-dominated farming systems, the local institutions, labour organisations and the moral economy are very important to their decision-making processes and to the livelihood of the family (Mazzucato and Niemeijer, 2000; Gonzalez, 2000). Among farming systems that are integrated within the modern institutions, extension services, financial organisations, markets, input supply, and transportation companies are very essential for its decision-making and success. Nowadays, both institutions are accessed by farmers as deemed necessary.

Characteristics of technology

A decision-making process could be enhanced or impeded partly by the intrinsic characteristics of the technology, such as *observability*, *complexity* and *divisibility/trialability* and partly from its extrinsic characteristics such as *compatibility* and *relative advantage* to the household domain (Rogers, 1983, 1995).

When a technological option is easily observable, a farmer can easily form an idea and proceed to evaluate the option. Observability of the option helps the farmer to easily compare it with previous experiences or the problem at hand, compatibility of the practice and its relative advantage (see below). When the options are less observable, decision-makers would not have the chance to arrive at a decision to try it. When an option is perceived as complex, it is likely that their risk perception increases, while their motivation declines, therefore negatively affecting the cognition process and thereby their attitude. When this happens, a farmer will end up sticking with the original experience and preliminary reflection without a formation of positive ideas to try out the option. Similar to lower observability, complexity also hinders farmers' reflections on the compatibility and relative advantage of the option. Arriving at a decision to take one action among many necessitates the divisibility of the option (if applicable) to individuals in order to encourage trying out the practice. Note that some technologies need small-scale trials before committing a large investment.

When the intrinsic characteristics of an option allow the farmer to proceed in the decision-making process, the farmer would be in a position to evaluate compatibility and relative advantage of the option, which are partly in the domain of the environment and partly in the household domain. When an option proves compatible, it would be tested for its relative advantage; that is, not adequately assessed from other sources or previous experience. Depending on the test, the practice would be included in the repertoire of practices for further observation.

Compatibility compares the option with the life-world of the farmer such as farming practices, value and belief system, knowledge, skills, resources, etc. Relative advantage compares technical performance (on-site and off-site effects), economic considerations (demand for labour, energy, resource competition, financial return, outside resources), social aspects (power relation, status, religion), institutional relationships (individual efforts, association, external assistance) and political/legal issues.

Reflections on compatibility and relative advantage of the option are dependent on the environment in which the decision-maker operates, which shows complexity of decision-making in a real-life situation, and differentiates it from learning for the sake of learning.

Physical factors

Natural landscapes are one of the triggering factors for human interventions. Plain landscapes and hilly landscapes do require different methods of farming. Different soil types also need different management practices. Added to these factors, rainfall characteristics raise yet another land-management issue. Without going into details of other biophysical characteristics that affect farming, these three physical factors are sufficient for shaping farmers' soil and water conservation decision-making processes in conjunction with the 'soft' side of land, after Röling (1997). Given a steep slope and erodible soils, a high rainfall period under low vegetation cover is likely to play an important role in the perceptions and behaviours of farmers on soil erosion and the role of SWC.

Practice and post-decisional evaluation

The analytical framework discussed above refers to pre-decisional processes. Another important element of the decision-making process, which is often undermined, is the post-decisional situation. What does the decision-maker do after a decision is made? This is an issue of great importance when decisions are related to the livelihood of the people involved.

The decision-maker does not close his/her mind from all the processes gone through to arrive at this decision. The original situation is always revisited by comparing it with the new situation. Social learning plays its role by showing what others do in similar situations. What have they gained or lost? Such questions run through the decision-maker's mind with repercussions to the ongoing practices depending on his or her attitude. When the decision-maker's evaluation is consistent with previous evaluative frames of reference, s/he will choose to continue with the new practice or idea. Otherwise, it may be modified to suit his/her needs, or rejected altogether, going back to the original practice. Similar action is taken for emerging issues that are related to this decision-making. This process is explained by the cognitive dissonance theory coined by Leon Festinger (1957) (cited in O'Keefe, 1993).

Dissonance often consists of two clusters of elements, which on the one hand reflect a set of favourable cognition to the decision made and on the other a set of unfavourable cognition. The degree of dissonance experienced depends on the proportion of these two sets of cognition and on the importance attached to either sets by the decision-maker. Consequently, a reduction of dissonance requires information to change the relative proportion of the two knowledge bases and/or to reverse the importance attached to the cognitive elements involved in the decision-making process. Unless dissonance reduction is carried out at the right time, there is a possibility that *regret* takes place as a post-decisional cognitive process that might reverse the decision made. This signifies how practice influences the decision–making process as indicated by the backward arrow from the practice to the rest of the elements in Figure 3.1.

The array of variables indicated above shows potential determinants of local level decisions. For instance, local level institutions have to react to the directives of the formal institutions on resource use, on obligations or rights of citizens, etc. As the clusters of factors are closely interwoven at the local level, change in one cluster would sooner or later affect the other clusters. The pace at which effects on other clusters may be observed depends on several factors and tends to vary from community to community within and across farming systems. The crucial element is the adaptive nature of the social system (Gold, 1980; Bartels, 2002). Adaptation in this case assumes the establishment of a new social equilibrium, which is in the process of a continuous change to form yet another equilibrium and so on, leading to a dynamic system. Similar trends take place when the force of change emerges from within the local system and apparently affects the 'upper' level systems.

The analytical framework is used to examine the landscape of each study area in a historical perspective. At the household level, it shows why one household differs from the other in terms of its land-management decisions. However, there are broad overlaps on the choice of land management among certain households with others who share common objectives and constraints, whereas farming systems exhibit more pronounced variations with respect to land-management practices. In addition, the analytical framework reflects the roles of human beings who make decisions as situations are unfolding. This makes the issues of land management a social phenomenon – a socially constructed process and outcome - in the sense that people adapt to their environment owing to their cognitive abilities, which help them to learn from day-to-day environments that largely result from human actions. Learning changes human behaviour because of new insights about the environment. Once again the backward arrows in the model indicate this spiralling relationship between factors that affect farmers' resulting behaviour.

In conclusion, this chapter discusses theoretical debates and empirical studies from which the research questions in this study emerge, and which enabled me to suggest the analytical framework (see section 3.9) for the case studies.

Research question 1 ('What are farmers' responses to the introduction of SWC measures?') links to the discussion on planned changed and development intervention (see section 3.3). Together with the discussion on indigenous knowledge (see section 3.5), this allows me to lay the basis for comparing technical interventions in chapter 6 and 7 (and their drawbacks) with indigenous practices in Chapter 5 of this study.

The focus of research question 2 on farmers' knowledge of and attitudes about soil erosion and SWC relates to discussions on indigenous knowledge (see section 3.5) and to the link between attitudes and behaviour (see section 3.7). Of course, rural peoples' knowledge is not limited to local knowledge only, particularly given current communication channels and intensity. However, under the specific conditions of my research areas, local knowledge plays an important role in land management as the case studies in Chapters 5, 6 and 7 will show.

My third research question deals with what farmers do to conserve soil and water on their farms. This shows how the academic Boserupian versus Malthusian debate (section 3.2) is mirrored at field level in farmers' current land management practices, showing them to be adhering to the 'Eco-dynamic' school, the 'land degradation' school, or otherwise. An overview of the case studies in this respect is presented in chapter 8.

Research question 4 emerges from the presentation of existing empirical studies (section 3.8), in which I summarise where current thinking had reached and to which my study contributes. My answers to question 4 on the determinants of SWC practices among small farmers within and across socio-economic and agro-ecological environments are also informed by theoretical insights on the link between attitudes and behaviour (section 3.7).

My analysis of the empirical material of the three case studies, within the context of the theoretical perspectives presented in this chapter, allow me to answer my fifth question of how constraints to promote soil and water conservation can be overcome.

I wish to stress the importance of a farming systems perspective and social learning. Systems thinking allows us to see how one level of analysis is contextualised and embedded in the larger systems, depending on the scale of analysis. More importantly, it shows the coupling of the hard biophysical component and the soft social and institutional components when we deal with land-management considerations, e.g., soil and water conservation. Therefore, a farming systems perspective helps me to examine different issues related to soil and water conservation within and across farming systems. The idea of social learning (see section 3.6), as a process that facilitates the construction of knowledge in the society through joint learning also cuts across all five research questions of the study. For example, it helps to explain farmers' reactions to the external interventions and how they construct and share indigenous insights.

The next chapter discusses the core of the field methodology used to operationalise the analytical model presented in section 3.9.

4 Research Methodology

4.1 Introduction

This chapter presents an overview of the field methodology and related issues. The overall framework of the study is the case study research as presented by Yin (1984). It consists of qualitative research and quantitative survey research. The data collection process was divided into two phases. Phase one entirely dealt with qualitative methods, while phase two focused on the survey methods, though the qualitative data gathering continued until the end of the fieldwork.

Section 4.2 presents an overall design of the study. The preparatory activities for the fieldwork are presented in section 4.3. This is followed by an overview of the qualitative research methodologies in section 4.4. The survey research methodologies are outlined in section 4.5. Section 4.6 presents the experiences concerning compensation to the communities involved in the field research.

4.2 Overall design

The study presented in this thesis made use of a golden opportunity to assess the impact of a major soil and water conservation effort in Ethiopia upon its termination, the Soil Conservation Research Project (SCRP). This project was implemented in six research sites that introduced and evaluated the technical impact of soil and water conservation measures that were largely established through food-for-work programmes to motivate local farmers to implement the measures on their land. In order to make use of this opportunity I selected three case study areas: Two from the SCRP and one based on an indigenous SWC system.

1 *Wolaita* (Chapter 6): a relatively high potential area with deep soils, but high population pressure and high rainfall, and hence high erosion, in southern Ethiopia where the SCRP had carried out a particularly interesting experiment. It picked one micro-catchment (with 92 families) and introduced, through food-for-work, all the anti-erosion measures possible, though focused in particular on establishing bunds on farmers' fields. A neighbouring micro-catchment was used as a control site (with 89 families). All possible erosion control bunds in this latter area were forcibly removed. The sediment load and run-off from the two micro-catchments were monitored through a specially constructed device installed at the confluence of the streams in the two micro-catchments, with the main river (see Plate 6.2). My study uses as case study areas (a) the experimental micro-catchment (treated), (b) the control (untreated), (c) an adjacent catchment, and (d) a distant catchment site. Qualitative work was done in all these areas, followed up by a quantitative sample survey.
2 *South Wello* (Chapter 7): a relatively poor, famine-prone and degraded area in the north of the country where SCRP has carried out a major project in the Maybar catchment to introduce a variety of soil conservation measures. My case study simply studied the whole catchment without imposing any controls. The major purpose was to study the impact of the experimental project and the reaction of the local people to it.
3 *Konso* (Chapter 5): an area characterised by a farming system that is nationally famous for its indigenous soil and water conservation practices. Vast hillsides are covered by terraces and provide scenes not unlike those in the Northern Philippines (e.g., Ifugaos: see Gonzalez, 2000), Indonesia or other Asian countries. I studied this area to get some idea of what it takes for an indigenous farming system to pay serious attention to SWC. The case study in Konso has more of an anthropological nature since I wanted to understand the habits, labour deployment, institutions and spiritual dimensions of SWC in that area. In Konso, I did not follow a watershed approach, as I did in the other two case studies. I selected villages based on an exploratory visit I made in 1998, dividing the *Wereda* into two areas, namely an area characterised by a hand-tool farming system and one based on ox-ploughing.

These three case studies form the empirical base of my study. The choice means that I have operated on different system levels. In the first place, I operate at the case study level, comparing the three different case studies. In the second site, in Wolaita, I compare the four different areas, the treatment area, the control, the adjacent and distant watersheds. In the second place, I compare households (i.e., household heads) with respect to their attitudes, knowledge on soil erosion and SWC on one hand and their practices regarding SWC on the other. I have spent considerable effort to operate also at the field or plot level. The way farmers systematically treat different plots is sufficiently different to warrant this effort.

The overall design used is therefore a case study approach, where case studies were selected to provide me with as wide a range of insights into farmers' SWC behaviours as possible in order to answer the research questions (see Chapter 1). Within each case study, I have conducted quite a major study devoting 1.5 years to qualitative work during intermittent visits to the three areas, and following this up in Wolaita and South Wello, with sizeable quantitative random samples with questions based on the results of the earlier qualitative work carried out.

Below, I explain in greater detail the methods of data collection I used in the study. In each chapter I will further provide details of the methods followed in each case.

4.3 Preparatory activities: exploratory visits, meeting communities and field staff

In order to gain better insight into the selected sites, the researcher visited all of the study areas for a period of two to three weeks. The first visits targeted the entire zones to develop an understanding of the broader farming system, and the institutional and economic environments. Contact was made with the bureaus of Agriculture in study regions, followed by visits to zonal and Wereda offices. During these visits, extensive discussions were held with key individuals to learn about the general picture of the agrarian system, major problems, types of interventions, areas of focus, etc.

Subsequently, the researcher became acquainted with the SCRP research stations and identified the watersheds to be included in the study. In the process, the researcher was introduced to the community and the grassroots workers.

4.4 Qualitative research

4.4.1 Group interviews and selection of individuals

Group interviews

Group interviews and focus group discussions were used depending on the nature of information sought. Focus group discussions included; the elderly, participants and non-participants in SCRP research and school drop-outs who had become full-time farmers.

Group interviews were set up progressively through the first study period. Attempts were made to develop a rapport with the community through short informal discussions that did not focus on taking notes. These discussions deliberately took place in the usual public meeting places in the village. Sometimes, people gathered while an individual interview was in progress. Looking at the composition of the voluntary audience, topics of a more general nature rather than focusing on the household level were introduced for discussion. In this manner, efforts were made to show the purpose of the study to the community. The informal group discussions were useful for identifying key informants and participants in group interviews. Names of some participants were also suggested by other participants and extension agents. Transect walks at an early stage of the fieldwork and visits to individual farm plots were good opportunities to meet community members and to become acquainted with the diversities of the land-management practices in each of the farming systems.

Selection of individuals

Individual interviews during this phase were *exploratory*, but also *explanatory* in the sense that people were directly providing their *explanations for actions*.

A thorough understanding of farmers' decisions was achieved through *farm-plot sampling* rather than per farmer, as is commonly done. The idea of *farm-plot sampling* emerged in the field during the exploratory visits of the study areas. Some degree of variation was observed among farm plots in the selected watersheds. Some farm plots have well-constructed, tall stone or soil bunds while the adjacent ones have no, or poorly maintained, bunds. Some bunds have vegetation cover, while others do not. Some farmers have removed bunds or shifted their original location and so on. In addition, it was learned that one household treats his/her plots differently for various reasons (distance from home, gradient, availability of construction materials). Looking at such variation under more or less similar biophysical conditions, the researcher found it more informative to use the farm-plot as a sampling unit during the qualitative phase.

Individuals were identified based on variations observed in the farm. Field assistants identified the owners of the selected farm plots. Efforts were made to include as much diversity as possible.

4.4.2 Methods of data collection

Discussions with managers and experts at various levels in both government and non-governmental organisations were held with the help of key questions on the topical areas. The methods of data collection discussed below refer only to group and individual cases identified according to the procedure outlined above.

Narrative interviews

Narrative interviews were used mainly with groups. Interviews with the elderly began with historical events and converged on the contemporary development problems. The researcher began the interview with a brief outline of major topical areas. Details of the interview questions were formulated from responses of the group. Discussions were allowed to take place to reach a consensus on dates and particular events of importance. Major historical landmarks were provided to facilitate the narration and to help recall details. Such interviews were held for two to three hours depending on the resourcefulness of the group. After the first narrative interview, the researcher thoroughly examined the field notes and formulated further questions to fill the gaps during the second round of interviews that shortly followed the first round. During the second interview, unique issues were explicitly clarified to ensure the correct interpretation of the message. In limited cases, more visits were required if comparable responses were not found from a similar group elsewhere in a given case study area.

Formulating the questions during the first and second rounds of interviews on critical gaps have enabled the researcher to gather adequate information on the topics of interviews. A historical background of each farming system was achieved through this process.

Group interviews on contemporary issues were usually completed in one session. Additional issues were treated during similar group interviews in each area. Group interviews in a particular site were finalised when variations of responses on issues initially considered and those that emerged during the session nearly converged or reached a point of saturation.

Semi-structured interviews

Semi-structured interviewing was the major instrument to gather information from individuals selected through the *farm-plot sampling* technique. Some questions were prepared during the preparatory phase of the study. The field guide prepared on the 'researcher's desk' was a general field guide. It was based on preliminary ideas and concepts conceived from literature reviews and the personal experience of the researcher. The field guide was enriched through discussions with experts in the field, exploratory visits and observation of the research sites. The interview schedule was periodically improved in light of the insights obtained in the course of the 18-month stay in the home country. It should be noted that visits to each research area were carried out one after the other.

Key informant interviews
Key informants were used at a later stage of the study on a few issues of which adequate information had not been acquired from the other informants. Key informants were used for generation counting [16] in Konso and community-based organisations in Wello.

Observation
The researcher periodically visited the specific research sites and the wider agrarian system in which they are situated during the course of the year and a half of the first field research period. This involved both dry and wet seasons in 1998, 1999 and 2000. During these periods, he was able to learn several things by observation. Issues that emerged from observation were used to guide interviews and discussions with people of each study area.

Transect walks and visits to individual plots created opportunities for observation. Closer observations were made in selected fields where measurements on a few physical and biological characteristics of the farm plots were carried out (see below).

Measurements
Biophysical data used in this study mainly come from secondary sources. However, seven parameters that were found to be desirable for clarifying qualitative observations and responses from the community were measured during the course of the first field period. These parameters are: slope, altitude, bund height and width (where applicable), tree and shrub counts, and plot size.

4.4.3 Methods of data analysis

The type of data analysis depends on the type of data itself. There are different, less structured methods of data analysis for qualitative research. *Grounded theory* commonly uses coding, technical memos and diagrams to systematically scrutinise the data from time to time (Strauss and Cobin, 1990). Yin (1984) also suggests data analysis techniques that are suitable for case study research. These are: pattern-matching, explanation-building and time-series analysis. Crabtree and Miller (1992:17-18) categorise data analysis strategies along a continuum. At one end of the spectrum, they see some techniques of analysis as 'objective' in the sense that they tend to isolate the researcher from the object of the research, towards the other end, techniques exist that are subjective, experiential, context-dependent, existential, interpretative, and generative.

In this study, data collected with qualitative methods were subjected to in-depth analysis using codes, pattern-matching and explanation-building as deemed necessary (Yin, 1984). Then different categories were created according to the objectives of the study. For example, land tenure, SWC practices, soil fertility, labour organisation, etc., The categorised information was used as a pool of information for writing up the different sections where applicable. Note that these categories were used to guide the data collection process too.

16 The Konso people have ceremonies whereby the shift of social responsibility passes from one generation to another. Each generation is marked by a stone, which lies half buried in the ground at the location specified for this purpose.

4.4.4 Field assistants

At each site, two assistants who know the community and the agriculture in the area were selected to provide assistance during each visit to the site. The individuals were either high school students who quit their studies for several reasons, or employees of the SCRP/Ministry of Agriculture. In Wolaita, a high school graduate who became a full-time farmer was used, whereas in Konso, a senior employee of the Ministry of Agriculture, who graduated from Alemaya University of Agriculture with a Bachelor of Science Degree in Plant Sciences, was used as a field assistant. The Konso assistant was also assisted by a senior employee of the Department of Agriculture who has insight into the local culture.

Assistants in Wolaita and Konso were also employed as interpreters of the local language, even though people who speak the official language of the country were also often encountered, particularly in Wolaita. Language was not a problem in Wello as the researcher speaks the same language.

4.5 Survey research

The survey research was conducted in two of the three cases selected for this study. These were Wolaita and Wello. Its main purpose was to provide further insights into variables identified during the qualitative phase. The variables used in the survey instruments were tested through semi-structured interviewing in each location. The two sites were selected due to intensive research and extension interventions having been carried out in soil and water conservation, among other practices.

4.5.1 Secondary data

Data/information at the macro and meso levels provided mainly secondary data. These data were gathered at various levels ranging from the federal to the smallest administrative unit of the Peasant Association. These sources of information include: research and extension organisations, authorities dealing with statistics, NGOs and Peasant Associations.

4.5.2 Design of the survey

Units of study
The units of observation were the selected watersheds in the case study areas, whereas the unit of analysis was the household, its members, farm plots and livestock.

Sampling frame
The sampling frame for the survey was developed from a list of farmers who own farms in the watersheds where the exploratory study had been carried out (see Chapter 6 and 7 for details).

Sampling technique
A two-stage cluster sampling method was used in Wolaita, while simple random sampling was used in Wello. The variation in sampling technique is partly due to the experimental design of the SCRP and partly the nature of the research investigation (See chapters 6 and 7 for details).

In Wolaita, the objective was to assess possible variation among the watersheds included in this study consisting of four sub-samples, whereas in Wello, only one sample was involved.

Sample size
The sample size was determined taking into account the degree of heterogeneity in the population with respect to soil and water conservation practices. Accordingly, 107 and 231 individual interviews were carried out in Wello and Wolaita, respectively.

Survey instrument
A structured survey questionnaire was used to collect the data. Variables included in the questionnaire were identified during the exploratory phase.

Use of enumerator
Unlike the exploratory phase where the researcher alone conducted the interviews and observations, enumerators were used for this phase, following an intensive training course and critical assessment of their performance during peer interviews, researcher interviews (role play) and finally, a pre-test.

Methods of data analysis
The study employed both qualitative and quantitative research methods. The Konso case study emphasised qualitative methods and secondary data, while in Wolaita and Wello, both types of data were applied. The statistical analyses used were: descriptive analysis, measures of association, the general linear model (univariate, post-hoc multiple comparison), and non-parametric statistics (chi-square test and Kruskal-Wallis analysis of variance).

4.6 Compensation of the community

Nowadays, some communities are expecting remuneration after an interview. This practice was introduced by western researchers who conducted research under great time pressures, which compelled them to do anything to get their interviews - virtually buying them. However, researchers using local funds, or funds administered through local channels can hardly do this.

The expectation of the community also varies from place to place. In this study, the Konso and Wello areas were found to be more demanding than Wolaita. Konso is now a touristic site and en route to the south where tourists have introduced cash payment for everything. The Wello site has developed this expectation due to research fatigue from foreigners and externally funded local researchers.

In principle, the researcher has no objection to compensating the community members for the their time and efforts contributed to the research process. However, as the ultimate owner of the history and knowledge of the natural resources and agriculture in a given area will be the community, the researcher preferred to contribute to the collective services rather than paying individuals who participate in group or individual interviews. In his view, providing some collective entertainment in accordance with the local social practices will help to develop a greater rapport with the community than monetary handouts. In the end, a small grant was transferred to the community-based organisations in Wello site and the provision of social entertainment (local drinks) in Konso and Wolaita. In addition, a token amount was paid to individual farmers at the end of the study period.

5 Society and Indigenous Soil and Water Conservation in Konso, Southern Ethiopia

Abstract

Notwithstanding the introduction of modern practices over the last forty years at least, indigenous land management is the major feature of Ethiopia's agriculture which is said to date back over 2,000 years. Land management in Ethiopia has evolved into various farming systems with different levels of intensification. The indigenous agricultural system in Konso was studied with a focus on soil and water conservation. The level of intensification in Konso shows a practice that is far ahead of the Boserupian thesis. It is characterised by stone-based terraces and well integrated agroforestry practices. It has existed for at least four hundred years. The strength of the system is the embodying culture and its institutions that foster this kind of agriculture. More specifically, its organisation of labour, indigenous population control methods and system of governance that protect the farming system have allowed this system to thrive. The uniqueness of the location makes its methods less applicable to other areas, yet it is an exemplary situation that can give a boost to conservation attitudes of other cultures. In spite of such a legacy, Konso's terrace-based agriculture is showing signs of deterioration due to the alteration of its internal and external driving forces: mainly, the abolishment of the population control methods, integration into wider markets and institutions, and the shortage of rainfall. The study concluded that the continuation of livelihoods in Konso now requires heavy external support to ease the pressure on land, by promoting irrigation and developing valleys for agriculture.

5.1 Introduction

The Konso people live in southwestern Ethiopia, in the former Gomu Gofa province. They are well known for their stone terraces [17] that are believed to have existed for over four hundred years. In spite of external interventions, the system has maintained its characteristics, albeit, with its own pace of dynamism. In appreciation of their contribution to natural resources conservation, the United Nations extended an award to the Konso people. In addition, Ethiopian Scientists (mainly, Anthropologist/Sociologists) and their associates are preparing to present Konso as a candidate World Cultural Heritage centre (Dr. Yonas Beyene, 2001, p.c.).

Stone terracing provides a typical soil and water conservation structure, covering most of Konso. There, land management is highly integrated and implemented within watershed development, not easily replicable elsewhere. Hill treatment is initiated from the bottom of the valley to the peak. These stone terraces have been built from internal motivation and institutions, and from the personal experience of the Konso people without any external influences or forced labour programmes. In a nutshell, this system has produced an architecture that was developed in a particular landscape and institution. Explaining the uniqueness of Konso's terraces, Hallpike (1972:21) writes: 'perhaps nowhere else in traditional Ethiopia has the hand of man so impressed itself on the landscape as in Konso.' With an exception of Watson (1998) who brought a new insight about land tenure in Konso, previous studies have not adequately addressed the interrelatedness of the social and technical dimensions of agriculture in Konso (Meseret, 1990; Ambron, 1984; Teferi, 1992; Kruger, *et al.*; Otto, 1994).

Konso's agriculture has received wider popularity both in Ethiopia and to some extent internationally. Unfortunately, there is little understanding on how to undertake measures that help to restore its internal dynamics. The major reason for this misunderstanding is lack of information on the genesis and processes of Konso's agriculture.

This chapter presents Konso's agriculture in its broader context. Its emphasis is on farmers' land management behaviours and their institutions. The key questions are: How did Konso's land management emerge and survive up to now? What is the knowledge base for this land management? What institutional supports are behind this knowledge and the practices? What are mechanisms of social learning among the community members? Can we adapt Konso's experience elsewhere? What are the current situation and future prospects of Konso's agriculture?

A description of the study area is presented in section 5.2 followed by a methodology in 5.3. The socio-economic situations and an overview of the production systems are discussed in 5.4 and 5.5, respectively. With these current backgrounds, the chapter goes on to the historical roots of the Konso people and their institutions. Thus, origin and identity (5.6), basis of social differentiation (5.7), land tenure (5.8) and local institutions (5.9) are discussed subsequently. Following that, section 5.10 presents the different forms of labour organisation in Konso. The place of beliefs, institutions and social learning in Konso's agriculture are examined in 5.11. Thereafter, the chapter discusses at length farmers' knowledge, land management practices and problems in sections 5.12 and 5.13. Finally, the conclusion is presented in section 5.14.

17 Note that terrace is used in this chapter to indicate the physical conservation measures that have already attained a bench-level status as opposed to the soil/stone bunds in chapters 6 and 7 that were designed to increase in height slowly (slow-forming bunds).

5.2 The study area

5.2.1 Location and population

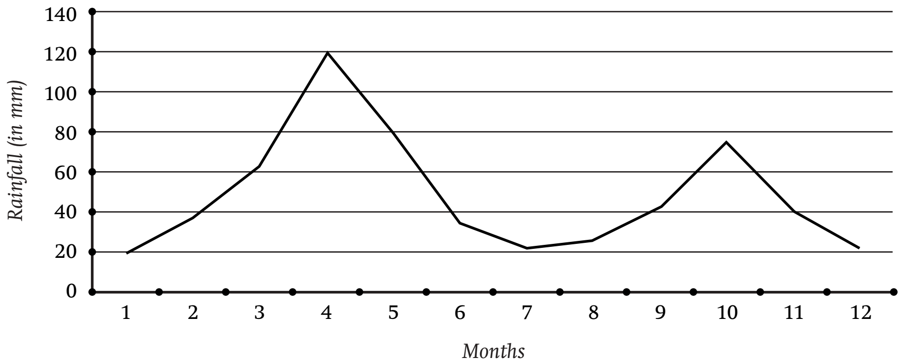
Konso is located in the Southern Nations, Nationalities and People's Region (SNNPR), in south-western Ethiopia (see map 1 in chapter 2). It is located south of Lake Chamo at about 85 km south of *Arbaminch* Town (the capital of the former Gamu Gofa province). According to the current administrative classification, it is a special *Wereda* accountable to the Regional Administration in Awassa, about 350 kilometres away due northeast. It covers very ragged terrain with little available flat land. The altitude of Konso varies from 500 masl in the lowlands to 2,000 masl in the highlands.

The population of the *Wereda* is estimated at about 200,000. Its growth is said to be remarkable during the last few decades. About three decades ago, the population of Konso was about 50,000 (Hallpike, 1972). Possible reasons for the population increase are: the abolishment of the traditional marriage-age restriction system *Fereyuma* (see section 5.9.1) and improved access to modern treatment, particularly after the commencement of the Norwegian Evangelical Church in 1954. The total land area of Konso is estimated at 2,430 square kilometres (Bureau of Agriculture, 2000). The population density of the *Wereda* is 82 persons per square kilometre.

5.2.2 Climate

Rainfall: Rainfall in Konso has a bi-modal pattern (NMSA, 2000). It is higher during the *Belg* season (March to June) than in *Kermt*. The latter occurs from September to November (Fig. 5.1).

Figure 5.1: Mean monthly rainfall in Konso (1971-2000)



Source: Data Base, Ethiopian National Meteorological Service Agency (1971-2000).

Moisture is perhaps the most limiting factor of production in Konso. Farmers in all corners of Konso mentioned that lack of moisture is a principal cause of poor production and crop failure. The average annual rainfall for 29 years is 551-mm. Decade-wide average rainfall are 464, 476 and 685 mm for the 1970s, 1980s, and 1990 (includes data for the year 2000), respectively. The minimum total rainfall record in 29 years is 210.6 mm which occurred in 1984, the recent great famine year in Ethiopia. Apart from total rainfall, the erratic nature and skewed distribution of the rainfall caused crop failures for three consecutive years (FARM-Africa, 2001).

Temperature
Konso has warm to hot temperatures that range between 12 to 33 degrees centigrade. The highest average maximum temperature is 32.7 degrees, which occurs in the months of February and March. The lowest minimum temperature is 12.2 degrees centigrade, occurring in the months of June to August.

5.2.3 Soil

There are six major soil groups in the Konso *Wereda*. These are Eutric Regosols, Lithosols, Chromic Vertisols, Eutric Nitosols, Chromic Luvisols and Eutric Fluvisols (Kelsa, 1996). Konso is one of the areas in the Southern Nations, Nationalities and People's Region, classified as highly degraded (Tefera, 1996). As will be shown later, the conservation effort of the people is unprecedented.

Farmers identified the following soil characteristics [18] based on their functions:
1 *Bolbolta*: brown soil from alluvial deposits with good depth.
2 *Borbora*: black vertic nature that sticks between the fingers when wet and cracks when dry. It is difficult for farming tools to penetrate though the depth is adequate.
3 *Kelkelita*: reddish, slightly sticky, resembling Borbora, but cracks less. It has a good depth.
4 *Ateta*: grayish (ashy) with fine texture.
5 *Tahita*: a mixture of sand, rough texture.
6 *Amata*: soil with a mixture of stone.
7 *Mokosha*: white in colour and very shallow soil due to erosion.

5.2.4 Research and development interventions

Konso, like many marginal areas in Ethiopia, has been isolated from most development interventions. The most notable ones are the development programmes of the Norwegian Evangelical Church that began in 1954. This religious institution has supported a number of projects for the development of the Konso people on its own and in collaboration with the Ministry of Agriculture. Even though several experiments mainly on cropping were initiated under the auspices of the Ethiopian Evangelical Church Mekane Yesus, agriculture in Konso still has a long way to go to achieve food self-sufficiency. Recently, other NGOs, such as FARM-Africa initiated a capacity-building project in the area. By and large, Konso has so far attracted more anthropological and archaeological researches than agricultural research.

5.3 Methodology of my study

An understanding of indigenous agriculture in Konso requires a historical journey back into their history. Historical analysis helps us to understand the nature of the indigenous institutions, how these institutions shaped their production systems and the general landscape. However, this chapter does not attempt to provide the ethnographic accounts of the Konso

18 Note that farmers in different villages use different names for the same soil characteristics, which is common in a local classification. For instance, Tahita's description in Gamole fits that of Ajaita in Buso. Therefore, care must be given to the description as one moves from one village to the other.

people that is extensively dealt with by Hallpike (1972), using classical anthropological field methods. What is examined in this chapter is the link between the institutions and agriculture, and more specifically, soil and water conservation.

This study covers the entire Konso special *Wereda*. In line with the specific research questions mentioned earlier, the farming systems in Konso were first assessed to determine the villages for study. Accordingly, the entire Konso was divided between hoe-farming and ox-plough cultures (see 5.5). Following that, major villages were selected in these settings. In the hoe-farming culture, *Buso*, *Gamole*, *Gareti/Doketu*, *Kolme* were selected. *Turo* area was selected for the ox-plough culture. In the previously mentioned study (Hallpike, 1972), these villages were also classified in their geographic locations, with *Buso*, *Gamole* and *Gareti* in the East, while *Kolme* and *Turo* are in the West and North, respectively.

A local staff member of the Office of Agriculture in Konso with a B.Sc degree in plant sciences assisted in facilitating the fieldwork and in the interpretation of my communications with the local people.

Data collection was carried out with the help of a range of qualitative and quantitative methods. These include: historical interviews, key informants' interviews, individual and group interviews, measurement observations, and secondary data.

The interviews began with a few key questions, elaborating on different issues. Emerging issues were discussed until a point of consensus or saturation was reached in a given village. Following each interview, the researcher reviewed the issues raised and prepared relevant questions to be raised in that village. The key questions raised in one village would then be raised in the next village as well, as meeting with one village is not necessarily consecutive. When new issues emerged in one of the villages, another round of visits was carried out in the previous villages to get their views on those issues. In this manner, 'ground truthing' was carried out throughout the qualitative phase. Individual interviews were carried out with a non-random sample of 24 farmers. Key socio-economic questions were administered to get an overview. Measurements were carried out for terrace length and field plots.

Observation was an integral part of the entire fieldwork. For better opportunities, I travelled over the testing hills of Konso under the blazing sun, encouraged by women and children transporting manure to their fields. As noted in Chapter 4, a formal survey was not carried out for this case. Instead, information from other surveys were used when appropriate.

The collected qualitative data were then entered into the computer, seeking patterns in the written text. Thereafter, information on similar issues was found with the help of a word processor by creating further patterns and categorisation of the text. This report is the result of such a process.

The formal interviews with the 24 farmers (non-random) were summarised and were included in relevant sections to support the qualitative information in addition to the secondary data sources.

5.4 Socio-economic situation

According to a recent survey (Eyob, 2000)[19], average family size was 5.7 persons. Sex composition was nearly equal. Based on the non-random sampling of 24 farmers, the family size ranges from 3 to 12. Large family size often occurs among farmers who marry more than one wife.

19 Note that this survey involved 2490 households in 11 PAs in the Konso special Wereda.

The majority of the rural families is illiterate. School enrolment was attended by 15% of school-aged children (Eyob, 2000). Children enter school at a late age and then quit for various reasons.

Prior to 1954, when the Norwegian Evangelical Church started its Christian mission in Konso, most of the Konso people were atheist. Even though the Ethiopian Orthodox church started operating in the area since the late 19th century, its followers are few as compared to that of the protestant church. The proportion of protestant Christians was 51% of the population, followed by atheist (35%), Orthodox (11%) and 3% Muslim and others (Eyob, 2000). Nowadays, there is a strong religious movement among the Christian churches due to a sort of competition between different branches. This movement is penetrating the traditional labour organisation and mutual assistance mechanisms.

Farming is the main source of livelihood for the majority of the Konso people. Additional sources of income are obtained from weaving, bee-keeping, trading, sale of forage and forest seeds, local brewing and meat retailing. In the past, weaving was restricted to craftsmen. However, since the incorporation of Konso into the northern state in 1897, weaving is carried out by cultivators as well, while craftsmen received access to land by purchasing it and through a local network. Of the total of 2,490 farmers, 23% participated in daily labour and trade (Eyob, 2000). Daily labour is mostly obtained in the rural areas in the form of *perga* (section 5.10).

Average land size is 0.9 ha, for those who own one plot and 1.5 ha for those who own more than one plot. Average cereal production is 0.5 and 0.3 t ha^{-1} for *Belg* (main rainy season) and *Mehir* (short rainy season) seasons, respectively (Eyob, 2000). Household variability in terms of socio-economic status goes back to the history of land acquisition, a system of inheritance that favours the elder son at the expense of younger brothers, and marginalisation of women from social, economic and institutional roles. Shortage of land in sufficient production often forces people to migrate internally or out of agriculture, usually to the nearby towns or large commercial farms. In a recent survey, Eyob (2000) reported a migration rate of 9%.

Konso is one of the food-insecure areas of the country. Growing food insecurity is partly rooted in the changes in the balancing mechanisms of natural resource utilisation. These changes are: increased population size, declining use of manure, expansion of bush farms without manure and conservation structures, shortage of labour, and short or no fallowing. Change of weather during the last few years has also contributed to the crop failures in Konso.

When crop failure occurs as in the case of 1999 and 2000, children and the elderly become the victims of famine and subsequent death. In order to save their lives, the EECMY Konso, Terapatic Feeding Centre admitted 602 children between October 1999 and December 2000[20]. Among these children, 4% died at the centre, 3% were referred to the hospitals while the remaining were rehabilitated and subsequently discharged from the centre. With the exception of five sets of twins, all the children were from separate families, which shows the extent of the severity of the problem in the entire community.

20 The data were obtained from the Ethiopian Evangelical Church Mekane Yesus Clinic, Konso.

5.5 Overview of the production systems

5.5.1 Crop production

Konso's agriculture is principally a sorghum-hoe-terrace complex (Westphal, 1975). This feature still dominates the majority of Konso today. However, there is also an ox-plough system at *Turo*, *Kolme* [21], *Gawada* and *Gomide* where the land is relatively gentle in slope. This distinction is often overlooked in the description of Konso's farming system.

Under favourable agro-ecological conditions, community food culture and rituals primarily determine crops grown. Besides, exchange values of crops play no less important roles in crop choices.

Plate 5.1: A typical terraced field in Konso

Konso farmers grow many types of crops. Crop diversity within small terraced fields is a remarkable feature of the cropping system (see Plate 5.1 for a typical terrace structure in Konso). The most common crops are cereals of which sorghum is the most important, followed by maize. No less than 20 varieties of sorghum are grown in the area. Other cereals include finger millet, teff and wheat barley. Cereals are often intercropped with pulses, among others, for risk aversion, soil fertility and land saving. Pulses grown in the area are: haricot beans, pigeon peas, lablab, peas, chickpeas and cowpeas. Owing to their drive to self-sufficiency, the Konso people grow fibre crops such as cotton. The use of cotton became popular after their clothing style shifted from skins to textiles some hundred years ago. The exchange of cotton with the neighbouring tribes was also important. The growing diversity of their food habits and knowledge of crop associations also led them to grow tuber and root crops such as yam, cassava, sweet potato and taro. Oil crops are also grown on Konso land; common oil crops are safflower and fenugreek. The warm climate of the area also favours production of citrus crops, though on a small scale. Some farmers have a few lemon, orange and guava trees. In addition, they also grow banana and papaya. Crop diversity, in a seemingly hostile environment also

21 The use of oxen for ploughing at Kolme is, unlike other places, in response to a labour shortage rather than suitability of the landform for the ox-plough.

favours the world's celebrated stimulant crop, coffee. The ritual practices and traditions in the society also call for the growing of chat and tobacco.

5.5.2 Farm tools

The major tools are: *sipilota pona* (metal tools for the dry period), *liwa*, *payra*, *panga*, and the ox plough. The major features and use of these tools are explained below.
The indigenous farm tools are displayed in Plate 5.2.

Sipilota: a digging stick with a metal tip used to uproot sorghum stalks during dry season. Because of the laborious nature of the work, this tool is mainly used by men.
Liwa: the same as sipilota, except smaller - it is used for weeding by both men and women.
Payra: a tool composed of wood, twin metal tips attached to short sticks. The sticks are wrapped together with leather string and finally tied with a knot together with the main wooden frame. This tool is used by both male and female farmers.
Panga: mainly used for cutting and slashing of shrubs and weeds. The panga is used by all members of the community.
Ox-plough: this tool is widely known in Ethiopian agriculture and as such does not need further description here. It was introduced after the incorporation of *Konso* over a century ago.

Plate 5.2: Farm tools used in indigenous Konso agriculture (from left to right; payra, liwa, panga and sipilota)

5.5.3 Livestock production

Livestock production has been part and parcel of Konso's mixed agriculture. The types of livestock commonly raised are cattle, goat, sheep, donkeys and poultry. Generally, the system lacks draught animals for transportation. Livestock are highly appreciated for their economic and ritual purposes. Unlike other parts of the country, the majority of Konso people raises livestock for manure and savings while traction is important in only some parts of Konso. Milk and butter are greatly used in the ritual services. Animal sacrifices that require a particular colour and sex encourage a close integration between livestock production and crop production.

There is a system of animal sharing [22] whereby poor families can obtain access to livestock, which also means access to manure. Of the total of 24 farmers interviewed, 38% were involved in animal-shared rearing. Cattle ownership ranged from none, to four oxen, cows and sheep, whereas the ownership of goats reached up to eight heads of animals per household. However, animal disease coupled with the present extreme shortages of forage, and grazing land have limited the production of livestock and thereby the availability of manure.

5.5.4 Forest production

Trees, like livestock, are an integral part of Konso agriculture for their ritualistic, economic, social and ecological services. Multiple uses of trees have led to different patterns of tree production and management. These are: natural vegetation, ritual forests, homestead forests, agroforestry and plantation forests.

Natural vegetation
This covers the remnants of trees in the high elevation areas that are not accessible to man, and bushes in the hot lowlands. Some of the bush land is being cultivated for bush farms while other uses are hunting, firewood and grazing.

Ritual forests
There are a few natural trees used for ritual services that are associated with the regional *Poqallas*.

Homestead forests
Konso villages have a remarkable tree cover. I was particularly surprised by the coverage of trees in the villages when I first visited Konso. The dominant trees grown are *Morinaga stenopetala* and coffee trees. Their presence is not surprising after I learned the importance of these trees to the daily diet of the community [23].

Agroforestry
The survival of Konso's agriculture is due to its integrated nature, which might not be the case if only stone terraces were used. This integration is partly realised with extensive use of agroforestry practices. The vertical and horizontal spaces are occupied by plant species that meet family dietary needs, and that are used for cash crops, apiculture, animal feed, shade for other crops and people, erosion barriers, soil fertility and as a farm boundary.

Plantation forest
Tree plantations began following the arrival of the Ethiopian Evangelical Church *Makane Yesus*

22 Animal sharing is common throughout Ethiopia. It takes place between two or more parties for mutual benefit. The donor provides an animal to the recipient who will tend it. The recipient will use the by-products and power of the animal in his or her custody depending on the type of animal. For instance, if it is a heifer, the first offspring may go to the recipient with a possibility to share the milk and butter. The second offspring would go to the donor and so on. The arrangement varies for different animals involved. It may even be sold to share the price according to the contribution of the parties.

23 The Morinaga leaf is mixed with cereals and cooked with water and served in a daily meal. Coffee leaves are boiled with milk and used as both stimulant and food.

(EECMY) in 1954. In the course of community development and rehabilitation programmes, EECMY has introduced exotic tree species. Some of these trees such as *Eucalyptus* spp, *Gravillea robusta*, *Accia cyanophylla* are now commonly seen around settlement areas and roadsides. However, their coverage hardly matches the efforts that have been put into their promotion in Konso.

Common trees species in Konso are: *Juniperus procera, Euphorbia spp Terminalia browenii, Olea africana, Ficus sori, Cordia africana, Sterculia africana, Accia abysinica.* Among these, *Juniperus procera* has a high significance in Konso's rituals (*Olahita*) and for its wooden statues (*Waga*). *Olahita* is an important part of the 'generation grading' system while the *Waga* represents an individual's achievement, for instance hunting successes, wealth, and the like (see sections 5.9.1 and 5.8, respectively for more details).

Wildlife is an integral part of the forest ecosystem. In the past there were large herds of large mammals such as lions, elephants, leopards, antelopes, wild pigs, gazelles, deer, wild goats and hyena. Except for the latter two, most of these animals have vanished by now. As a result, hunters must travel a great distance for the ritual hunting expedition. The disappearance of wildlife is one of the indicators for the expansion of agriculture and increased population density.

5.6 Origin and identity

The Konso people are one of several nationalities living in the SNNPR. They came to their present territory several generations ago. Earlier settlers arrived at Konso by different routes and often after interim settlement elsewhere. Their original settlement was based on families who later grew into clans. Individuals outside blood relations were also integrated into clan networks for access to resources and protection. Over time, those clans created the Konso nationality by maintaining their ancestral roots.

There are nine clans (kaffa) in Konso: 1) *Keertitta*, 2) *Paasanta*, 3) *Tokmaleta*, 4) *Eelayta*, 5) *Mahaleta*, 6) *Sawdatta*, 7) *Isalayta*, 8) *Arkamayta*, and 9) *Tikissayata* (Hallpike, 1972; Otto, 1994). Their settlement pattern is, however, not according to clan composition. These clans are exogamous, a practice that affects women's identity and access to resources and active participation in politics.

The Konso people have common ancestral roots with many neighbouring nationalities that are evident from their linguistic and cultural relationships. Earlier travellers and anthropologists documented these relationships (Cerulli, 1956; Hallpike, 1972). Hallpike (1972:3) in particular emphasised the linguistic similarities between the *Oromo* (*Borena*), *Gidole* and other ethnic groups in the area with the Konso. Elders know the origin of each clan leader passing down information orally from generation to generation. The oral tradition serves as a prominent means of information transfer in this society.

According to Cerulli (1956:51), there were Konso (and *Burji*) settlements in Kenya, in *Moyale* and *Marsabit*. Konso people still live in Kenya with their distinct culture (Yonas Beyene, 2001 p.c.). Recently, I learned that there is a large group of Konso and *Burji* settlers in Marsabit (Adeno Wario and Karen, p.c, 2001). Their settlement dates back to the colonial period in the early twentieth century. The settlement took place after the British colonial government agreed with the then Ethiopian government to allow the Konso and *Burji* people to start sedentary farming in *Marsabit* Mountain. The purpose was to supply food for the army and the civil societies instead of importing from interior Kenya. The sources added that sedentary agriculture was not common in that area at that time.

Looking at their present settlement pattern, one may wonder as to why their ancestors decided to settle here whereas they could have settled in a relatively fertile and flat terrain in the neighbourhood. From repeated group and individual interviews, I learned that there was little or no chance of settling elsewhere than the present land. There were territorial competitions among different nationalities to claim as much fertile land as possible. In addition, the fertile valleys were hot and infested with malaria. As a result, they resorted to their present place because of its cooler weather, reliable protection from enemies and a reduced risk of malaria.

5.7 Basis of social differentiation

Social differentiation in Konso is based on how early a person has settled, seniority (age) and gender. These elements have direct implication for one's access to resources and power in the society (Hallpike, 1972; Watson, 1998).

The early settlers had easy access to land (see section 5.8). They were believed to have subdued devils that resided in the jungle. As a result, they emerged not only as the landed social groups, but also as spiritual leaders, who came to be named *Poqalla*. *Poqalla*-hood is the highest rank and honour among members of the society (Hallpike, 1972; Otto, 1994). Over time, *Poqallas* emerged as clan leaders in the day-to-day socio-economic, political administration and in religious matters. Their religious role and image within the society is the basis of their power. They are believed to have been born with a special mark on their hands, speaking with messengers of God (Waqaa), making rain; removing curses from crops, livestock and people. *Poqallas* were central to the society's spiritual and material wellbeing. They were not only the gateway to peace, but also to prosperity as a source of land, for blessings for obtaining a good rainfall, a good harvest, good livestock husbandry and many children. After the formation of the *Xela* system of administration (section 5.9.1), which is a cross-clan system of administration, the *Poqallas*' political leadership turned out to be an individual merit rather than an outright position as during clan administration. However, their religious role and economic position continued as before the formation of the *Xela*.

There are three regional *Poqallas* in Konso, namely, *Quffa*, *Bamelle* and *Kalla*, who are responsible for *Fasha-Kolme*, *Gareti-Doketu*, and *Gamole-Turo* areas and their environs, respectively. Regional *Poqallas* emerged with growing rituals and political influence among the lineage *Poqallas*. These *Poqallas* are responsible for many villages irrespective of lineage. In addition to regional *Poqallas*, there are clan *Poqallas* whose responsibilities are to bless their clan. Hallpike (1972: 88) indicated that the number of lineage *Poqallas* in four villages, namely *Idigle, Buso, Degato* and *Gaho*, had a total number of lineage *Poqallas* of 113 at the time of his data collection (i.e., 1965 to 1967). The number of *Poqallas* who first occupied *Buso*, *Gamole*, *Turo* and *Gareti* villages was 12, 7, 11, and 18, respectively. From this figure, the ratio of *Poqallas* to the non-*Poqallas* has been very small. The *Poqalla*, however, transcends his religious role as recently illustrated by Watson (1998). Unlike previous anthropological studies (Hallpike, 1972; Ambron, 1984; Otto, 1994) that posited *Poqallas* merely as priests, Watson clearly showed the economic roles of *Poqallas* due to their access to land as earlier settlers.

In Konso, seniority is established at various levels. In the household, the first-born son has the privilege of taking the largest share of his parent's land. Unlike his younger brother(s), he stays with his parents to take over the family compound, whereas others have to settle in another place in the village. At the community level, seniority is established according to the generation-grading system (section 5.9.1). According to this, the junior grade (under 20 years), has no right to marry, claim resources nor assume responsibility in the community. The turning point in manhood starts with the entrance to the warrior grade at which point they can marry, assume social responsibility, and serve the community as a peacekeeping force. After the warrior grade, there is the elderly grade with sub-grades. The elderly mainly bless the warrior grade and the community on various ritual occasions (Hallpike, 1972).

In terms of gender, males have the upper hand over their female counterparts. Land is inherited by males rather than females. Females do not participate in most of religious ceremonies, political leadership nor in conflict negotiations.

The socio-economic consequences of the basis of social differentiation discussed above in the early days of Konso society is highly reflected in political power and the main resource, land. The following section discusses land tenure in Konso in a historical perspective to show its importance in land management.

5.8 Land tenure on a timeline

In view of its importance to explain the background of the strong conservation effort in Konso, land tenure is presented in three historical epochs. These are: 1) Prior to the incorporation into the northern system, 2) From the incorporation until the *Derg* Regime (1897-1974), and 3) From 1974 to date.

5.8.1 Prior to the incorporation

The establishment of land rights in Konso dates back to the time of influx of different clans and occupation of the present land territory. Land acquisition of different clan leaders is one of the important social decisions that shaped the landscape of Konso. Land acquisition used to take place through a practice of 'land burning' (see also Watson, 1998). The first person who came to a piece of land, lit a fire to burn the trees and bushes to turn it to residential and farm land. The next person who came to the territory also lit a fire and let it go out by itself, which subsequently marked his claim. The same practices took place for the following settlers. The fact that the fire was allowed to go out by itself was associated with God's (*Waaqa's*) will to allocate that much land to that family. Therefore, one's luck determined the coverage of the fire that in turn determined the land size. Some families opted for slash and burn [24], instead of burning the land. Owing to the land-acquisition system, some people came to have a smaller size of land than others. For instance, at *Buso* village, *Etigele* family had the largest land size, whereas the *Kayo* family had the smallest land size, all because of the coverage of the fire. Of course, not all *Poqallas* held land by fire. Most of the *Poqallas* in Buso held land by slash and burn, which provided a relatively smaller piece of land as compared to obtaining land by burning it.

After the original settlers occupied the available land, a new pattern of ownership began to emerge. The latecomers would obtain land from the original owners with the commitment to associate, respect, give gifts, and provide labour service to them during peak farming seasons. This way of access to land is called *Piyolada*, a term for 'borrowed land' from *Poqallas* in return for labour and other services. Borrowed land is not limited between *Poqallas* and non-*Poqallas*. The latter groups also exchange land, though there is a difference in obligation, for *Poqallas* have multiple roles in the community. Land acquired in this manner is not subjected to sell

24 Land claimed by slash and burn is called Fax land to denote the means of access.

or transfer to a third party. The original owner can claim it back whenever he so wishes because of: poor management of the land, failure to provide labour, and any act of dishonour to the owner.

The other form of access to land is through grants by *Poqallas* to the lineage members as sole accumulators of land for their clans. The land obtained in this manner is called *Kodeyata*. Such land can be sold or lent to, or inherited by children. These are rights exercised by the receiver because of lineage. *Kodeyata* is also given to non-clan members because of special relationships with *Poqallas*.

Children obtain land from their fathers whereby most land goes to the oldest son. As in many other societies, there is no land inheritance for women.

As private ownership of land was institutionalised in the society from the very beginning, land sales are very common. Because of this long tradition of a land market, the number of fields purchased by a man is inscribed on a traditional statue called *Waga*, in addition to his hunting successes, victories over his enemies and number of his wives. A cluster of stones indicates the number of fields one has purchased. *Wagas* are erected along public roads and near the entrance of the residential areas, which further conveys the message to the generation that follows (Metasebia, 1997).

The system of access to land in Konso ensures that everyone gets some land to start his living. Expanding the amount of land however depends on one's hard work, achievement and motivation, reflected in the land to be inherited to his children, which is also indicated on the *Waga*.

5.8.2 From incorporation until the Derg Regime (1897-1974)

Konso was incorporated in the northern system in 1897 by the Army of Milinik the second. Following the incorporation strategies of the system, Konso's local land lords, *Poqallas* were designated as local chiefs, and given the official names of the northerners, *Balabat*, to assume responsibility of the local administration, being accountable to the resident administrator from the north. Accordingly, they maintained their original lands, but transferred their right to claim the tribute and tax to the northerners. Because of their co-operation with the central government, most of Konso's *Balabats* maintained their traditional roles.

Apart from a few areas in the northwest that have relatively gentle inclines, there was hardly any land that attracted northerners to establish their clean field-cropping system (Amborn, 1984). They were less interested in the terraced and agroforestry land of the majority of the Konso people, which did not fit into their ideal image of a farm. They instead capitalised on the juniper trees for construction in the new administrative centre they created adjacent to the old Konso villages, now called *Bequale*. The rest of the trees were transported to other administrative towns in the north and east (Gidole and Chencha) by human labour, over a distance of approximately 80-120 km. Apart from that, the incorporation did not interfere with the religious and other local institutions. Of course, two Orthodox churches were established in the main settlement areas of the northerners.

5.8.3 From 1974 to date

After overthrowing the monarchy in 1974, the military Regime promulgated a radical land reform proclamation in 1975. The proclamation indicated that land belonged to the state, while it entitled each citizen with a maximum of 10 hectares of land for personal use. Like any other rural people, tenants were granted a usufruct right to till the land for which they had been paying a tribute to the landlords. In the same manner, *Piyolada* was claimed by the tillers against their indigenous land-tenure system. Since then, the production relations between the tenants and the landlords officially discontinued. This means that the *Poqallas*' role as a source of land for the junior lineage ceased with this change.

Following the land reforms, new formal institutions were established in rural Ethiopia, where Konso was no exception. These were Peasant Associations, Service Co-operatives and Producers' Co-operatives. The revolutionary leaders and students who participated in the 'Development through Co-operation National Work Campaign' dismantled the indigenous institutions and replaced them with the Peasant Associations.

In 1991, the military regime was in turn overthrown and replaced by a Tigrian-led, coalition force called the Ethiopian People's Revolutionary Democratic Front (EPRDF). The constitution of the new government stipulates that the land remains the public property while people have usufruct rights. As far as the fundamental land policy is concerned, there was no change since 1974.

In spite of changing land policies during the last hundred years or so, farmers in Konso still believe in private property of land. A common view on land is that 'land spiritually belongs to the *Poqallas*, as a property it belongs to the state, as for use, it is private' (see also Watson, 1998). In one of the group discussions, a farmer expanded this outlook on land as follows: 'Land belongs to the state. Below the state, it belongs to Kalla (one of the regional *Poqallas*). But, actually the land belongs to me. I got it from my father. When he generalised, he said, 'what was in my hand is mine.'

There is still a land market in Konso, though people do not declare it as it used to be. However, it is believed that those who sell land are weak farmers, as purchasing land rather than selling it is praised in Konso. The land category that is called 'Fax' land is readily sold because this land was obtained by slash and burn. It is common to use land as collateral. As long as the credit has not been paid, the creditor uses the land. When the land is *Piyolada*, sale is still not practised, because of the original ownership to a *Poqalla*. But, this land too is mortgaged under the guise of the name *Maresha*, meaning 'the plough', indicating, that it is not the land that is mortgaged, but the plough. In confirming the special treatment of *Piyoladas*, one farmer gave his own situation as an example: 'We received land from the Karpena family. In the past, we used to give them one leg of meat and one side of ribs each year. Even though we have stopped that gift-giving since the *Derg*, we cannot sell the land in spite of the state ownership of land because we know that the land actually belongs to that family.'

This section has shown that indigenous land tenure played an important role in perpetuating good land-management practices by ensuring the transfer of land to children, reflecting the economic, social and political status of the people. Because of this, borrowed land (*Piyolada*) has been maintained very well to continue the access to land. This is contrary to the land-tenure theory that is based on the western land-ownership pattern wherein, non-private lands are said to be mismanaged. The other important aspect of land tenure in Konso is that the northerners showed little interest in their land's topography and therefore their large tracts were not threatened by claims of the new landlords in the 1890s. Due to the special arrangement made by the northerners in leaving the land rights to the regional *Poqallas*, there was little alteration in the land-tenure pattern during the land reforms of 1975. Note that in other parts of the country, land that includes hills and forest which was transferred from the previous landlords to the tillers, suffered marked mismanagement when falling under public property. Therefore, the Konso case presents an example of a more or less stable land-tenure system over generations, which contributed to the continuation of indigenous land management even after the 1975 land reforms.

5.9 Local institutions: indigenous governance, its structure and foundations

5.9.1 The origin of indigenous governance

Ancestors of the Konso people who settled in the present territory had scattered settlements, segregated by their lineage due to the land acquisition system. Because of attacks from neighbouring ethnic groups, they came to settle in permanent villages. Each Konso village was autonomously administered by its own elected administrative council. The election procedure and constituencies of this council are discussed in section 5.9.2.

The system of governance was developed from the beginning of the Konso settlements until being replaced by the formal Peasant Association in 1974. According to historical interviews, the development of a common language began with the establishment of common rules [25].

Traditionally, gatherings were signalled by drums (*Timbas*) made from the cordia tree. In order to show their unification, two sacred drums were constructed from this tree, and named *Ketennas* for eastern villages and *Keeha* for western villages in all of Konso. In addition to these, there are village Timbas that serve the peace and unity of each village. Coming together was under the conviction of the spiritual drums - the binding forces of the Konso people. These drums have played and are still playing very important roles in the life of the Konso people. People still believe in the power of the drums. They symbolise the power of the mighty *Waaqa* (God). Prayers for rain and protection against pest damage are made with the drums. However, this does not mean that the society is always peaceful and harmonious. There are conflicts of various natures, ranging from individual to clan, to between villages. However, they have established a mechanism to reconcile arising conflicts in their own way. Various bodies take action to ensure that peace and stability in the community follow the symbolism of the spirit. The drum is like a switchboard in case of conflicts. Once the drumholder (*Apa timba*) and the peacemaker (*Nama dawra*) arrive at the place of fighting, both parties must refrain from further assault. This shows the importance of the social institutions in maintaining peace and order in society. These agents were the counterparts of the police in the modern peacekeeping machinery.

The rule of the elderly or the *Xela* or its delegation, is accepted in the community. Fines and ritual cleansing take place accordingly. If someone violates the ruling, he or she will not be permitted to borrow utensils or fuel from the neighbours. No-one will accompany a violator in fetching water, fuelwood, etc. If the person does not comply with the ruling, he/she will be expelled from the community, as the final stage.

Signifying how protection from an enemy was an important issue, villages were constructed on hillsides that guarantee protection from the three sides of the village, with the possibility that the fourth side can be defended. To this end, euphorbia species and other trees were grown for use as a fire extinguisher and to ambush an enemy who may attack their villages. This forest plot is called *Dina*. The growing of forest plots for defence and fire control is deep-rooted in the Konso culture. According to a local proverb, ‘a village without a *Dina* is like a woman without a dress.’

25 Language development among people who have come from different origins requires a detailed anthropological study.

In order to defend themselves from enemies, the villages have been concentrated in a few settlements areas. As a result, the size of villages often grow larger than the size of traditional villages in Ethiopia, and perhaps in Africa and elsewhere. Even during the time of Hallpike's study, the average size of a village was 1,500 people (Hallpike, 1972:27). Actually, Hallpike uses the term town, instead of village due to the large and dense population living within a walled settlement. With the population increase, new walls have been constructed around all the villages. Nowadays, the original site is fully inhabited, with rather too close compounds, and houses within compounds. As a result, some villages are encroaching into the traditional forested plots (*Dina*). Walled villages are a typical scene in Gereti, Gamole and Fasha areas. Turo settlements are relatively scattered and unwalled. The major reason is the lack of stone in the area. A section of one Turo village that was walled was destroyed during the war between the Italian army and an Ethiopian folk army called Fano. The latter targeted the village because of their co-operation with the Italians. As the remnant stones were eroded throughout the valley a long time ago, one can make the claim that there must not have been a single walled town in the area.

A continuous system of administration in Konso began with the establishment of *Xela*, an administrative assembly. This assembly is referred to as *Keladule Dhegeya* (literally, 'based on agreement'). It is elected from among people who have reached the *Xela* grade according to a generation grading system in Konso. The generation grading system is a typical feature of the indigenous administration. It defines an eligible age for leadership that is controlled by a mechanism called *Fereyuma*, as discussed below. Konso's generation grading system was initiated to ensure that children remained two generations behind their fathers. The main purpose of this restriction is to maintain the physical strength of men. Men are given important roles in Konso's political and spiritual world. They need to be strong in order to shoulder the societal responsibilities such as engagement in war, and withstanding rigorous labour demands in agriculture and hunting expeditions. The generation grading system practised in the eastern villages of Konso has seven grades (see Table 5.1). For a detailed treatment of this issue in all of Konso, see Hallpike (1972).

Table 5.1: Generation grading system in the eastern Villages, Konso, SNNPR, Ethiopia

Grades	*Fraida*	*Xela*	*Kat*	*Orshita*	*Qura*	*Qulula*	*Ukudeta*
Approximate age	< 20	20 - 36	38 - 54	56 - 72	74 - 90	92 - 108	100 - 126
Description	Junior age	Warrior	Elderly	Elderly	Elderly	Elderly	Elderly

The *Xela* system began its operation by dividing the cultivators in Konso, excluding the craftsmen, into two categories. The first group was named *Kalkusa* and the second, *Herpa*. *Herpa* and *Kalkusa* are *Xeltas*[26] that show membership in the administrative assembly (*Xela*). The first term of 18 years was given to *Kalkusa*. For this purpose, 16 families were identified for each *Xelta*. One *Xelta* is responsible for the *Xela* for 18 years. The families that began the first cycle held the symbol of the generation, *Timba*, for two additional years in addition to its own [term]. Therefore, the number of families involved in the circulation is 16 instead of 18. An example from one of the eastern villages (*Doketu*) that shows the list of families responsible for the *Xela* in each *Xelta* is presented in Table 5.2.

26 This refers to the particular generation that is holding the office term.

The western and northern villages have their own version of *Xelta* cycles. For example, Kolme, located in the west, practises three generation grades instead of two. These are: *Kalkusa, Melkusa* and *Herpa*. The generation shifts took place every nine years instead of 18. Some 150 years ago, they shifted every twelve years. At Turo (north), which shares a regional *Poqalla* with Gamole in the east, *Xelta* names are called *Xelpihayta* and *Perpihata* corresponding to *Kalkusa* and *Herpa*, respectively. The generation shifts takes place every five years instead of 18 years like in Gamole.

Table 5.2: Sequence of Timba circulation in Doketu between Kalkusa and Herpa Xeltas, Konso, SNNPR, Ethiopia

Years	*Kalkusa*	*Social Status*	*Years*	*Herpa*	*Social Status*
1-3	Pata	Poqalla	1-3	Telliyya	Poqalla
4	Kasimma	Non-Poqalla	4	Kaanparo	Poqalla
5	Pariyye	Non-Poqalla	5	Palette	Poqalla
6	Katto	Poqalla	6	Kompa	Poqalla
7	Koata	Poqalla	7	Pittitta	Poqalla
8	Porre	Poqalla	8	Taanta	Poqalla
9	Qura	Poqalla	9	Kema	Poqalla
10	Kajjo	Poqalla	10	Mareeta	Non-Poqalla
11	Sugta	Non-Poqalla	11	Puulla	Non-Poqalla
12	Lasha	Poqalla	12	Ashuma	Poqalla
13	Qaaja	Non-Poqalla	13	Karshammo	Non-Poqalla
14	Yimme	Non-Poqalla	14	Ullupa	Non-Poqalla
15	Robo	Non-Poqalla	15	Dinke	Dinke
16	Kerko	Non-Poqalla	16	Milee	Poqalla
17	Alexo	Poqalla	17	Telliyya	See 1-3
18	Jalule	Poqalla	18	Milee	See 16

The principle of generation grading was enforced by a system of *Fereyuma*, which forbade marriage until about the age of 30. The spacing between children and fathers was thus maintained through *Fereyuma*. Women who conceived before their marriage age were forced to abort, or as in the northern and western villages, they were expelled from the community. Sexual relations with one's senior opposite sex were a taboo, though older men sometimes married women who are their juniors. The other reason for *Fereyuma* was to control the situation whereby children and parents produce children at the same time, something that was believed to cause God to withhold rain.

In addition to *Fereyuma*, men's contacts with their wives were constantly kept under control by having to sleep in the men's sleeping quarters. The common belief was that men should minimise their sexual activities in order to cope with the heavy fieldwork and for war. Bearing a child before three years have elapsed since the last birth was also looked down upon though there was no sanction against such happenings. All of these practices have been abolished since 1974. The effect of *Fereyuma* on generation shifts is shown with the help of an example (Box 5.1).

During each *Xela* there are two *Karas*, hunting expeditions undertaken by the youth. This exercise is a crucial stage in manhood in the culture. For the *Kalkusa* group, *Kara* is done when

Herpa's Xela is at the end of its seventh year. The next *Kara* is carried out at the end of the 18th year. The same holds true for the turn of *Herpa's Kara*.

Box 5.1: Example of how Fereyuma works

> When will a child from Kompa family (see table 5.2) be allowed to marry if he was born when his father has already served in the *Xela* for seven years? Note that Kompa's family (*Herpa*) takes over the *Xelta* at the sixth year from the first family (*Telliyya*). Therefore, in his father's generation he has to wait for 11 years in the junior generation (*Fraida*, see Table 5.1). Then, the other *Xelta (Kalkusa)* takes over the *Xela* for another 18 years. After that, his generation takes over, but they have to wait for five years when the restriction to marry (*Fereyuma*) is removed. This ceremony is called, *Kenota*. Finally, marriage is allowed after the sixth year. In total, Kompa has to reach 35 years before he is allowed to marry and conceive a child. When Kompa's son enters the *Xela*, his father enters the *Orshita* grade. Accordingly, he remains two generations behind his father. The time for his juniors is shorter, depending on which cycle of their father's *Xelta* in which they were born. In some villages, e.g., Gareti, both sex are treated in the same way. In other villages, restrictions on women are rather relaxed as compared to that for men.

According to the generation grading, social organisation in Konso has a record of over 500 years (see also Metasebia, 1997). When generation shifts take place between *Kalkusa* and *Herpa*, the incoming generation erected a symbolic stone at a designated *Mora* (a 'sacred place') in the village, often the main *Mora*, but also the entrance to the village. This stone is called *Deka Diruma* (literally, 'stone of manhood'), for it is erected after the painstaking hunting expedition (*Kara*) which could last two months or more (in the old days), at times with fatal consequences. During the generation shifting ceremony, new generation members also erected *Olaahitta*, a bunch of *Tid* poles (*Juniperus procera*). This ceremony takes place around November-December.

As *Deka Diruma* is strictly maintained, the number of stones directly shows the number of generations in each village, at least since the system began its operation. I was told that prior to stones, wood was used for a good number of years and erected as a symbol for returnees from a hunting expedition. In the eastern villages, Doketu has 55 stones (28 for *Kalkusa* and 27 for *Herpa*). In this village, they practised hunting expeditions (*Kara*) twice a year after which they erect the stone. This means that generation grading was practised for 504 years, (18 x 28), on an 18-year cycle. In a neighbouring village, Buso where they erect *Deka Diruma* once every 18 years, there are 21 *Deka Dirumas* - 11 for *Kalkusa* and 10 for *Herpa*. In this case, we have evidence of a 378-year old record of the village and institutions. The current *Xeltas* (*Kalkusa*) in these villages had already served for 11 years by 2000 and will hand over in 2007. Considering the case of Doketu village where the records have reached a maximum number of *Deka Dirumas*, the system of generation grading in Konso began 504 years ago (i.e., in 1497). The previously published record by Hallpike (1972: 192) noted 21 stones in 1966, for eastern villages, which by adjusting for the leap years allowed him to arrive at 361.5 years (i.e., since 16041/2). As the number of years since the cycle starts vary according to whether the village in question practises *Kara* or not or even one or two *Karas*, the basis of Hallpike's findings on this needs further assessment.

5.9.2 Institutional structures

Traditionally, administration in the customary Konso villages did not have a supreme chief. Power and authority were distributed horizontally and vertically among different social actors. Each village had its own internal administration, which with some variation fulfilled the necessary social functions for peace and unity.

A *Xelta* has a leader, who is still recognised to the present day. These leaders have different names in different villages: *Apa tula* at Buso, *Senkelita* at Gareti and Gamole, *Qolota* at Turo and *Shoregota* at Kolme. In the eastern villages, two individuals take on leadership as Senkelita during the service period of 18 years. An individual who belongs to the senior group serves for 13 years while the one from a junior group serves for five years. Seniority is established according to participation in the *Kara*, based on one's age group. Regardless, the generation stays in service for the entire 18 years according to its respective cycle. There are families designated for this position. For instance, in villages where the Senkelita position is exercised, there are four families, two for *Kalkusa* and two for *Herpa*. These families are said to be designated by *Waaqa* (God). The same pattern of designation takes place in other villages too.

Xela leaders are assisted by *Apa pila* ('holder of knife') and *Apa lisha* ('holder of whip') at Buso and Gareti. Assistants to the *Xela* leader at Turo and Kolme are *Sara* and *Lishota*, respectively. Gamole do not have an Apa pila and Apa lisha. The outgoing *Xela* leadership nominates these leaders. The criteria for nomination are: wisdom, physical fitness, personal conduct, bravery, wealth, fairness, and a commitment to the community. Final approval is carried out at the biggest *Mora* of each village after the annual assembly (for example at Morkito in Buso).

While *Xela* is a generation whose service terms varies from village to village, there are also religious positions that are closely associated with it. These are *Apa timba* and *Apa kuma*. The former one is the holder of the village sacred drum, whereas the latter holds the sacred stick that is used during the *Kora* ceremony. *Kora* is the annual general assembly of each *Xela* constituency (*Kora Perra*). This assembly takes place far away in a quiet valley bottom. During this summit, major socio-economic, institutional and political issues that concerns the community are discussed, and consensus reached. New *Xela* leaders are chosen during this meeting and announced when the meeting ends. According to the system, females are excluded from these discussions. The end of the ceremony is marked by spraying of milk with the sacred stick held by the *Apa kumas*. This last function is carried out when the assembly participants enter the biggest village *Mora*.

Apa timba changes every year according to the sequences (see the example indicated in table 5.2). Note that there are many *Poqallas* who hold important leadership positions because of their spiritual positions and wealth. *Apa kumas* are elected in the same way as the *Apa pila* and *Apa lisha*. In the eastern villages, however, this election is from two families, one permanently represents *Kalkusa* and the other, *Herpa*.

Most of these roles are now nominal, apart from the religious/cultural aspects. Traditionally, administrative decisions were made at the house of the *Apa timba*. He had messengers called Sara who announced the meeting. The importance of *Apa timba* is exemplified by a root, while *Xela* is associated with a branch. This is because the leader came from the early settlers of Konso and the founders of the system.

Porshodas and *Hiyodas* assisted the executive body. *Porshodas* were elected based on their personal qualities from designated families in each village. *Hiyodas* were selected from the community, based on their quality to lead and advise on a broad range of matters. These people were said to have had political skills. Because of their frequent involvement in public matters, their farms were poorly managed. Unlike *Hiyodas*, *Porshodas* were accountable to the *Xela*.

Porshodas were like village administrators. They used to manage the traditional forest plots (*Dina*); the follow-up of road and compound boundaries; the inspection of village gates for their timely closing; the mobilisation of people; assistance to the sick, organisation of labour for funerals, and for maintenance of roads, ponds and water points.

These institutions formally ceased operating actively since 1974 when the socialist government overthrew the monarchy. In their place, the Peasant Associations were established, while the traditional roles were relegated to the settlement of local disputes within the villages, lineage or family. Even so, some cases are still referred to the traditional authorities when the parties agree to be mediated by the local institutions instead of the judicial committee of the Peasant Association or the regular court.

5.9.3 Foundation of indigenous institutions

Indigenous institutions in Konso are spirit-led. The binding forces within and between villages are the *Timbas* in which, according to them, certain powers are vested. They have served as an instrument to unite people from different origins and for making peace. Spirit have governed a wide range of the community's life, including the following activities:

1. Land acquisition: As indicated earlier, early settlers accepted the coverage of fire as a land demarcation. There was no second chance to claim more land with fire, the first chance was the last chance.
2. Production processes: Production processes such as time of sowing and time of harvesting are carried out after the annual spiritual ritual is practised by a designated elder on a specific field. Individuals who perform this kind of ritual must observe certain restrictions. For instance, they do not sleep outside their home, attend a funeral before the burial ceremony, shave their hair, urinate outside their land area. These people also put curses on pests and diseases.
3. Water development: Elders from a designated family bless water wells. This family carries out rituals to ensure that the well gives adequate water to the community.
4. Forest protection. There are two types of protected forests. The first type belongs to regional *Poqallas*, called *Mura poqalla*, and the second, *Mura dowra*. The community, because of the spirit associated with such forests, does not cut these forests down. In the past, their use was possible only with the blessing of the *Poqallas*. Otherwise, the offender would face a misfortune, sooner or later.
5. Human reproduction: Fertility of human beings, like fertility of the land, is expected to take place if and only if there is peace and unity within the community. Therefore, the entire system strives to ensure peace and unity at all times. Whenever, the peace is disturbed because of human behaviour problems, a cleansing ritual takes place depending on the nature of the conflict. One of the reasons to observe *Fereyuma* is to avoid child production by parents and children at the same time, which according to their belief, God does not permit.
6. War and hunting: One of the main tasks of the elderly is to bless the warrior group to succeed in war and hunting.
7. Election of leadership: Leaders of the community are endorsed during the annual assembly (*Kora*). The decision made during that meeting is final. The community believes in the decision of the *Kora* as a symbol of the spirit.
8. Human health: Human diseases were traditionally treated by spiritual doctors. They carried

out all the prescriptions of the local healers because of their conviction that spirit is behind poor health.
9. Land market: A market for land was common in old Konso. The final oath of sale of land was carried out in the presence of local land sale facilitators who sanctioned the oath by cutting a blade of grass from the land.

The major venues of religious exercises are *Moras* (sacred huts). Ancestors built these places. They were originally located outside the residential areas, but, the village now encompasses these *Moras* due to the expansion of the settlement. In addition to the sacred *Moras* there are non-sacred *Moras* where men meet, play gebeta (a board game) and sleep at night. Male visitors also sleep at these *Moras*. Generally, *Moras* are the place for men. During religious proceedings, women who are in their active reproductive cycle are not allowed to participate. There are certain *Moras* that women cannot walk through for fear of becoming infertile.

5.10 Labour organisation

Access to farm labour plays a crucial role in complex and drought-prone environments like Konso. The analysis of an informal interview of 24 households shows that ownership of assets such as livestock and land size affects farmers' access to labour. Out of the total, 21% have sufficient labour for their farm. However, this does not mean that this category of farmers has a comparable level of food availability. The rest of the respondents had annual labour costs that range between Eth. Birr 20 to 600 [27] for the cropping season of 1997/98, with an average labour cost of Eth. Birr 110. Families who have a longer period of food availability have better access to labour as compared to those who have a few months' available food. Among the case study villages, farmers in Turo tend to spend more on labour than in Buso and Gamole villages, because of better access to land in Turo than the other areas. Even though there are generation-long labour organisations, food shortages are impeding the people's mutual assistance mechanisms as discussed below. In the past, clan members, neighbours and friends used to bring their own food to assist families who could not afford food for the labour party.

There are many types of labour arrangements employed in Konso. The major features of labour institutions reported in Gereti, Buso, Gamole, Kolme and Turo villages are outlined below.

Alumella

This involves 20-30 members. Members may be charged depending on their labour demands, but not at the same rate as non-members. The money collected from labour charges is used to buy oxen for meat. This practice is common throughout Konso. Those who use the group have to prepare food and *Caqa*, a local drink brewed from cereals. In every *Alumella*, there are 2-4 female group members. Their task is to organise food and drinks in the field. This is commonly observed in the field during peak working seasons. However, married women are not involved in this kind of work. The same is true for Perga, discussed below.

Perga

The size of this labour/savings group is usually up to 20. Members do not pay for the service. The group saves money obtained through working for others. Women charge their own members grain and butter (seasoned) that is measured by a local measurement system. At the end

27 The exchange rate for 1 US dollar = 8.5 Ethiopian Birr in October 2002.

of the season, they make a feast from the grain and enjoy themselves. Membership in *Perga* ceases with marriage.

Keffa

This is a labour party organised from one's clan. People resort to their clan members at times when the head of the household is sick, dead or, in recent years, travelling for military service.

Xirasha

This is a married woman's working group, which operates on the basis of a working norm. Each task is divided among the members to allow ease of mobility and exchange of favours. The women often help each other finish their tasks.

Ugenta

This labour party does not involve repayment of labour. Someone who wants to organise *Ugenta* needs to prepare food and drinks for the party. In any case, there is an implicit commitment as long as a person has participated in your *Ugenta* sometime in the past. The number of participants can be 5 to 20. *Ugenta* can also be organised from one's family members. If someone is old and has no labour and maintenance tools, he can ask his neighbour to support him. He can also ask his friends for construction materials. The beneficiary prepares only food and drink. In case he has no food, his relatives can help him with grain and drinks. This food arrangement is called *Xarana*.

Fedeta

Like *Ugenta*, *Fedeta* does not involve payment of money for the service. It is organised by personal request of the individual interested. Participants may be drawn from neighbours, clan members and friends. The size depends on the amount of work involved.

Kenta

This is a kind of labour party organised by neighbours, in addition to relatives and friends participating in the work. It takes place when a family head is imprisoned, or sick or dead. In this case, everyone brings his own food.

Piyolada

The name literally implies 'land borrowers'. People who have no or less land often go to their *Poqallas* to get land. One of the commitments of the *Piyolada* is to provide labour services to the *poqallas* no less than three times a year, in return for the use of the land. This is a type of labour source that was the exclusive domain of the *Poqallas*. Participants in the labour party, togather with others, are people who have borrowed land from *Poqallas*. The type of work could be anything from sowing to weeding to terrace maintenance. This labour arrangement was officially abolished in 1974. But, owing to the spiritual links between the *Poqalla* and the Konso people, they still provide labour services to *Poqallas* under the guise of spiritual significance and clan relationships.

5.11 Beliefs, institutions and social learning in Konso's agriculture

5.11.1 The role of belief systems and institutions

Agriculture in Konso is founded on the strong link between the spiritual world (God - *Waaqa*), land and people (see also, Watson, 1998). The association between these three entities is important for peace, human fertility and production.

The overriding belief system in Konso is that *Waaqa* is a supernatural force above the earth and mankind. Their belief system however does not fit into the same context as that of the Christian or Muslim religions. The Konso people believe that *Waaqa* lives far away from earth, though whatever they do is under His supervision. They see *Waaqa's* manifestation in the peace and order of the society, rather than in regular repetition of prayers in order to have a spiritual link with *Waaqa*. *Waaqa* gives rain to the earth so that the earth can give food to the people as they till it to sustain life. In the same way *Waaqa* blesses the womb of women to give offspring. In order to maintain this relationship, mankind is expected to respect the rules of *Waaqa* which require peace and order in all spheres of community life. The elderly are the mediators of these rules. They are the ones who give the blessing in the name of *Waaqa* for the maintenance of the rules. The wider codes of conduct of the people emanate from these rules. For instance, if two people quarrel over a farm border, the *Waaqa* would withhold rain and the whole community would suffer. If people kill each other or disobey the rules of *Waaqa* in other ways, then women will become infertile, livestock will produce still- or deformed births, people will perish due to disease, etc. In order to avoid these consequences, the society must quickly act through its institutions. The joint administrative body that encompasses the warrior group (*Xela*), elderly and the religious figures (*Poqallas*) takes action against the offender(s). The offending party may be identified by witnesses or by magico-spiritual procedures.

On top of these ties between the spirit world and the people, it is crystal clear to the Konso people that they have to work the land to get the grain they eat. What they expect from *Waaqa* is rain, which is the most important physical element for the Konso people. Furthermore, they know that production will be at stake without adequate soil and water conservation measures. This is a fundamental issue affecting the character of agriculture in Konso - the source of unique labour discipline that is widely appreciated.

The dominant paradigms in the structure of the society are masculinity and seniority. Male is the dominant sex whether it is among human agencies or among animals used for ritual sacrifices. During blessings, they emphasise the birth of sons, though girls are also mentioned. Senior citizens, elderly, early settlers, older brothers (not sisters) are the manifestations of seniority in the society. Thus, power, wealth, respect and their derivatives favour seniority.

Collective decision-making and collective works are the major features of the Konso people. It is important to note that discussion and collective management is rooted in the Konso system of governance. This is clear from the name of their institution, called *Keladule Dhegeya* ('based on agreement'). Therefore, every matter is decided upon in meetings (*Sharita*). The discussions carried out during the ruling of *Xela* and the annual assembly (*Kora*) have been very important in this system (see section 5.9).

Collective action is clearly manifested through their organisation of labour (see section 5.10). The labour institutions are the people's response to the challenges of the landscape. Undoubtedly, it is an intentional struggle for survival, which they maintain up to the present date. The link between the people and natural resources is reflected in their local proverbs. These proverbs praise their terraces, ponds, streams, trees, livestock, hard-working men, etc.

5.11.2 Mechanisms for social learning

Institutions and land management practices established by the ancestors were passed down to the present generation through social learning that is embodied in the system. In this regard, institutions can be seen as a self-perpetuating system. This property shows the strength of a system or an institution.

Konso values and belief systems have proved resilient to the many forces that took place during the last century, from the incorporation by the north in 1897, to the interim period of Italian occupation (1936-41), to the volatile policies of the *Derg* government (1974-1991) and the market forces of the 1990s.

Social learning takes place through religious ceremonies and their venues such as *Moras* and other public meeting places (Kora), blessing speeches made by elders, folk dances, proverbs, songs sung during different farming operations, hunting expeditions (*Kara*), gender- and age-based labour parties, wedding and mourning ceremonies, which convey the individual and societal features. Folk songs during the seasonal and daily routines of the community, such as markets, water collection praised good farmers and good farming practices such as strong terraces, big trees, permanent water points and productive farms. These are parts of the culture that strengthen the current practices and their values are also passed down to the future generations.

Besides collective social learning mechanisms, fathers share a great deal of issues with their children, particularly sons. The head of the household is expected to inform his members about public decisions. Undoubtedly, women are highly marginalised from social decision-making. Women's marginalisation is attributed by the Konso's to the widely-held belief that *Waaqa* disliked women because of their deviation from His wants. The greatest marginalisation is reflected in the women who are in their active sexual maturity years. In addition, some men also ascribed their marginalisation to the fact that women actually come from another clan rather than their own, in which case they might leak out the secrets of the society. Girls are prohibited to mix with the warrior group as they are believed to influence the moral and physical strength of men who should cope with heavy community duties such as policing, defence of their territory and hunting.

5.12 Farmers' knowledge, land management practices and problems

5.12.1 Farmers' knowledge and land management practices

Land management in Konso is a result of a continuous adaptation of the environment to meet the needs of the community. This adaptation involves:

1. integrated soil and water conservation;
2. controlled livestock husbandry; and
3. an irrigation system based on flood harvesting.

These practices and associated problems are highlighted in the subsequent sections with the purpose of showing the complexity of the farming system and the land management practices, people's knowledge and skills that were developed over time.

1. Integrated soil and water conservation

Soil and water conservation in Konso is marked by the combination of physical and biological conservation measures. These include: stone terraces, tied-ridges, thrash lines, agroforestry, intercropping, fallowing, manuring, Kraal shifting, burning of debris, minimum tillage and commercial fertiliser. Each of these practices is briefly discussed in the subsequent pages.

Stone Terraces

As mentioned earlier, soil and water conservation measures have evolved over time in Konso. Earlier settlements began in the valley. This was a relatively flat area where the use of flooding was the dominant practice to get water and fertile soil. In addition, the use of thrash lines and tree branches were reported to have begun in the valley. At the beginning, population size was small, so there was no need to cultivate the hills. Later, people moved onto the highlands for both their settlement and farming because of incessant attacks from neighbouring ethnic groups. However, land management practices developed in the valleys were inefficient for hill farming. As a result, the Konso farmers began building stone terraces to prevent the soil from running down the slope.

Looking at the use of stone in both fields and residential areas, it would be interesting to know from where the skills of terrace construction in Konso originate. That is, was it in the fields or in the residential areas? Or did they develop simultaneously?

Two ideas came out of group discussions on this issue. One point of view holds that the terrace construction skills (*Kawwatta daweeta*) were obtained through the building of towns and houses. This group mentioned the special design of Konso houses that have two major compartments in individual compounds. The upper layer (*uita*) where residential huts and the kitchen are built, and the lower layer (*arketa*) where livestock are kept. These two layers are always separated by a stone terrace. The lower layer should be strong enough to keep the animals in their compartments. It is seen as a sign of bad luck to the household should animals, particularly cattle and sheep, enter into the human residential layer. Therefore, an animal that manages to pass through this layer will be killed. In addition, the external wall around the village is constructed from stone. The height of such walls ranges from 2-5 metres.

The other point of view holds that the skills of stone construction came from the farm to residential areas. They believe that earlier settlers had the experience of constructing stone barriers in the valley bottoms along with thrash lines and that that experience was used when hillside settlement began. This group has emphasised the water-harvesting structures that had stone reinforcements.

Whether or not the skill for stone terrace construction originates from one of these two options or from both, Konso farms and villages demonstrate an interrupted chain of stone terraces and walls respectively.

The very idea of using thrash lines for moisture conservation and water-harvesting structures for use of flood water in the valleys was an important turning point for soil and water conservation efforts. Over time, the effect of barriers on soil movement was learned after observing layers of soil accumulating behind a fallen tree in the mountains. Stone lines replaced tree branches and logs. Terraces have been constructed from the floor of the valley to the top of the hill. They were built generation after generation. Father constructed part of the field, the children took it further and so on. In this way, full coverage of the slopes was achieved. This actually shows how the culture of soil and water conservation transferred from generation to generation.

Terracing in Konso begins from the lower part of the field and moves upward along the slope. During construction, people dig a basement of 30-50 cm, with a width of about 25 cm. The height of the terrace depends on the slope of the area. When the area is gently sloping, the height of the terraces and the width between terraces decreases and increases respectively. There are several terraces of over two meters while the terrace width in between mostly ranges from 2.5 to 6 meters. The stone wall is built against the newly cut wall face. The soil from the upper part is moved down behind the stone wall and is carefully piled. Space created due to irregular stone faces are filled by soil. In this manner they attain a bench terrace immediately. The height of the terrace is often maintained above the ground. This structure, among other components, ensures infiltration of raindrops that fall on each plot.

Soil conservation experts start conservation of a watershed or a field from the top and go down to the lowest point. They work on the premises of slow growing terraces that were to attain bench structure over time. This is expected to be achieved through periodic maintenance and soil movements between terraces. In view of this, the experts' view was found to be contrary to the farmers' generation-long experiences.

Everyone in the hoe-farming system acquires the skill of terrace construction. Maintenance of terraces is part of routine farming practice. They construct the lines on a contour without any measuring or guiding instruments, depending on their visual judgement of the ground's features. When the ground is steeper, they maintain terraces with a short width. Sometimes, they use a subsidiary terrace (*Paqayta*) to support the big one. *Paqayta* is built on land with irregular patterns. This is done to maintain a continuous line of the main terrace on one hand, and to prevent loss of soil and water due to difference on the slope.

After finishing the terrace, they add organic matter to compensate the covered topsoil. This is achieved by mixing the topsoil (*Kefeffa*) with the big *Payra*. The fact that the piece of land immediately under a terrace loses more soil in the process is well understood. That piece of land is given special attention during subsequent cultivation. In addition, the farmers have noted that backward movement of water within the terrace brings more soil and organic matter from the thrash lines on the edge of the terrace to the back of the terrace where most of the topsoil had been lost during construction. Women play a great role in transporting manure from the villages to the farms. During the construction process, they assist in collecting and heaping the stones.

Based on the stone-erection ceremonies discussed in section 5.9.1, that shows a record period of more than five hundred years, it can be safely estimated that the Konso people started using terraces for at least four hundred years. However, archaeological findings that are not yet available would provide the best evidence.

From the foregoing discussion, it is clear that soil and water conservation efforts in Konso are very labour intensive. The high demand of labour for construction and maintenance of soil and water conservation structures have proven to be one of the major limitations elsewhere. However, the Konso people have their labour organisations to meet their labour-intensive agriculture. Their understanding of soil erosion stimulated them to develop a coping mechanism. As a result, they established their 'niche' in a rather ragged and difficult terrain.

Farmers in Konso have an amazing appreciation for stone terraces. The most important advantages of stone terracing are:

- protection of soil;
- water-retention in the field;
- serving as shade for coffee trees at a young stage;
- serving as a support to climbing crops such as lablab;
- making hill farming possible;

- increasing soil fertility; and
- increasing production.

Of course, their appreciation is not without an understanding of the challenge. Almost all farmers who participated in individual and group interviews confirmed the high labour requirement to build and maintain stone terraces. Physical injuries arising from stone movements, physical fatigue and the need for more food was among commonly mentioned problems. The issue of food requirements is particularly important as the time for terrace maintenance coincides with the time of food shortage in Konso. During this time, the preceding harvest comes only from ratooning, which fails during drier years.

Tied-ridges

Tied-ridges are one of the components of soil and water conservation in the agricultural system. It is an age-old practice in the system that also originated in the valleys. Tied-ridges are constructed in order to reduce the run-off from the upper terraces and to retain moisture.

Thrash lines

Thrash lines are used as a mulch and source of organic matter. The material used for thrash lines are sorghum stalks that are uprooted during the dry season and maize stalk left in the farm. Cereal stalks easily decompose under the hot climate and the effect of termites in some fields. When the previous year's production has failed or the crop stand was poor, there will be a shortage of materials for mulching and thrash lines. This in turn affects the production of the subsequent year.

Agroforestry

Agroforestry is a typical feature of the hoe-farming system in Konso. This practice is less conspicuous in the ox-plough farming system.

Most fields in the hoe-farming system are characterised by a multiple cropping system. The dominant high tree species is *Morinaga stenopetal*. This is because of the importance of its leaf in the people's daily food. The next important tree is *Terminalia browenii*. It is grown for forage, farm tools and building materials. Other tree species that are grown in association with crops are *Olea africana, Ficus sori, Cordia africana, Strerculia africana*.

The next storey is filled by crops such as coffee, chat (*Catha edulis*), yam, cassava, pigeon pea and cotton, as the case may be. Coffee, chat and cassava are planted under the terraces, whereas yam is planted both below and above the terrace depending on the soil depth. When it is planted above the terrace, farmers maintain an adequate distance from the terrace to avoid damage of the terrace during harvesting. Those farmers who have shallow soil depth do not plant yam at all, as it requires deep soil for its conspicuous rooting system. Pigeon pea is planted near the edge of the terrace, except when it is sown as a ley crop whereby the land is left to fallow in the subsequent season(s). It is confined to the border in order to minimise the shade effect as it stays in the field for 2-3 years. It is worthwhile to note that not all farmers understand the beneficial effect of pigeon peas on soil fertility. Some farmers generally maintain low crop diversity due to a decline in depth and soil fertility. The pigeon pea is also excluded. Cotton is thinly broadcasted in the whole field, unless the largest share of the plot is allocated to it. Sorghum, millet and maize are the base crops for intercropping (see below). Pulses and oil crops such as fenugreek and sesame cover the lowest ground. All in all, one can count 10-15 crops in a field in addition to a high tree. Some studies have reported over sixty different crops grown for different purposes (Mesert, 1990). Note that farmers often try to maintain the intensity of intercropping with the level of soil fertility in each plot.

Integration of high trees in the ox-plough farming system is declining over time. With the introduction of the ox-plough about a century ago, farmers in *Turo* and the surrounding areas have moved from the hillside farming to gentle slopes with the help of oxen, thus abandoning terraces. Extensive bush clearing took place in the area with few scattered tree species left in place. As terraces are less compatible with ox-ploughs, farmers have abandoned the terraces that were built by their ancestors. Instead, they have focused on agronomic and soil management practices rather than physical conservation practices that typify Konso. Unlike the hoe system, cropping patterns in the ox-plough system involve less intensive intercropping. In the latter system, single or two crop intercropping is common rather than multiple cropping.

Adaptation of the ox-plough to terraced plots is observed in Kolme, which traditionally practises hoe farming. This adaptation was induced by a shortage in labour for land preparation, in order to be able to sow at the time when there is moisture.

Intercropping

The general pattern of crop association is a mixture of cereals with pulses. A cereal-cereal-pulse arrangement may take place depending on the level of fertility of the land. In most cases, 50-75% of the space is allocated to sorghum.

Farmers practise intercropping in order to ensure the availability of food from different crops and to obtain feed (thinning products) on continuous supply. Some crops are drought-tolerant (sorghum, cotton, pigeon pea), while others (e.g., haricot bean) are early-maturing if there is adequate rainfall. The harvesting sequence is haricot bean followed by millet, maize and sorghum, in that order. Pigeon pea and cotton last longer in the field. This arrangement helps them to minimise risks from moisture stress. In addition, pigeon pea and cotton provide a soil cover, particularly in the ley system wherein pigeon pea gives adequate coverage. The effectiveness of this system, however, needs to be studied. Farmers have observed that some crops can be vigorous if they are sole cropped (e.g., sorghum). On the other hand, they stated that haricot bean cannot withstand direct sunlight. They understand that haricot bean gives shade to the roots of sorghum and maize and thereby conserves moisture under its shade. In addition, they have underlined the use of haricot bean leaf to improve soil fertility when it decomposes. Apart from this, they do not understand the use of nodules in leguminous plants, which they consider to be a disease [28]. Different farmers gave different interpretations, including leprosy, worm infection, physical damage and the like. Most farmers understand the anchoring service of pulses' roots. Unlike others, one farmer who had attended 8th grade level education and who had attended a farmers' training centre in the 1980s, reported his knowledge of the nitrogen-fixation ability of legumes. He also indicated that his fellow farmers do not understand this capability.

Intercropping also helps to minimise risks from disease and pests. When pests affect sorghum, farmers may get production from haricot bean and pigeon pea and vice versa. It is also seen as a method to minimise erosion. Few farmers noticed this phenomenon. Sorghum remains in the field for ratooning after the other component crops are harvested, making use of the short rainy season. Ratooning provides soil cover to the fields to minimise erosion. Nowadays, farmers in ox-plough areas commonly practice sole cropping of haricot beans to avoid the undesired shade from maize and sorghum as well as nutrient competition. Moreover, in ox-plough system, many farmers, particularly those who have large farms, do not practise ratooning, which could have given good soil coverage during the short rainy season. They are indifferent because they can produce enough during the main rainy season. They

28 Farmers in Wolaita and Wello (Chapter 6 & 7) gave a similar explanation.

think that they had better put their land under fallow instead of using it for ratooning. Apart from that, the ox-plough system is dominated by cereals and pulses. There is a poor integration of root crops in this system.

Intercropping also helps farmers make better use of their limited land and scarcity of labour. Farmers who have a small farm can grow the major crops they need for their home consumption, though this hardly ensures family food security. Cultivation and weeding practice also benefits different crops in the same field. Unlike sole cropping, weeding in intercropping system requires careful operation, to avoid damaging the roots of crops with different rooting arrangements.

Fallowing

Fallowing as a land management practice is carried out from short (half a year to two years) to longer periods (three to five years). Generally, farmers allocate their plots to different land-management practices according to the opportunities they have. For instance, almost all farmers do not fallow their main and accessible farm. In this case, they devote most of the available means of soil-fertility management practices to such plots. Due to the bigger field size in the ox-plough system, farmers still practise fallowing of five more years.

Manuring

The major sources of organic matter are manure, household refuse and thrash lines. Pulses and tree leaves and branches of harvested trees also provide organic matter.

Manure is obtained from animals raised at home and from the community garbage square, located outside the village fence, adjacent to the traditional *Dina*. Unlike in northern and central Ethiopia, animal dung is not used as fuel [29]. Until about 30 years ago, farmers in Konso used to apply dried human faeces to their field (see also Hallpike, 1972). This practice was abandoned after they came to know the disease cycle, particularly, drinking-water contamination. The issue of dignity was also involved to cease the practice. Use of community garbage is not appreciated by some farmers because of risk of weed seeds, bad seeds and excess ash that burns crops during dry spells.

It is normal to see a Konso woman crossing the hills every morning with some organic matter on her back wrapped with skin, a gourd of *caqa* and her *payra* or *sibilota* depending on the season. In that, whether she is a single head of a household or a partner, Konso women contribute a lot to the agriculture of the area, while also fulfilling the home management and reproductive responsibilities.

Kraal shifting

Those farmers, who own cattle and labour, practise kraal shifting. This method is practised for distant farms where the application of manure by human labour is difficult, in spite of the availability of manure. Unfortunately, it is not suitable for families who do not have labour to protect the animals from wildlife and theft.

Burning of debris

Burning of debris takes place in the months of January and February. During this period Konso and Deresha *Weredas* seems to be setting off fireworks because of all the smoke blowing into the sky. Farmers collect non-decomposed stalks of cereals, tree branches, residues of

29 I was ridiculed by a farmer for raising this question.

pigeon pea, cotton branches and weeds and burn them by making the heaps scattered throughout the field. This ash is then ploughed under. According to farmers, this practice increases the soil depth and fertility. In the latter case they have used the analogy of butter[30]. They added that the soil would look like a woman who has polished her skin with butter, when debris is burned and ploughed under. During the period of shortage, competition arises between the use of crop residue for soil fertility or animal feed.

Mininum tillage
Tillage in Konso involves minimum tillage. The major tillage is carried out every second or third year. The range depends on the fertility status and labour availability, and other management practices such as manuring and fallowing. Due to the shortage of labour, women-headed households often opt for manure application instead of tillage. Tillage is carried out by the larger *payra* to turn the subsurface soil to the top for aeration and exposure to sunlight. During the minimum tillage years, they simply uproot the sorghum stalks in the dry period and then cultivate (without tilling) the land during the rainy period for sowing.

Commercial fertiliser
Nowadays, a few farmers have begun using commercial fertilisers in areas with better moisture availability and access to irrigation from rivers.

Indicators of declining soil fertility
Farmers easily identify indicators of soil fertility. Commonly mentioned indicators are: decline of crop productivity, difficult workability, emergence of noxious weeds, particularly striga. For instance, the decline of crop productivity is further explained by stunted crop growth, a yellowish leaf colour, and small head-setting. While they can identify these indicators right away, other related soil fertility indicators come out only after facilitated discussion. These are soil depth, change of soil colour and water-retention capacity.

Farmers related soil depth to workability. They said that less fertile soils are difficult to till, unlike the fertile ones. Fertile soils are soft like humus. They have noted that water percolates through these kinds of soils instead of carrying the topsoil away. Moreover, they have observed the cohesion between the farm tools and the soils. Unlike the light soils, fertile soils have the property to stick to the farm tools and are also ‘heavier’ when held in hand.

They associate change of soil colour to poor fertility. However, they could not explain how the colour change is created. In the course of further discussion, however, they were able to relate the change of colour at least to removal of topsoil by erosion. The different colours reported for poor soils are: light, pale, grey and whitish (cf. 5.2.3). It was noted that a whitish colour is an indication of an eroded soil that is called *Mokosha*. Fertile soils have red, brown or dark colours.

Soil fertility management practices among farmers result in different trends in soil fertility. Most farmers reported a decline of soil fertility in different plots while a few farmers had managed to at least maintain or increase fertility of a few plots.

Some farmers who managed to increase soil fertility in at most two plots used manure on a continuous basis. The other means was fallowing for five years. Plots where fertility has been maintained for the last 5-10 years were able to due to manuring, terracing and flood harvesting.

Decline of soil fertility is a widespread phenomenon. The common problems identified by farmers are summarised in table 5.3.

30 Surprisingly, I have heard a similar analogy from farmers in the Dire Dawa region, over 1,000 km away in eastern Ethiopia.

2 Controlled livestock husbandry

The Konso people have developed a livestock husbandry system that is compatible with their soil and water conservation practices. Aftermath grazing is one of the major obstacles to biological conservation and structural measures in most cereal ploughing farming systems in Ethiopia. People in Konso strictly keep their animals away from the crop fields in order to protect their integrated soil and water conservation system. They achieve this by tethering methods and *Fora*, a 'camping grazing' system wherein the herd is taken away for a period of time to distant areas. *Fora* helps to minimise pressure on nearby grazing areas and forage plants on the farm. Without these arrangements, age-old terraces, thrash lines, and agroforestry practices could not have taken root.

Table 5.3: Summaries of problems of declining soil fertility, Konso, SNNPR, Ethiopia

Problems	*Reasons*
1 Repeated sowing	Shortage of land
2 Short or no fallowing	Shortage of land
3 Less or lack of manure	Shortage of livestock, distance of farm plots
4 Soil erosion	Lack of terrace, or poor maintenance due to shortage of labour and food
5 Highly erodable land	Due to steep slope
6 Poor management of land	Shortage of labour and distance for the available labour
7 Shortage of materials for thrash lines	Poor crop production, use for animal feed

Obviously, Konso farmers did not practise controlled livestock husbandry at the early stage of farming in the valleys where there were no perennial crops and physical structures sensitive to animal trampling. Therefore, controlled livestock husbandry is a stage in the farming system development rather a practice that has developed with state rules and regulations.

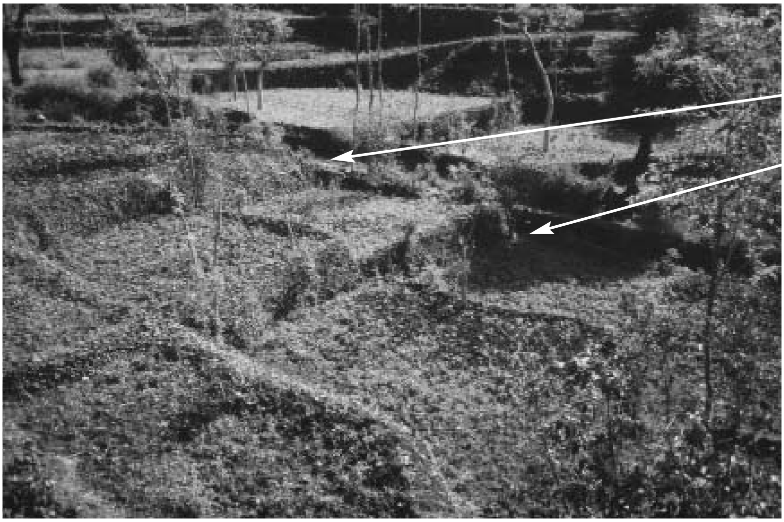
3 Irrigation system based on flood harvesting

There are a few seasonal and perennial rivers in Konso. These are: *Segen, Woito, Gato, Delbena, Gaba maga, Yanda fero* and *Regede*. Delbena and Gaba maga are relatively accessible rivers. Other rivers are located in the valley. Because of this, river irrigation has not been developed in Konso in spite of the people's vision and hard-working nature. However, they have developed amazing flood-harvesting structures in the seasonal riverbanks.

The irrigation structure built at *Teshmele* (1,240 masl) is an engineering miracle, for bare-handed workers. Massive flat stones are lined to divert the direction of the flood from its river flow. Networks of canals were then constructed (see Plate 5.3). Passage bridges were constructed from local stones to distribute water from its main course to different fields. Excess water is finally guided to join its natural way. The fields at Teshmele have deep soils as a result of years of silt accumulation. The height of the structure ranges from 1-2.5 m in the fields and 3-4.5 m in the riverbanks.

Flood harvesting in Konso is a round-the-clock task. A drop of rain has great meaning in that moisture-stressed land. Whenever there is rainfall, every able member of the family runs to his field. They do this whether it is midday or midnight. At night they light their torches kept aside for this purpose and reach their farm. Everyone opens his canals by monitoring the field capacity, to protect loss of soil. This practice is common in the *Buso, Aba Roba* and *Nalia Segen* Peasant Associations.

Plate 5.3: Terraced fields irrigated by flood rivers in Konso



5.12.2 Replicability of soil and water conservation practices in Konso

Are soil and water conservation practices in Konso replicable to other parts of the country? I am prompted to raise this question because of:1) a growing 'conservation tourism' organised to Konso, mainly by NGOs, but also by Regional Governments; and 2) a frequent mention of the Konso case by scholars with the implicit intention to adapt it elsewhere.

Answers to this question can be confirmatory or non-confirmatory depending on the set or sets of practice we are talking about. Whatever the result may be, what can be adapted would be the technology or the practice, not the embodying culture. It is the latter aspect that distinguishes land management of one society from the other. Whether adaptation would take root or not depends on the existence or creation of internal motivation, and of a deep commitment and understanding of the biophysical processes to manage land in a certain way. For instance, if a given society happens to begin building terraces after visiting Konso, this does not guarantee the same success. However, there is always room for sharing experiences among farmers from cross-cultural backgrounds for there are several common experiences among farmers in spite of their geographical locations. For that matter, many of the agronomic practices employed by Konso farmers are common all over Ethiopia. However, the total system of land management that developed in Konso, with both its 'hard' technical side (the terraces), and its 'soft' side (the institutions, culture, and political system) cannot easily be adopted elsewhere.

5.13 Problems and prospects of agriculture in Konso

Agriculture in Konso has supported its people for several centuries. Its carrying capacity was maintained mainly due to relevant land-management practices and was partly assisted by slow growth of the population, both of which are the results of their institutions. Population growth remained slow due to *Fereyuma*, and the social limitations on sexual activities even within marriage.

Long ago, agricultural lands were put under long fallow periods. Vegetation cover was then much denser than today. As a result, soil fertility was high. Due to the availability of animal feed from various sources, competition for crop residue was minimal. For the same reason, animal productivity was very high. Nowadays, the general perception is that the past was better, particularly in relation to wealth and prosperity.

Crop failure occurred from 1998 to 2000, consecutively, whereby many lives were saved by food aid. Crop failure occurred due to shifts of rainfall patterns, and not because of poor land management. In Konso, soil and water conservation structures of most farms are still in place. Variation in land management, undoubtedly, brings about differences in crop productivity, but not indiscriminate crop failure. Therefore, it can safely be said that the declining trend of agriculture in Konso is primarily because of a change in the rainfall regime. This is probably due to gradual effects of changes in the microclimate and perhaps the influence of the global or at least the regional climate. Even though the collapse of the population control system, *Fereyuma*, plays its part in the decline of soil fertility through its impact on the fallow system, it cannot explain the total failure of crops in Konso.

Plate 5.4: The growing scars in the once- glorious Konso stone terrace network.

When crops fail, people sell their animals to buy food for the family. They cut the trees down that would have had very little chance to rejuvenate. As a last resort, able family members migrate in search of a job to support the family. Women and children embark on cutting firewood from the bush lands for sale. As a result, conservation structures in the field are neglected to the extent that some families are seriously frustrated from maintaining them. In recent years, the maintenance of terraces has become a difficult task because of the shortage of food to organise a labour party. People become physically weak to cope with the arduous tasks of terrace maintenance under the blazing sun. Consequently, the at one time uniformly maintained and celebrated terraces of the Konso land are showing immense scars of damage (see Plate 5.4). In the past, the majority of the people migrate internally within Konso or to the rural areas of the neighbouring *Weredas* (Messeret, 1990). As these opportunities are now oversaturated and also failing under pressure, more and more people are migrating to the urban centres and the large farms nearby.

When productivity in the terraced fields declines, farmers expand the bush farms which are often cultivated only once a year and without a stone terrace. The common conservation practices in such fields are thrash lines. However, the stalks lined for these purposes are eaten by animals grazing in the bush forest, as these areas are normally not used for crop production.

Given the present scenario, what is the future of agriculture in Konso? How can people live from such a fragile environment? The rainfall pattern is very much undermining an unprecedented culture of land management. In view of this, it is high time to look for alternative means of livelihood. Unfortunately, alternatives are not readily available. In my view, a lasting solution remains in the development of valleys. Such measures require the development of infrastructures for irrigation, improved health facilities, improvement of roads, supply of electricity for deep wells, building marketing infrastructures and creating mechanisms for resolving conflicts about resource use within and between ethnic groups. These alternatives are likely to ease the pressure on the cultivated hills and possibilities to restore the indigenous land-management practices, such as long fallow and improved vegetation.

5.14 Conclusions

Konso's system of agriculture has unparalleled complexities, at least in Ethiopia, that involves a unique human impact on the landscape. It is a typical example of a multiple production system where an adequate balance has been created in relation to the needs of each household. The system encompasses crops, livestock and tree production with interrelated management practices. The unique feature of Konso agriculture is a stone terrace-based integrated soil and water conservation system. These terraces cover major parts of the agricultural land in Konso and stretch over tens of thousands of kilometres. Farmers apply several methods of soil fertility management practices. Among these, the agroforestry pattern developed in that environment plays an important role, among others, in soil fertility management and food and feed production.

The emergence of this unique agricultural system is rooted in the history of the Konso people, mainly in their belief system and institutions that have an indigenous record of over 500 years. Their belief system is the centre of their institution that caters for all aspects of societal functions, from the production system to internal stability to the protection from interference of neighbours. The indigenous institutions adequately integrate the spiritual and the emerging political actors in pursuing the societal goals. In this regard, the harmonious collaboration of, among others, the *Xela*, *Apa timbas*, *Apa kumas* and *Poqallas* is very interesting. These institutions proved resilient to the many external forces that interfered with the Konso system over the course of the last century.

With respect to land management, the social organisation of labour and indigenous land tenure played a great role. The scope of their labour organisation transcends a mere labour exchange mechanism by creating labour markets, saving method, mutual trust and assistance.

Konso people have developed a culture of hard work and a knowledge-intensive system of production. They have a knowledge and skill of tested agricultural practices that is passed down from generation to generation. The new generation learns the agricultural practices and the culture of hard work from the functions of the social structure and the family circles.

The heritage of Konso's agriculture characterised by the stone terraces is one of indigenous intensification far ahead of the Boserupina thesis (1965). There was no research or extension support nor was there slave labour to construct it. All was the result of the ingenuity of the Konso people. Thanks to the institutions born out of societal necessities, that were maintained and passed down to the present generation, the present shape of Konso's agriculture was ensured. Thus, Konso's intricate system of soil and water conservation is based on (1) the technical measures, with stone terraces, that are so visible when one visits the area, and (2) the institutions that support it. These include the organisation of labour, the erstwhile human fertility management system, the leadership and disciplines, as well as the spiritual system that underpinned it all. In this respect the Konso system of land management is similar to that of the Ifugaos (Gonzalez, 2000). The necessity of this combination of the hard and soft sides of land use (Röling, 1997) makes impossible to contemplate introducing only the hard side without paying attention to developing the soft side.

However exemplary the Konso soil and water conservation system may be, it cannot be copied wholesale elsewhere, as the embodied culture remains its own. Even then, farmers in other parts of the country can learn a great deal from Konso's agriculture to improve upon what their culture and physical environments provide.

Unfortunately, indigenous agriculture in Konso has begun to show a sign of exhaustion from its long wrestling with the many forces that have been interfering with it. The exhaustion appeared because of unfavourable internal and external situations. Internally, the population size increased over the last 30 years due to the disintegration of the indigenous population control mechanisms (*Fereyuma*). Externally, wider integration into the regional markets and institutions, peace and stability that allowed temporary migration [31], and shortage of rains which caused crop failures over consecutive years. Therefore, chains of stone terraces now show immense damage due to lack of maintenance. Farmers are now unable to carry out the periodic maintenance due to a shortage of food. This situation has forced farmers to migrate to other places in search of alternative survival strategies. As a result, their indigenous labour organisation, which was the backbone of the soil and water conservation efforts, has failed to operate as usual.

The Konso agricultural system, particularly in its hoeing culture has moved very far from one's idea of farming. It rather consists of energy-draining exercises with which people are forced to live. This is even all the more true as the age-old terraces are falling apart on many farms. Therefore, maintaining livelihood in that environment requires heavy external support to reduce the land pressure so that long fallowing can be practiced to ease soil fertility-restoration practices. This can best be done through land reclamation within Konso, by developing an irrigation system from the limited accessible rivers and development of the valleys. The latter requires immense infrastructure facilities, rural development packages and collaboration with the neighbouring ethnic groups to avoid conflicts on resource use. In the short run, however, food should be provided to families who are food-deficit in addition to supporting food to organise the traditional labour parties credit to expand off-farm and non-farm income sources.

The importance of the Konso case for this thesis is that it makes clear the importance and

31 Note that these social forces, while beneficial in creating alternative livelihoods, work negatively against the maintenance of the indigenous agriculture.

nature of the 'soft' side required for a working system of soil and water conservation. The following chapters will examine soil and water conservation in two areas whose external interventions about two decades ago introduced purely technical soil and water conservation measures. The elaborate labour organisation, human fertility management and other institutions developed in Konso provide a backdrop against which to understand what happened.

6 Farmers' Response to Interventions in Soil and Water Conservation in Wolaita, Ethiopia

Abstract

The Soil Conservation Research Project (SCRP) that was financed by the Swiss government succeeded the former Wolaita Agricultural Development Unit (WADU) in the early 1980s, to develop and disseminate a suitable soil and water conservation programme in the wet Woyna Dega agro-ecological zone in southern Ethiopia. The project was stationed at Gunno, Wolaita. The SCRP project was actively operational from 1982 to 1995 and gradually phased out in 1998. This study was initiated to assess the impacts of the project on farmers' soil and water conservation (SWC) practices, to analyse farmers' responses to the SCRP's introduced technology and the reasons behind their responses, to understand farmers' knowledge and attitudes on erosion and SWC practices, to assess farmers' SWC practices and to find out suggestions for improvements. The study used a combination of qualitative and quantitative research approaches. The study shows that farmers in Wolaita have a fairly adequate knowledge and understanding of the erosion processes and their negative consequences. The soil bunds introduced in Wolaita were found to be effective in minimising runoff. In spite of that and in spite of farmers' appreciation of the problem, there ultimately resulted an increasing non-acceptance of the soil bunds introduced by the SCRP through food-for-work. The reasons for the poor acceptance of the soil bunds were: lack of farmers' participation in the problem identification and subsequent research processes; use of food-for-work as an incentive without a profound and continuous educational process; negative side effects of the soil bunds that increased farmers' risk of crop loss, which the research-extension system failed to improve; and a termination of previously active labour co-operation within the community for heavy farming operations such the construction of bunds. With the exception of land size, livestock ownership and family size, farmers' responses to the soil bunds were not affected by other household and individual characteristics such as age and level of education. In addition, no strong evidence was found on the negative impact of land tenure on the utilisation of soil bunds in Wolaita. Finally, the study concluded by underlining the need to bridge the gap between physical and biological conservation measures in Wolaita in view of the increasing incorporation of steep land under agriculture.

6.1 Introduction

Wolaita is located in southern Ethiopia, and is one of the overpopulated areas in the country. The production system of the area is that of mixed farming. Short V-shaped valleys dominate the terrain. The higher edges of the valley are used for settlement while farming takes place along the concave slopes down the valley. Farming also takes place on steep slopes in the mountains and hills.

In the early 1970s, the Wolaita Agricultural Development Unit (WADU) was initiated to promote modern agricultural technologies including a range of soil and water conservation practices in the entire Wolaita zone. This unit was terminated in the early 1980s and succeeded by the Soil Conservation Research Project (SCRP). The SCRP used Gunno as its experimental site while the government's extension system continued attempts to promote soil conservation practices in the whole of Wolaita after the termination of WADU.

In spite of the continuous efforts that span more than three decades, the soil and water conservation techniques introduced did not take root among the farmers. In the experimental catchment at Gunno, farmers did not maintain their soil bunds except during the first two years after the construction of the bunds. In some cases, farmers removed soil bunds completely or selectively. Understandably, the dissemination of the soil bunds to wider areas in Wolaita did not succeed in spite of increasing erosion threats due to the expansion of farming to steeper land.

The purpose of this chapter is to show how farmers reacted to the soil and water conservation intervention that began during the 1970s and to analyse their reasons in order to identify effective interventions for sustainable land management in the area. These issues lead to a number of questions: What is the farmers' understanding of soil erosion processes? What is the farmers' perception on soil and water conservation as a land management practice? What do they expect from soil and water conservation? What do they do to conserve their soil from erosion? What are their reasons for not carrying out periodic maintenance and construction of new soil bunds?

Section 6.2 presents a general background to the study area. This is followed by the history of interventions in soil and water conservation (section 6.3). The methodology followed in this case study is discussed in section 6.4. Section 6.5 presents the results of the study, i.e., as an integration of both qualitative and quantitative studies. Finally, the conclusions are given in section 6.6.

6.2 The study area

6.2.1 Location of the study area

Wolaita was recently upgraded to a zone in the Federal Administrative System, which was initiated by the government in 1991. It is 400 km south of Addis Ababa and located between the Omo river in the west, Lake Abaya in the south and the Blate river in the east (see map 1 in chapter 2).

According to the 1994 census of Ethiopia (CSA, 1996), the Wolaita Zone has a total population of 1,147,691. Of this 93% is rural, whereas the urban population accounts for only 7%. The zone has a total land area of 3,928 km^2. A population density of 550 persons per km^2 was recorded at the Soil Conservation Project site at Gunno (SCRP, 1996b). Population density of all of Wolaita, based on the 1994 census, is 292 persons per square kilometre (CSA, 1996).

6.2.2 Historical background

Socio-political history

Wolaita is composed of 110 clans that are divided into two ethnic groups: Mala with 12 clans and *Dogela* with 98 clans (Wana, 1998). According to a historical interview with elders in Gunno, the Wolaita people originate from a place called Kindo that is located in the Southern Region.

Historical evidence shows that the present territory of Wolaita is a result of successive battles with neighbouring ethnic groups and nationalities (Wana, 1998). War has been one of the dominant historical features of the Wolaita people much like that of the Northern Kingdom, which subjugated the Wolaita in 1894. During those days, successive kings of Wolaita mobilised tens of thousands of soldiers with traditional hand-held weapons and horses for war expeditions or territorial defence. As such, war has played its part in shaping the political history of the region, particularly in terms of creating the motive to increase population size in order to maintain a strong army. To that end, efforts were made to settle outsiders using land and power as incentives.

Before incorporation into the Northern Kingdom, Wolaita had its own kingdom that ruled from the thirteenth century (1268) (Cerulli, 1956).

Christianity was introduced well before the final incorporation of Wolaita into the Northern Kingdom in 1894. The introduction of Christianity before Wolaita's incorporation was partly due to the process of empire building of the Wolaita kingdom, which brought people from diverse origins together.

Before its incorporation, Wolaita had been prominent in terms of agriculture and trade. The latter was, however, based on bartering until a cash economy was introduced after the incorporation (Tsehai, 1994).

Land tenure

Early settlers acquired land by slash and burn. During the period that it was the Kingdom of Wolaita, the king administered the land. Newcomers including those from the north were admitted into the kingdom to increase its power base. War heroes were given special treatment: they were offered the best land irrespective of whether it had been occupied by others or not. According to the elders, this led to tenure insecurity during the time of the kingdom. Distribution of land to war heroes and nobility occurred particularly during the reigns of King Amado and his son, King Gobe (Wana, 1998). Nevertheless, the land tenure system allowed owners to inherit, give, lend and sell their land without any restriction. Purchase of land was the best means of capital formation and carries a significant social prestige.

With the 1975 land reforms, rural people obtained access to usufruct land, which was placed under the administration of the Peasant Associations. Even though the land reform was received with enthusiasm on its early days, bottlenecks later began to emerge, such as corruption by the Peasant Associations, villagisation, removal of rights to land owned outside a given Peasant Association and insecurity of tenure as land became scarce.

In spite of these changes in land tenure, the basic features of the farming system based on perennial tree production continued in the whole of Wolaita to the present date.

6.2.3 Local institutions

Apart from the administrative institutions of the earlier kingdom, local institutions existed that were functional at the village level, and survive to the present day. These are community-based organisations for funerals and weddings (*Idiriya*) and local thrift (savings) groups (*Shufa*). These organisations are very important for mobilising resources and labour that serve members of the community irrespective of their wealth status. However, people with more resources enter into wider social relations that transcend the neighbourhood boundary, including age group, kinship, etc., for refuge during bad times.

In addition, farmers who do not have enough land, but have enough labour, get access to land through the well-established crop-sharing arrangements. Similarly, livestock-shared rearing is practised. Local institutions also provide access to labour through different reciprocal or non-reciprocal labour arrangements.

6.2.4 Description of the farming systems

Climate

In terms of moisture regimes, the study area is classified as moist sub-humid. According to the traditional classification, it is in the *Weyna Dega* altitudinal belt (Weigel, 1986a).

Wolaita has a bi-modal rainfall pattern that extends from March to October. The first rainy period (*Belg*) occurs in March to May, while the second rainy period (*Kremt*) covers July to October, with its peak in July/August. The average annual rainfall over 43 years is 1,014 mm. The mean annual rainfall for the decades of the 1970s, 1980s and 1990s was 1,015mm, 920 mm and 1,290 mm, respectively (NMSA, 2000). According to the SCRP's data (SCRP, 1996b), the mean annual rainfall at Gunno station is 1,314 mm. As elsewhere in Ethiopia, the major problem of rainfall in Wolaita is its distribution.

The mean annual temperature in Wolaita is 19.5 °C. The coldest and warmest months are September and March respectively.

Soils

According to Weigel (1986a:7), who carried out a detailed soil survey (scale 1:5000), about two-thirds of the survey area is covered by Eutric Nitosols associated with Humic Nitosols. These are dark reddish-brown soils with an extremely deep profile that reach depths of up to 10 meters (*ibid.*: 13). This is visible from deep gullies and road construction works. While high rainfall availability and high moisture storage capacity of these soils favour a good crop production, low availability of phosphorous and nitrogen are severe limitations under the current soil management practices (*ibid.*).

Land use, farming patterns and crops grown

Wolaita has an enset-based mixed farming system, where enset (*Ensete vetricosum*) is a co-staple food together with cereals, roots and tuber crops (Westphal, 1975). Like everywhere in the highlands of Ethiopia, livestock is an integral part of farming. Farmers rear cattle, sheep, goats, chickens and equines.

Wolaita has a unique farming pattern that creates a beautiful landscape and vegetation cover. The residential areas are often situated along the concave slope of short V-shaped valleys that dominate the landscape. A communal area used for grazing, public activities and roads often divide a village. In lower altitude areas, the road along the concave slope and within the residential area is fairly suitable for motorised transportation. Farms generally start from the back of the house and extend to the bottom of the valley, ending in a woodlot. Found close to the house are a mixture of spices and a cabbage plot that covers a narrow strip of land. Adjacent to this is a coffee plot. Next is a block of enset, followed by root crops such as yam or taro. Maize, the major staple food crop among the cereals, is next to the root crops. The boundary of maize marks the low end of the fertile part of the farm called *Darkua*, and is followed by the *Shoka* zone. Ranges of crops are grown in this part of the farm. Below maize, sweet potatoes or potatoes are planted. Small cereals such as wheat, barley and teff are planted in the lower part of the *Shoka* zone. Pulses are planted either next to the maize, or after the tuber crops. Beyond the small cereals, grass is planted nowadays, along with some trees. Crop rotation takes into account this general cropping pattern in the two farming zones. Finally, the woodlot intercepts the river or the lowest point along the valley floor (see Plate 6.1).

While the above is the general pattern, farmers often make modifications depending on their specific needs. These include: family food and cash needs, farm size and labour availability. Apart from the crops mentioned, some farmers grow banana and sugarcane in strips or in a given spot. In the same manner, they grow fruit such as avocado, papaya, oranges, guava and mango in different patterns. A few farmers also grow chat (*Catha edulis*) by intercropping it with other crops. Vegetable production is rare in the area. However, a few farmers produce rainfed potato, cabbage and onion.

Plate 6.1: A typical land use pattern in Wolaita

6.3 History of external interventions

Wolaita district is one of the few areas in Ethiopia where externally financed projects have been deployed since the 1960s. The most notable ones were the Wolaita Agricultural Development Unit (WADU) and its successor, the Soil Conservation Research Project (SCRP). In addition, the Wolaita Rural Education Project (WREP) that was sponsored by a French aid organisation and later by Agri-service Ethiopia, was a well-known external intervention before the mushrooming of NGOs following the 1984 famine. While rural development was the concern of all external projects, WADU and SCRP had a major focus on soil and water conservation, though the latter one was limited to research only. The following two sections give an overview of WADU and SCRP. However, the latter is given greater attention because of the technical data on runoff and soil loss it collected from 1981 until the early 1990s.

6.3.1 The Wolaita Agricultural Development Unit (1970-1982)

In line with the dominant rural development paradigms of the 1960s, the government of Ethiopia initiated a project called the Wolaita Agricultural Development Unit (WADU) that catered for the present Wolaita zone. The project was funded by the World Bank. It was operational from 1970 to 1982. The WADU was designed as an integrated rural development project with multi-faceted project activities, which included the provision of fertilisers and improved seeds, crop protection, soil conservation, livestock improvement, agricultural credits, organisation of co-operatives, assistance to rural artisans, store and road construction, and water development (WADU, 1981).

The project implementation began in the lowland part of the Wolaita to promote a settlement programme whereby people from the northern and central highlands were settled. In the highlands, the project focused on extension services combined with the aforementioned components.

The WADU's soil and water conservation practices included construction of bunds, gully establishment, spring protection, water harvesting, and afforestation. To that end, it introduced soil bunds in Gunno in 1974-75 because of severe soil erosion in the area. At the end of the project in 1980/81, a total of 31,511 ha of land had been covered by soil bunds (WADU, 1981). Before WADU, soil bunds were not in the repertoire of soil conservation practices of highland farmers in Wolaita. Cash was used to construct the bunds, whereas food-for-work was used to maintain them. As farmers were short of money due to the poor marketing infrastructure, attracting labour for bund construction was not difficult. Some farmers destroyed the bunds shortly after their construction because of the inconvenience they presented to the ox-plough. The state agents sent those farmers to prison to ensure that they refrained from similar acts in the future. Farmers who told me about this situation estimated that about 20 farmers had been involved.

In order to lay the foundation for comprehensive data collection that would serve the entire country, WADU initiated a hydrometric site at Gunno in 1977. Recording began in January, 1981.

After WADU was phased out, all project activities were taken over by the Ministry of Agriculture, with the exception of the research component which was taken over by the SCRP, which began its operation in Ethiopia in 1981 (see below).

6.3.2 Soil Conservation Research Project (1982-1995)

Inception and termination

The Soil Conservation Research Project (SCRP) was initiated in 1981. This project was launched upon the request of the Ethiopian government to guide the massive soil and water conservation programme supported by the World Food Programme (WFP) since the 1973 famine. Soil and water conservation activities in Ethiopia comprised the largest food-for-work project in Africa supported by the WFP. The Swiss and Ethiopian governments covered the financing of the project.

The SCRP established six research sites in Ethiopia. The headquarters of the project was located in Addis Ababa, where a laboratory was based and part of the database management was carried out. The major data processing took place in Switzerland (Karl Herweg, p.c. 2002).

The SCRP sites are located in different agro-ecological zones of the country in order to generate research results that would be relevant for soil and water conservation activities in the country. There are marked differences among the zones in terms of human and livestock population density, access to markets and diversity of agriculture.

Each research site has operated in a watershed of approximately 10 km^2 with a limited catchment area for treatment with soil and water conservation practices (1-2 km^2). The research activities were more or less similar in the research units, as we shall see in chapter 7.

The SCRP fell under the auspices of the Ministry of Agriculture until the establishment of the Ministry of Natural Resource Development and Environmental Protection in the early 1990s. The association of SCRP with the departments of these ministries was nominal rather than functional in nature. As a result, the SCRP managed to create its own autonomous space of operation without establishing modalities and mechanisms to work with 'host' institutions and other related organisations with a mandate for research and/or extension in the country. For its first ten years, the project did not have a mechanism for internal and external research reviews and planning processes (Waters-Bayer, *et al.*, 1998). The lack of clear institutional arrangements contributed to a growing tension between the project and the host institution. More than a decade and a half's worth of technical research failed to save the project from the scrutiny of the new government in 1995, leading to its closure.

In 1996, the SCRP research sites were decentralised and put under the management of the Regional Governments in which they were located. Finally, the project was closed in June 1998 (Waters-Bayer, *et al.*, 1998).

The Gunno research site

Gunno is located in the former North Omo zone (now Wolaita zone). It is situated on 37^0 39' E and 6^0 51' N, 15 km NE of Sodo town. Its elevation extends from 1,800-2,100 masl.

Unlike the other research sites, an exceptional design was employed at Gunno, where a twin catchment was used to compare the effect of conservation measures, with one catchment under treatment, while the adjacent 'untreated' catchment, receiving no bunds was used as a control.

The treated catchment is called Zerwa, (68 ha) whereas the untreated one is Goppo (89 ha). Treatment entailed the introduction of soil bunds (SCRP 1996a). According to a census taken in 1983, there were 92 and 89 households in the treated and untreated catchments respectively. The total populations in the respective catchments were, 413 and 408 people (Gunten, 1993).

Description of technical intervention

The SCRP commenced its work at Gunno with a visit of experts to the area who informed the community about their intention to construct certain structures, which they said were useful for soil and water conservation. Leaders of the Peasant Association communicated the plan of the project to the community. Ten farmers apparently had to give up land because of the establishment of the research site at Gunno, but did not receive any compensation for this loss.

The SCRP forced farmers in Goppo, the untreated catchment, to destroy the bunds and diversion ditches constructed by the WADU. Those who protested against that action were threatened and actually brought to court. The SCRP was assisted in this action by a local development agent. During the group interview, farmers were able to mention the name of the development agent involved, who still works for the ministry. The agent confirmed and regretted this action of 20 years ago, when I interviewed him.

Farmers from both the treated and untreated catchments participated in the construction of soil bunds[32] in the treated catchment. The incentive used by the SCRP was food-for-work. The food items were cereals and edible oil. In addition, farmers in the catchment were given a hand tool (*akaffa*). The labour was organised into groups of 20 people per working team. Technicians were marking the spots for bund construction, which were based on technical parameters. Maintenance was carried out by using food-for-work as the incentive. This maintenance was carried out during the first two years after construction of the soil bunds. Thereafter, no food-for-work nor maintenance took place, apart from a few individuals who maintained some bunds on their own initiative.

General awareness-raising conservation education was organised for the farmers from both catchments by SCRP technicians. The WADU had carried out similar training in its farmers' training component. Owing to the original plan of the hydrometric station, farmers from the untreated catchment were not allowed to put the knowledge and skill of bund construction into practice because that would jeopardise the interest of the scientific research. Quoting the farmers from the untreated catchment - 'we were told to learn for the future' - a future that they did not know at that time. In this connection, they explained the frustration which resulted from their exclusion from the treatment by soil bunds while the SCRP technicians were continuously collecting information from their plots every season in the same way they did for the treated catchment. During my discussions, local people did not hide their stereotyping of educated people, whom they think are highly engaged in 'writing, but doing nothing for the rural people'.

The conservation education given to farmers included:

- erosion monitoring by looking at indications in the field (mainly rills);
- contour ploughing;
- planting grass on soil bunds;
- use of agroforestry;
- using branches and banana stems for gully stabilisation; and
- maintenance of soil bunds (moving the soil deposited alongside the bund onto the bund to raise its height).

These educational activities were, however, presented on a piecemeal basis rather than incorporating them into the farming system through an informed or organised deliberative participatory learning process. Besides this, farmers already knew some of these practices such as contour ploughing, multiple cropping, 'agroforestry', and the use of banana stems for gully stabilisation.

Runoff and soil-loss results

The SCRP collected a wide range of data to help understand the land management dynamics in the agro-ecological zone. Runoff and soil loss were measured at the plot level, whereas river

32 Bunds occupy a considerable amount of land that vary according to slope. On a 8% slope, 2-5% of land; on 8-16% slope, 8-12% land; on a 16-30% slope, 15-20% land and on a higher than 30% slope, 25% of land (FAO/MoA, 1986, cited in Belay, 1992:52).

discharge and sediment yield were measured at the catchment level. The test plots and catchment-level measurements distinguished between the treated and untreated catchment. The plot-level measurements showed on-site effects, whereas the catchment-level measurements showed off-site effects (see Plate 6.2).

Runoff and soil loss from individual plots were assessed according to different land use, soil type, slope length and gradient using plots of 30 m^2 (2x15m) and 3 m^2 (1x3m) (see Appendix 1 for details). Farmers who owned the land where the test plots were installed co-operated with field staff in removing and replacing the structure during the seasonal farm operations. Farmers themselves selected the crops grown in the test plots. Yield samples of each crop on test plots and other plots were taken from farmers' fields in both catchments. Yield data from non-test plots were taken from fixed and non-fixed plots.

Plate 6.2: Hydrometeric station at Gunno, Wolaita

Outlet from the untreated catchment

Outlet from the treated catchment

Four test plots were treated from 1982 to 1992 at Gunno. Test plot 1 was continuously laboured to expose the soil in order to determine soil erodibility. Test plots 2 and 4 were cultivated plots with different crops. Test plot 3 was maintained under a grass cover. The former three plots were on a slope of 16%, while the last plot was on a relatively steep slope (42%). Two micro-plots (MP 5 and 6) with a 16% slope were staged next to test plot 2. Test plot 2 and micro-plot 5 were monitored from 1983 to 1991, whereas micro-plot 6 was continuously hacked and therefore represented bare surface conditions. Data from micro-plots were collected from 1983-1991 (SCRP, 1996b; SCRP, 2000a).

According to the SCRP (1996b), soil loss at an on-site level is highest in August. Erosion at the site level is also considered as high, with a very low runoff (Table 6.1). High refers to soil loss of 50-100 t ha^{-1} whereas runoff was considered to be low, at 200-300 mm per year.

Table 6.1: Summary of experimental results at Gunno, Wolaita, Ethiopia

Particulars	*On-site effects (plots)*					*Off-site effects (catchment)*	
	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Treated	Untreated
Runoff (mm/y)	155	15	171	321	347	149	246
Erosion rate (t ha^{-1} y^{1})	80	.02	48	49	110	0.1	0.7

Source: SCRP Database 1982-1993 (SCRP, 1996b).

In the case of the off-site results, sediment yields of both the untreated and treated catchments were considered very low (<1 t ha^{-1}). The river discharges from the untreated and treated catchments were moderate and low, respectively (SCRP, 1996b). A river discharge is considered to be moderate when it yields up to 200-300 mm, and low when this figures between 100-200 mm.

In addition to experimenting with plant covers, test plots were also used to evaluate the effect of soil loss and runoff under different conservation techniques. These techniques were grass strips, graded *Fanya Juu* [33], graded bund, level *Fanya Juu*, and level bund. In this case, runoff and soil loss under these techniques were compared with a control plot from 1987 to 1991 whilst under different crops.

Soil and water conservation tests at Gunno were found to be satisfactory in terms of erosion reduction. The reduction of runoff was, however, associated with a potential for waterlogging above the bunds. Production under different soil and water conservation practices tested at the station showed a slight increase. The impact on the catchment hydrology was, however, found to be minimal (SCRP, 1996b).

When I started my study to assess the impact of SCRP at Gunno in 1998, the project had ended officially with very little follow-up by the regional government with the exception of the climatic data and hydrometric readings.

6.4 Methodology of my study

6.4.1 Unit of analysis

I used the design of the SCRP project to identify the watersheds to match the objectives of my study. Thus, farmers were selected from four locations (watersheds). These were farmers in the (1) treated and (2) untreated catchments, and in (3) adjacent and (4) distant catchments. The latter two catchments were defined by the researcher, while the former two were used in the SCRP's experimental design. Farmers from the treated and untreated catchments were selected to measure the direct positive and negative project impacts, whereas the adjacent and distant farmers were considered to assess the spatial impacts of the project. 'Adjacent' refers to farmers who are farming just next to the two experimental watersheds. The distant location (at 8-15 km away from the SCRP sites) falls in the Waja river catchment that covers most of the southwestern side of Damota Mountain with an altitude of 2,908 masl. Because of its steep slopes, it was believed to serve as a critical test for the conservation measures promoted in

33 Fanya Juu is a Swahili term, which indicates throwing the soil up the slope from below to create a contour bund.

Wolaita. Thus, the main reason to include the distant location is the fact that it is erosion-prone, something that is expected to increase the acceptance of soil bunds.

The SCRP sites and the adjacent catchments generally range from 1,800 to 2,100 m. The distant location in the Waja river catchment approximately ranges from 1941 m at the bottom to 2,908 m at the peak of Damota Mountain, situated north of Sodo town.

The watersheds covered by the study are located in three *Weredas* (i.e., districts). These are: Kindo Koisha, Sodo *Zuria* and Boloso Sore (Table 6.2). Farmers selected for the formal interview were drawn from four Peasant Associations: Dogoshakisho, Damot Waja, Doge Mashedo and Gunno.

Most of the farmers who participated in the survey were men (90%). Women were targeted during the qualitative phase of the study. Households within respective watersheds were interviewed and observed. Watershed and community-level observations were drawn from group interviews within and across watersheds. At the household level, the study dealt with both the total farm as well as plots to gain a better understanding of farmer decision-making and constraints. Therefore, survey results are reported by locations (watersheds) and/or plots as appropriate.

6.4.2 Sampling

A survey was conducted after one and a half years of qualitative fieldwork. A sampling frame for the survey was prepared of farmers who live and farm in the four locations mentioned earlier. A farmers' list was prepared by enumerators from the locality with the assistance of executive committee members of the respective Peasant Associations and development agents who are responsible for the area. Preparation of these lists took 3-10 days, depending on the size of the watersheds. The total number of households listed in the sampling frame in each watershed were as follows: 103 treated, 120 untreated, 195 adjacent and 680 distant.

Household heads were selected using two-stage cluster sampling. At the first stage, the four watersheds were purposively selected. At the second stage households within these watersheds were randomly selected. Finally, a total of 231 farmers [34] were selected for an interview (Table 6.2). These farmers represent a fraction of farmers in Wolaita. However, the areas selected for the sample are representative in terms of farming practices and are typical of soil and water conservation efforts carried out in Wolaita.

6.4.3 Methods of data collection

Both primary and secondary data sources were used. The primary data were collected using both qualitative and survey research methods. The qualitative research featured group and individual interviews, focus group interviews and observations. A semi-structured interviewing schedule was used in all the interviews. The qualitative aspect of the research featured narratives around the research issues on soil and water conservation using key questions to spark the discussion. All other relevant issues were built up on the previous questions until the point of saturation on the issues was reached. The entire qualitative data set was collected by the researcher using interpreters. A structured survey instrument was used to collect the survey data. Enumerators who speak the local language were used at this stage of the research. They were given a one-week intensive training course including two days of pre-testing.

34 The sample gives a precision of ±7%, with a 95% confidence level based on a 55% coefficient of variation for land size from the same sample.

Table 6.2: Number of sampled farmers per Wereda, village and location in relation to Soil Conservation Research Project site

		Location in Relation to Soil Conservation Research Centre				
Name of Weredas	*Name of Villages*	*Treated*	*Untreated*	*Adjacent to the centre*	*Distant from the Centre*	*Total*
Kindo Koisha	Shega	25	24			49
	Feteta	40	1	7		48
	Maheldoge			6		6
	Centra			3		3
	Huletegna		15	5		20
	Shakisho					
	Mashedo		6			6
	Subtotal	65	46	21		132
Bolo Sore	Offa			7		7
	Subtotal			7		7
Sodo Zuria	Ketena 1				21	21
	Ketena 5				23	23
	Ketena 3				18	18
	Ketena 7				13	13
	Ketena 4				17	17
	Subtotal				92	92
Total		65	46	28	92	231

6.4.4 Methods of data analysis

The qualitative data were partially analysed during the process of data collection to immediately be able to identify gaps to be filled through subsequent data collection. The final analysis was carried out through pattern-matching to suit the research objectives. The patterns were obtained from the recorded field notes. This process involves the selection of a key word that fits the main research questions and the elaboration of the information gathered on that theme. Elaboration was facilitated by the in-built *grounding* process of the data collection phase, which attempts to answer all relevant questions until the point of saturation.

The quantitative data were first summarised on a data summary sheet prepared for this study and subsequently entered into a computer. Both activities were carried out by assistants under the supervision of the researcher. Before the final analysis, the researcher carried out data screening and cleaning whereby he discovered a serious data entry mistake. As a result, he checked all 231 cases involving 900 primary variables. Finally, the data were analysed with appropriate statistical procedures based on the level of measurement of the variables involved, i.e., the nominal, ordinal and interval levels. The Statistical Package for Social Sciences (SPSS version 10.0.7) was used. The statistical analyses include: descriptive statistics;

frequencies, averages, cross-tabulation; association; general linear model; univariate, post-hoc multiple comparison and non-parametric statistics (chi-square test and Kruskal-Wallis analysis of variance).

6.5 Results and discussion

6.5.1 Socio-economic situation of farmers in Wolaita

Household characteristics

Households in the study area consist of both nuclear and extended families. Therefore, family members included parents, grandchildren, cousins, nephews and nieces. The majority of the households is, however, of the nuclear type. Even so, there is multiple dependence on the same farm plot, a situation that can be termed 'farmholds' rather than households.

Table 6.3 presents key household characteristics related to farmers' land-management decisions. The subsequent discussion in this section is partly supported by the information in this table. The table presents the status of the entire sample (231 farmers) and the four locations with respect to these variables. Test of difference among the four locations is given by chi-square or F-ratio, as appropriate.

Of the surveyed farmers, 88% were married. Of the 198 married farmers, 87% were married to one wife. The remaining 12% and 1% of the farmers were married with two and three wives respectively, which indicate that polygamy is not very common, unlike in the past. The family size ranges from 1 - 16 persons, with an average size of 6.5 persons. Family size does not show a significant difference between locations (Table 6.3).

Due to the small farm size per capita (average 0.62 ha), it is common to find two generations of subsistence farmers in the same household. An age range of 60 years is an indication of this situation. The minimum age of the surveyed farmers is 20, whereas the mean age is 43 years. Age too does not show a significant difference between locations.

Economically dependent age groups (0-14) and elderly (65 and above) vary from nil to 12 persons per family, with a mode of four persons. Ninety-six percent of the cases has seven dependents. The economically active age group ranges from 1 to 10 persons with a mean of 3.2. The mode of the economically active age group is two persons, mostly a wife and a husband. The sample does not show a significant difference between the locations with respect to the economically active age groups. Amare (1988) found economically active age groups of 2.6 and 2.5 for treated and untreated catchments respectively. The dependency ratio at the household level varies from 0.2 for 2% of the farmers, to 8 for 1.4% of the farmers. The modal dependency ratio is 1, covering 21% of the households in the survey. In 48% of the households, the dependent age group exceeds the economically active age group, whereas 31% of the households had a more economically active age group as compared to dependent age groups. With respect to a resource base, cropland distribution of the families with the modal dependent population (4 persons per family) ranges from 0.13 ha to 1 ha.

Even though the study area is only 200-250 km from major urban centres, migration is not common. Out of 231 cases, 30% and 16% of the surveyed farmers has reported temporary and permanent migration, respectively. Most of the temporary migrants were male, whereas females exceed males among the permanent migrants. The number of households that obtain remittance income from migrants was negligible. There is no significant difference between the locations with respect to migration.

Table 6.3: Household characteristics and access to resources in Wolaita, Ethiopia

Variables	*Total Sample*	*Locations*					
		Treated	*Untreated*	*Adjacent*	*Distant*	*Tests (χ^2/F)*	*Significance*
Family size (mean)	6.5	7	6	7	7	0.376	ns
Age of household head	43.4	42	44	41	45	0.889	ns
Dependent family members	3.4	3.3	3.4	3.7	3.5	0.244	ns
Economically active labour	3.2	3.4	2.8	3.0	3.2	1.130	ns
Migration							
Temporary (%)	30	20	15	8	27	0.202	ns
Permanent (%)	16	16	4	2	14	7.471	ns
Education of Household Head						5.001	ns
Illiterate (%)	147	29	18	11	42		
Basic Education (%)	18	22	28	22	28		
Grade 1-8 (%)	53	30	21	13	36		
Grade 9-12 (%)	12	17	25	8	50		
Crop land (mean in ha)	0.45	0.49	0.51	0.44	0.40	2.686	*
Grass land (mean ha)	0.09	0.13	0.09	0.08	0.07	10.107	***
Forested land (mean ha)	0.09	0.13	0.10	0.09	0.07	9.021	***
Total land (mean in ha) [35]	0.62	0.71	0.69	0.62	0.51	5.359	***
Livestock owned (number) [36]	3.2	3.5	3.0	3.8	3.0	6.864	ns
Use of fertilisers 1998 (mean kg)	46.1	52.6	47.8	44.6	37.9	0.928	ns
Use of fertilisers 1999 (mean kg)	44.3	47.6	45.9	46.1	38.8	0.556	ns
Visits by extension agents						11.282	*
(%) Yes	27	38	26	41	17		
(%) No	73	62	74	59	83		
Access to credit						10.776	*
(%) Yes	72	60	88	81	71		
(%) No	28	40	12	19	29		

*Note: ns, * and *** shows: not significant, significant at $p \leq 0.05$, and at $p \leq 0.001$ for χ^2 or F test. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

Most farmers (64%) are illiterate (n=230). Some of the farmers who participated in the literacy programme in the 1980s (8%) are now unable to read or write. The educational attainment of 28% of the farmers ranges from grade 2 to grade 12. In terms of grade distribution, 18% fall in the range of grades 2 to 6, 5% had achieved grades 7 and 8, and 5% were between grades 9 and 12. The overall chi-square test for education does not show a significant difference between the locations. Only 5% of the total farmers interviewed in this area reported ownership of radio, which indicates poor access to cheap and relevant source of information.

The majority (99.6%) of the respondents in Wolaita are Christians of different churches,

35 The total land figure does not include the communal land to which all farmers' households have access, such as village and distant grazing areas.
36 Excluding chickens.

composed of Orthodox (62%), Protestants (37%) and Catholics (0.9%). Before the introduction of Christianity a century and a half ago, the Wolaita people were pagans. Their object of belief was large trees (e.g., *ficus*). Some people believed in witchcraft (*Wukabi*). During military rule, paganism and witchcraft were abolished, and thereafter people began to neglect tending the big indigenous trees and shifted to eucalyptus, which was introduced in the last quarter of the 19th century. Ancestral cemeteries were covered by indigenous tree species. After people converted to the Orthodox Christian religion, the ancestral cemeteries were no longer used. Nowadays, only Protestants bury their dead in the private burial places. Followers of the Orthodox religion celebrate four days of every month, apart from Sundays, and one week of *Meskel* holiday in October. Protestants on the other hand celebrate Good Friday, Christmas and on Sundays. Farmers do not report any difficulties because of religious holidays. There are also no days where farm work cannot take place due to superstitious beliefs.

Rural people in Wolaita mainly depend on agriculture for their livelihood. Farming is the only means of living for 84% of the 231 farmers surveyed. The major off-farm employment in the area is trading. Only very few farmers earn a meagre income from pottery, wood carving, basketry, or wage labour. School dropouts and returnees from military service go back to their parents' land. Individuals with no access to land can hardly find other means of livelihood due to lack of know-how to create self-employment, lack of finances and poor rural infrastructure.

Land ownership and land fragmentation

Due to high population pressure, landholding per capita is small. The average landholding of the surveyed farmers is 0.62 ha, with a mode of 0.5 ha (Table 6.3). Farmers who own land in excess of 1 ha number 11%. Total land size, grassland and forested land show a highly significant difference across location ($p \leq 0.001$), while cropland was significant at $p \leq 0.05$. The coefficient of variation of the total and croplands were 55% and 57% respectively. Those farmers who have a greater land size can practise more mixed farming than those who have little or no land for hay production or grazing.

Inheritance from parents was the main source of land for most of the surveyed farmers. A small proportion of farmers got small plots from the Peasant Association both during and after the *Derg* Regime.

Land ownership in terms of land size has been fairly stable over the last 25 years. Approximately 53% of the farmers did not see any change in their holdings, while 37% have reported a decrease in farm size during this period, and 6% managed to increase their holding through purchase and inheritance. The remaining 4% started their own farm in the last five years.

Important reasons for the decline in landholding size are soil erosion (38%), sharing the land with children and brothers (30%), sale/lease (12%) and redistribution by the state (8%). A few farmers (12%) faced a combination of situations that led to a decrease in their holdings. For instance, three farmers reported that their land was taken by the SCRP without compensation. In addition, these farmers added that they shared their land with their children and brothers, sold/leased and lost some portion due to soil erosion.

Farmers in the area are very well aware of the government's claim on land. Of the total farmers, 33% of them replied that the land belongs to them, while the rest stated that the land belongs to the government. Even then, only 4% of them see this claim as a problem to their land-management practices. This issue has also been pursued through small group and key informant interviews, which confirmed the same trend.

In Wolaita, as in many societies in Ethiopia, land is inherited by the male child. In the next ten years alone, 54% of 231 farmers are expecting to share land with their children. In spite of extremely small farm sizes, one to five male children are in line to inherit land from their parents in the next ten years.

Due to increased land shortages, farmers shift grass or wood plots to crop production. Small landholdings are one of the reasons for the destruction of soil bunds in the area.

Slope gradient

Farmers' land management practices and production problems are better understood if analysis is carried out at both the plot and farm level and at the watershed level for community-level decisions. Farmers in Wolaita divide their farms into small plots for operational reasons even though their landholdings mostly fall in one location. Because of this, farm distance is not a very important factor except in terms of transportation of manure. Following farmers' practices, farm plots were numbered starting from the plots next the house to the last one located before the grass or wooded plots. This study found a maximum of twelve such plots, with an average of plots being 5.9. Only the first six plots will be presented here. The other plots were omitted because of limited response. Note that the percentages of each plot do not add up to 100 because of multiple responses. This may also hold true for some additional percentages provided in the subsequent discussions, when the interest is on the specific response other than the sample distribution.

The slope of the plots greatly influences the rate of erosion by water (cf. Universal Soil Loss Equation). The slope is one of the observable factors in the erosion process that prompts farmers to monitor erosion. In view of this, farmers were asked to identify their plots according to four descriptive gradient classes: namely, steep, moderately steep, moderately flat and flat. In addition, the farmers were asked if plots were under the ridge, a situation, which was inherently affected by erosion (see Table 6.4).

Apart from the first three plots, the percentage of respondents with moderately flat to flat slopes was found to be greater than that of moderately steep to steep slopes in all other plots. The percentages of moderately steep to steep were greater than those who rated their plots as moderately flat to flat. The difference in percentage of farmers reporting moderately steep to steep slopes increased when moving towards the plots located down the valley, the *Shoka* field. Most of the farmers with steep farm plots are located in the distant location (Waja catchment), whereas most of those who consider their farm as flat are located in and around the SCRP catchments.

Use of external inputs

Nowadays, commonly used external inputs in the farming system are improved seeds and fertilisers. The major sources of seeds in the study area are the local market, from the farms themselves and from government organisations, in order of importance. Supply of improved maize seed from government sources is fairly adequate as compared to other small-grain cereals.

Table 6.4: Slope gradient of farm plots, Wolaita, Ethiopia

Gradient Classes	*Plot 1*	*Plot 2*	*Plot 3*	*Plot 4*	*Plot 5*	*Plot 6*
	n=230%	n=227%	n=215%	n=201%	n=172%	n=126%
Steep	20	20	24	28	30	34
Moderately steep	15	17	18	25	31	33
Moderately flat	24	27	23	19	19	16
Flat	40	36	32	24	18	14
Land under steep ridges	-	-	3	3	2	2

Farmers in the study area use both urea and DAP[37] fertiliser. Most farmers (68%) have used fertilisers on their farm at one time or another. In last two years (1998 and 1999), 62% of the farmers had used fertilisers in the cropping seasons, whereas the remaining 38% did not use any fertiliser.

Looking at the rate of usage of fertilisers, the percentage of farmers using DAP was greater than that of using urea. The percentages of farmers using urea in 1998 and 1999 was 38% and 41% respectively, whereas, the users of DAP over the same period numbered 55% and 60% respectively. Mean fertiliser use for 1998 (46.1 kg) was slightly greater than that for 1999 (44.3 kg). An analysis of the amount of fertiliser used in 1998 and 1999 shows that mean fertiliser usage by farmers from the treated catchment was the highest in both years, whereas corresponding figures for the distant farmers were the least over the same period. There was no significant difference between locations in terms of fertiliser usage during those two years (Table 6.3).

Labour organisation

Major sources of labour in the study area are family members, labour parties, and relatives and friends. Labour is mostly organised according to its importance for: cultivation or hoeing (88%), harvesting (77%), house construction (64%), and sowing (62%). Land preparation and maintenance and construction of bunds were mentioned by only a small percentage of respondents (8% each).

The organisation of a labour party is rooted in the tradition of the Wolaita people (Data, 1998). Labour parties are organised for house repairing, wood splitting, grass cutting and routine farm operations. Different labour groups are organised according to labour demand of the work and household resource status. These are categorised as: *Dagua*, (small 10-20, large 120-130 people), *Yurpia* (10-20 people) and *Zayia* (5-10 people). The latter two forms of labour groups are mostly reciprocal unlike the first one. In addition to these three forms of labour organisation, the community has another labour support system called *Wossa*. This does not involve reciprocal labour because those who qualify for *Wossa* are often handicapped, the elderly or widows.

Apart from actual labour participation, community members help each other with a contribution of grain for the preparation of food and drinks, collecting firewood, fetching water, and the preparation and serving of food and drinks. Women fulfil these roles, while men participate in the field operations.

37 Di-Ammonium Phosphate.

Nowadays, the organisation of a large labour party is uncommon, partly because of the small land size and the extensive use of the ox-plough that has eased part of the labour process.

A new source of labour other than the traditional labour organisation is found in the congregation of church members. Whenever a church member faces a labour shortage, members set a date and provide labour for him/her.

Trends in crop production

As indicated earlier, Wolaita is suitable to a range of crops. In spite of its ambient environment for agriculture, many farmers are not able to produce sufficient food for their families. The average yields of barley, haricot bean, maize and teff at Gunno research station from 1986 to 1993 were: 0.6, 1.2, 2.5 and 0.8 t ha^{-1} (SCRP, 1996a). Looking at the trend of crop production over the past decade, the majority of surveyed farmers (82%) experienced a decrease in total crop production. An increase in crop production was reported by only 12% of the farmers, while the remaining (6%) did not see any change in their production.

The increase of production was achieved by using commercial fertiliser with local or improved seeds, the use of manure and household refuse, share-cropping, leasing more land, and shifting grass/woodland to cropland. Some farmers use a combination of strategies to achieve their objectives.

Table 6.5: Farmers' prioritisation of problems in crop production

Crop Production Problems	*Ranks*
1 Decline in soil fertility	2
2 Pests	8
3 Disease	6
4 Drought*	3
5 Shortage of rainfall*	1
6 Soil erosion	4
7 Shortage of land	5
8 Lack of fertiliser	7
9 Shortage of manpower	9

** According to farmers, drought refers to a prolonged absence of rainfall, whereas shortage of rain refers to its erratic nature whereby crops are affected due to little rainfall or to its interruption after its onset.*

Production gaps are often filled by market supply. Most families (93%) purchased food in 1999 and 2000. In 2000, 95% of the surveyed farmers purchased food grains. The average period over which food grains are purchased was six months. The few months before the next harvest are critical to families with many members. Food shortage in Wolaita is very common even outside the years of widespread famine in the country. For instance, Amare (1988) stated that 78% and 76% of farmers from treated and untreated catchments respectively reported a food shortage during the year. The periodic vulnerability of Wolaita to food shortages is widely documented and aggravated by erratic rainfall, among other factors (Dagnew, 1995). The farmers identified different problems related to crop production (Table 6.5). The problems that were identified are closely interrelated. Priority problems lean towards biophysical constraints. The importance of soil erosion was reflected in the relation to a decline in soil fertility, discussed in later sections. Socio-economic problems such as a shortage of manpower occur when some farm operations in the *Belg* season and that of the Kremt season overlap. Due to indigenous institutions that give access to labour and oxen through social arrangements and rents, farmers did not emphasise a shortage of these resources. Their focus leaned towards factors that are outside the control of their institutions.

Livestock production system

Livestock rearing is a typical feature of the farming system in Wolaita. There was no significant difference between locations with respect to the ownership of livestock. During the survey period, 93% of the 231 households in Wolaita had some kind of livestock. Cattle are the dominant livestock species integrated with the cropping systems of Wolaita. Farmers who owned one and two heads of oxen are 34% and 5% respectively. Draft animals such as donkeys and horses are rare compared to cattle. In terms of location, farmers in the distant location who live in the mountainous area own more draft animals. Sheep are more common than goats.

Shared livestock rearing[38] is very common in the area. Fifty-seven percent of the farmers have been involved in shared livestock rearing during the last two years. Shared livestock, like any other partnership, requires common interest, mutual benefits, social ties and trust. Shared animals are cows, heifers, sheep and goats. Rearing of these animals gives the recipient farmers the opportunity to get offspring, milk, butter and manure. Oxen and bulls are shared for fattening purposes in addition to traditional services like manure and draft power.

Livestock feed comes from individual grass plots, communal grazing, crop residues, thinning products and weeds. In the residential areas and on individual grass plots, animals are mostly tethered. Free grazing is applied in bigger communal grazing lands. Due to strict animal-control systems and live fences around farming plots, the livestock do not interfere with trees and grass on soil bunds.

Animal production has declined in the past ten years; 84% of the farmers have experienced a declining number in their stock, while only 8% managed to increase their stock. These are young farmers who established their families in the past ten years. Few farmers (8%) maintained their stock through breeding or purchasing.

Disease was the major problem that reduced livestock in the area. It was reported by most of the farmers (72%). This situation is said to be improving. The second most important bottleneck to livestock production is a shortage of feed (69%). This is aggravated by the shortage of land, droughts and erratic rainfall that affect the production of biomass from the farms and the grazing areas. Other problems that account for a decline in livestock include a low price per head of animals, physical injury to the animals and a lack of cash.

Farmers sell animals for various reasons: purchase of food, house construction, funerals, improved stock composition, wedding ceremony, shortage of feed, disease outbreak, purchase of cloth, profit, loan repayment, health expense and other miscellaneous social reasons (e.g., shared rearing, court expense). Among these reasons, 'purchase of food' and 'house construction' were the most important ones. Cattle, specially oxen, were the most frequently sold animals in the area.

Access to information and credit

Nowadays, the extension service of the regional state is the main source of information in agriculture. The SCRP has served the community in the experimental watershed with soil and water conservation practices during its active period. Unlike farmers in the lower altitude,

38 See footnote 22 in chapter 5.

farmers in the upper catchment of the Damota Mountain that is designated as a 'distant location' in this study did not get adequate extension services due to the landscape and accessibility. The New Extension Intervention modeled after Sasakawa Global 2000 provides farmers mainly with seeds and fertilisers, but also with improved animal breeds and soil and water conservation methods. The major extension method for the participants of the new extension propgramme is the individual method. Among farmers in this study, 27% was contacted by the extension agent during the last two years. Of the total 231 farmers, 68% obtained credit from different sources (Table 6.3). The major source of credit is the regional state, which provides agricultural credit to the rural community followed by micro-finance. Consumption credits are obtained from relatives and friends.

6.5.2 Farmers' knowledge, perceptions and practices in soil and water conservation

Farmers' knowledge and perceptions on soil erosion and soil and water conservation

Our understanding of farmers' knowledge and their perception of factors that influence their land-management practices is of paramount importance for promoting sustainable land management. It is also interesting to know if and when farmers practise what they know and perceive. As discussed in chapter 3, the relationships between *knowledge, action* and *attitude* are not straightforward. The following sections of this Chapter deal with how farmers' land-management behaviour is shaped as a result of an interplay between socio-cultural, socio-economic, institutional and technical factors.

During the qualitative phase of this study, efforts were made to understand farmers' knowledge and perception on soil erosion, soil fertility, incentives for soil and water conservation and their view about the future generation. This was achieved with the help of a long list of statements on these issues that were used in individual interviews. Following the interviews, farm plots were visited with farmers who were involved in the interviews. Their opinions on knowledge and perception were compared with their behaviour in land management. This exercise provided a useful insight into *why farmers do what they are doing and how they perceive what they are doing*. More specifically, we were interested in why they showed reluctance to adopt/maintain the soil bunds that were introduced by two successive projects since the 1970s. In addition, there is a need to know how many farmers know, can and do carry out some land-management practices. However, it was not known how many farmer were practising land-degrading farming in a population of a given watershed or otherwise. It was possible that conservation-oriented farmers are few as compared to those who follow land-degrading practices and vice versa. In view of this, selected statements were included in the survey instrument to assess farmers' responses within the population of the study area.

The statements were measured at three levels: (1) not clear, (2) disagree and (3) agree. This short set of alternatives was considered in the interest of clarity to the farmers based on the experience from the pre-test during the qualitative phase.

Table 6.6 shows results of farmers who agreed with the statements on knowledge. Cases with 'disagree' range from 0 to 2.6 percent, while cases with 'not clear' range from 0.4 to 2.6. Thus, responses with a small percentage were not included in the table 6.6.

The responses across the four locations for the most part do not show differences, except for three statements that showed significant difference at $p \leq 0.001$ (item 2 and 6) and at $p \leq 0.01$ (item 4). Responses of farmers from the treated catchment differ significantly from the untreated and distant locations with respect to farmers' knowledge on the consequences of overgrazing and continuous cultivation of land to erosion. The responses of farmers from the treated catchment also significantly differ from all the three locations with respect to the consequences of high population to land degradation. Interestingly, a few farmers from the treated catchment area who were exposed to soil and water conservation experimentation for nearly three decades, with intensive coverage during the last 15 years, show some reservation on the knowledge statements treated in this study. The reason for this reservation could be *cognitive dissonance* whereby farmers changed their actions likely due to a conflict with their objectives (Chapter 3). The large majority responded 'disagreed' or 'not clear' while they agreed with most of the statements. Apart from that there were no differences with respect to the other knowledge statements, nor was there any difference among the other three locations (i.e., 2, 3 and 4).

Table 6.6: Farmers' responses of agreement to statements on knowledge of soil erosion and soil fertility processes, Wolaita, Ethiopia

	Locations						
Statements	*(1) Treated (%)*	*(2) Untreated (%)*	*(3) Adjacent (%)*	*(4) Distant (%)*	*n*	χ^2 *(p-value)*	*Between - Location Differences*
1. Steep lands are prone to erosion	99	100	100	100	229	2.538 (0.448)	
2. Overgrazing exposes land to erosion	91	100	100	100	224	15.568 (0.001)***	1-2* 1-4**
3. Land with poor vegetation cover is easily eroded	97	100	100	100	228	5.099 (0.165)	
4. Continuous cultivation reduces soil fertility	91	100	100	99	223	11.845 (0.008)**	1-2* 1-4*
5. Soil erosion reduces soil fertility	99	100	100	100	229	2.538 (0.468)	
6. High population pressure can increase land degradation	82	100	100	100	218	32.976 (0.000)***	1-2** 1-3*
7. Farm bunds have to be maintained regularly	97	100	100	100	228	5.099 (0.165)	1-4***

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise. Between-location differences were analysed with the Kruskal-Wallis one-way analysis of variance. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

It is needless to state that farmers do understand the severity of erosion on steep lands from their life experiences. They understand the relationship between overgrazing and erosion as animal hooves expose soil by removing grass and other vegetation. Widely cited examples were footpaths and animal-resting places, which showed signs of vegetation removed by animal hooves.

With regard to vegetation cover, most farmers understand the anchorage function of plants without understanding their association to reducing the erosive force of raindrops. The effect of roots to enhance infiltration is hardly understood among farmers. What is clearly observed by farmers is that their land is less eroded when there is good plant coverage. The farmers' choice of crops involves trade-offs between the benefits from the crops in question and the fertility status of the plot location. In view of this, they classify crops according to the demand of their nutrient requirements from the soil, which they call 'energy'. Accordingly, crops such as maize and legumes enrich the fertility while a crop such as teff reduces the fertility. However, how the soil enrichment process takes place is not very clear except through leaf decomposition. Because of this, I asked several farmers about the function of nodules in the leguminous crops. The common answer was that it is a disease, a kind of deformation.

Contrary to a widespread belief that soil erosion is not noticed by farmers (Hurni and Kebede, 1992; Kassaye, 1997), they could easily identify soil erosion on their farms, and its impact on soil fertility. However, as indicated in Table 6.5, their focus is not on soil erosion per se, but on soil fertility. They mention the symptoms of soil erosion only when specifically asked. Their common indicators are small and large rills that are seen in the field after the rainy period. Owing to their day-to-day experience with these phenomena, they all understand that erosion affects their productivity through reducing the 'energy' of the soil. However, they do not mention sheet erosion. One way whereby they indirectly mention sheet erosion is that 'runoff' takes away the 'cream' from the soil. They have observed that the 'cream' of the soil is restored when erosion is controlled. In another discussion they associated 'energy' and 'cream' to the quality of a good, fertile soil. Continuous cultivation is one of the reasons cited for the decline in soil fertility. They generally believe that the land should rest for a period of time after some years of cultivation (for more information on indigenous soil knowledge in Wolaita see Eyasu, 1997; Data, 1998).

The relationship between population pressure and land degradation is not that clear to farmers. Their observation on this issue is linked with land inheritance. Therefore, the dependence of a large population on the ecological services of the land needs further contextualisation when discussing with farmers. For instance, the queuing at the water points, the space used for residential areas, etc., are marked indications that they can easily understand and relate to a population increase. Dwelling on this issue, farmers indicated that about a century and half ago, there were no villages as such. All the families built their houses on their own land. As the land owned by a family was very extensive, each family had been residing no less than 2-4 km away from each other (see also Data, 1998:9). Farmers in Wolaita now understand the effect that more people limit the farmlands. Only approximately 10-30 meters now separate the houses of cousins and brothers. One farmer put his problem as follows:

'The farm work is so demanding; however, productivity is going down from year to year. Besides this, there are more people to feed than those who work on the farm. I have nine family members, but I work alone. When there is erratic rainfall, I also sometimes lose part of the little that I managed to grow in a season.'

Many farmers who participated in group interviews have shared the above view. For instance, one farmer added:

'What my fellow brother said is true. The land needs bribing, fertiliser. In the past when we started using fertiliser with the WADU (early 1970s), we used to buy 50kg for only 12 birr. Now, the same quantity of fertiliser is 150 birr. What we harvest is too small to feed our family three times a day and to also buy shoes and clothes for our children who go to school.'

For obvious reasons, they tend to emphasise the issue of soil fertility. Farmers in all locations are aware of the importance of soil bunds in their area where soil erosion is the enemy to the soil fertility they have built up with great effort. They also know the importance of soil bunds and its management from several years of group and mass communication in the area. In spite of that, bunds[39] are not yet part of their repertoire of land management practices.

In order to learn how farmers' knowledge would influence their perception, statements of

39 Other studies (Data, 1998; Alemayehu, et al., 2001) report that farmers in the mountain areas practise stone bund construction on their farms, but these too are limited to few bunds in selected sites rather than a typical case for Wolaita.

perception related to the knowledge statements in Table 6.6 were presented to the farmers (Table 6.7). The level of measurement was similar to that of the knowledge statements used in Table 6.6.

Farmers' responses were strong in terms of both the 'agree' and 'disagree' statements. The response for 'not clear' was too small to be included in this table, ranging from 0.4 to 2.6 percent. Among the six statements presented in Table 6.7, items 3 and 4 were highly significant ($p \leq 0.001$) while item 6 was significant ($p \leq 0.01$). As in the case of knowledge statements, farmers from the treated catchment significantly differ from the other three locations, whereas there is no difference between the latter three locations, with respect these statements (see between location difference, Table 6.7). There is no difference across locations with respect to the role of soil and water conservation for crop production (item 1), the need to maintain soil fertility for the future generations (item 2) and farmers' responsibility in soil and water conservation (item 5).

Table 6.7: Farmers' perceptions of soil and water conservation and crop production, Wolaita, Ethiopia

Statements	*Responses*	*Locations*						
		(1) Treated (%)	*(2) Untreated (%)*	*(3) Adjacent (%)*	*(4) Distant (%)*	*n*	*χ2 (p-value)*	*Between - Location Differences*
1. Soil and water conservation increases crop production	Agree	97	100	100	100	228	5.099 (0.165)	
2. We have to maintain soil fertility for the future generation	Agree	92	96	93	96	217	1.004 (0.800)	
3. We have to feed the present generation instead of thinking for the future	Disagree	74	98	100	100	212	42.025 (0.000)***	1-2*** 1-3** 1-4***
4. A high production now is preferable than getting the average for the next five years	Disagree	79	100	96	99	214	29.804 (0.000)***	1-2*** 1-3* 1-4***
5. Soil and Water Conservation is farmers' responsibility	Agree	88	98	93	97	216	6.703 (0.082)	
6. Farmers should be paid for soil and water conservation in their farms	Agree	77	96	96	92	205	13.500 (0.004)**	1-2** 1-3* 1-4**

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise. Between-location differences were analysed with the Kruskal-Wallis one-way analysis of variance. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

As underscored in their responses to the knowledge statements in Table 6.6, farmers value the importance of soil and water conservation to crop production. In view of declining land size from generation to generation, farmers were asked about their views on the future generations. The concern for future generations is strong and is directed to each family. As farming is the major means of livelihood that they know and which is accessible to them, they see the maintenance of soil fertility as a saving for their children. In view of this, they strongly agree with the importance of soil and water conservation for crop production, which they see as the farmers' responsibility. Contrary to this opinion, close to 90% of the farmers expects payment for any SWC measures they practise on their own farms. Farmers from the treated catchment widely differ on the payment issue from farmers from the other three locations.

Shifts in land use and emergence of soil erosion

Farmers do not sow seeds on land that is threatened by erosion without some means of minimising the erosion. In the first place, erodible sites are not selected for production on a tillage basis. The agrarian history of Wolaita also shows this general observation.

Due to a judicious allocation of land resources for crop and livestock production systems by farmers, soil erosion was not the major bottleneck of crop production in highland Wolaita until the early 1970s. According to farmers, it came to occur widely after the expansion of cereal production from the flat to sloping land, which used to be operated by hand tools (*gesso* and *ayile*). The expansion was enhanced by the shift from the gesso to the ox-plough for land preparation. Note that the ox-plough has been found suitable for flat terrain while *gesso* was used for steeper land near the homestead areas. Cultivation was and still is carried out by *ayile*. In the past, Wolaita farmers used to grow coffee, enset, taro and some maize only on the garden plot, called *Darkua*. The outer fields, *Shoka*, were used for grazing only. *Darkua* is the only cropland known in the system that is managed with organic fertiliser. In the early 1970s, they expanded their farming horizons to the *Shoka* land, using ox-ploughing and fertiliser introduced by the WADU. According to the farmers, the WADU encouraged them to utilise fertiliser in their *Shoka* plots. For its part, the WADU promoted crop diversification to supplement enset and root crops (see also Alemayehu *et al*., 2001). Credit for oxen was one of the WADU's programme activities. Prior to the 1970s, farmers were in a position to maintain a balance between the *Darkua* and *Shoka* lands according to the food requirements of the household, livestock size, grass requirements for house construction, etc. Grass from the *Shoka* land has been supplementing the *Darkua* by supporting a large herd per family which produces manure for fertilising the *Darkua* plot (see also Eyasu, 2000). After shifting large portions of *Shoka* land to the cultivation of cereals, livestock depended on a small portion of grassland located mostly towards the lower end of the farm. In addition, the scarcity of grass for construction increased farmers' expenses. A shortage of land led to the diversion of using crop residues for soil fertility to animal feed. With the shrinking of woodlots down at the bottom of the valley, crop residues, including enest stems, came to be used for firewood, which further contributed to the decline of soil fertility. Farmers underlined that erosion is aggravated when the fertility of soils declines.

As a result of the growing population, farmers in the middle altitudes were forced to convert part of their home yards to crop or tree production. Farmers in the Domota mountain area (the distant location) have widely converted the forest to farmland. This shift of land use was carried out without sound physical conservation methods on very steep slopes cultivated on all sides of the mountain, ranging from 1,941m to 2,908m at its peak, in the watershed covered by this study. These farmers do not have access to feasible technical means nor do they receive security from the lands brought under cultivation.

The state and causes of soil erosion

Farmers were asked whether there were erosion problems in any of their plots on the farm. Of the total 231 farmers interviewed, 68% perceive erosion problems in some of their plots. In terms of their location, the breakdown was: treated (28%)[40], untreated (20%), adjacent (10%) and distant location (42%). With respect to the causes of erosion, some farmers have a clear idea of why they have erosion problems, whereas others only have general ideas. Of the total, 56% of the farmers identified steepness (also see Table 6.8); 44%, water erosion; 25%, poor management, whereas 33% of them simply said it is because of natural problems. One farmer said 'I do not know' while another person attributed the cause of erosion to removal of the soil bunds. Soil erosion occurs as a result of a combination of factors as mentioned by 68% of the farmers (steepness, water erosion, and poor management).

In addition, farmers were asked why soil erosion occurred on their farms on a plot per plot basis (Table 6.8). 'Lack of bunds' is generally mentioned in all plots except for P1. Even then, floods that enter from the residential area affect this plot.

Erosion due to 'lack of bund' occurs in plot 1 on farms in the distant location, contrasting with P1 in the other three locations. The reason has more to do with the steeper land features in the distant location than with other factors associated with the proximity to the station. Erosion in the other plots is randomly distributed among farmers from all four locations.

'Lack of bunds' does not show a significant difference between plots except for in P4 where the between-location response was significant, at $p \le 0.05$. Only a small proportion of the farmers at the distant location mentioned lack of bund in P1. Farmers from the other three locations did not mention lack of bund as a problem to soil erosion in P1. This is probably due to the direct negative experience they had in the treated catchment.

Among reasons indicated in Table 6.8, 'steep lands without bund'[41] and 'lack of diversion ditches' were frequently mentioned problems with a substantial percentage across locations and plots. The response of 'steep land without bund' varies across location and plots with $p \le 0.001$ for P1 and P2, while P3 is significant at $p \le 0.01$. Responses to this item for P4, P5 and P6 do not show variation across locations. Farmers from the distant location emphasise steep lands and absence of bunds more often than those from the other three locations. This difference can be explained by the fact that farming is practised on predominantly steep agricultural land in the distant location.

'Damaged bunds' occur in the treated catchment and the distant location where soil bunds were installed through food-for-work. The response on this issue was significant for P3 ($p \le 0.01$), P4 ($p \le 0.001$), P5 ($p \le 0.05$) and P6 ($p \le 0.001$). Farmers from the treated catchment associate soil erosion with damaged bunds more strongly than in the other three locations.

The diversion ditch is a very important physical conservation measure that is widely practised in the area. Farmers felt that the higher occurrence of erosion in some plots compared to others was due to an absence of diversion ditches. However, their response with respect to the upper two plots (P1 and P2) shows a significant difference across locations ($p \le 0.05$). This is caused, among others, by the exposure of some plots in the upper location to floods from outside the farm boundary. Unlike other locations, farmers in the treated catchment did not mention a lack of diversion ditches as a reason for soil erosion, which is particularly apparent in the first four plots. A variation in the degree of flood hazards from farm to farm was also reflected in the group discussions. The difference between farmers from the treated location and other locations could be because of less intensive flooding from the pathways and better

40 These farmers constitute 68% of those from the treated catchment (65 in number).

41 'Steep land without bund' was deliberately included in the survey instrument in order to capture a more precise response than that of 'lack of bund', which may occur on less steep lands as well.

fertility in the upper plots, as soil fertility has increased in more plots in the treated catchment over the last ten years.

Some farm plots are inherently prone to runoff because of their location. 'The land is under a steep ridge' is one of the features that farmers mention to show erosion prone plots. These kinds of plots are distributed across the location, though it does not show a significant difference between locations.

Table 6.8: Farmers' reasons for soil erosion, Wolaita, Ethiopia

Reasons	*Location*	*P 1*	*P 2*	*P 3*	*P 4*	*P 5*	*P 6*
Lack of bunds	Treated (%)	-	2	6	9	2	5
	Untreated (%)	-	11	15	9	7	2
	Adjacent (%)	-	11	11	14	7	7
	Distant (%)	5	11	7	1	2	-
	χ^2	7.721	5.358	3.643	8.399	3.555	5.819
	(p value)	(0.052)	(0.147)	(0.303)	(0.038)*	(0.314)	(0.121)
Steep land without bund	Treated (%)	2	3	11	15	9	5
	Untreated (%)	-	13	17	17	4	-
	Adjacent (%)	11	14	18	11	7	4
	Distant (%)	36	45	34	21	8	3
	χ^2	46.443	42.575	13.268	1.737	0.999	2.038
	(p value)	(0.000)***	(0.000)***	(0.004)**	(0.629)	(0.801)	(0.565)
Damaged bunds	Treated (%)	5	3	14	17	11	12
	Untreated (%)	-	-	-	-	-	-
	Adjacent (%)	-	-	-	-	-	-
	Distant (%)	-	2	3	1	1	1
	χ^2	7.762	2.101	14.539	25.361	9.636	17.222
	(p value)	(0.051)	(0.552)	(0.002)**	(0.000)***	(0.022)*a	(0.001)***
Lack of diversion ditch	Treated (%)	-	3	3	11	8	6
	Untreated (%)	8	13	15	13	4	4
	Adjacent (%)	7	7	14	7	7	7
	Distant (%)	14	19	17	12	8	2
	χ^2	10.133	9.421	7.127	0.682	0.618	2.090
	(p value)	(0.017)*	(0.024)*	(0.068)	(0.877)	(0.892)	(0.554)
The land is under steep ridges	Treated (%)	2	3	6	12	11	8
	Untreated (%)	-	2	7	4	7	4
	Adjacent (%)	-	7	7	7	11	11
	Distant (%)	2	8	7	9	3	1
	χ^2	1.553	2.749	0.033	2.257	4.133	6.175
	(p value)	(0.670)	(0.432	(0.998)	(0.521)	(0.247)	(0.103)

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise (χ^2 test). The letter 'a' shows adjusted chi-square and p-values. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

Another factor that was identified by farmers as a cause of soil erosion is a shift in the rainfall pattern. Wolaita farmers prepare land for the *Belg* season starting from October. Rainfall for the *Belg* season used to start in January, but the onset of the rains has shifted to March or April over the last thirty years. Farmers stated that the soil is easily eroded if exposed to sunlight for too long after ploughing. However, the farmers' complaint about the rainfall pattern could not be ascertained based on only 43 years of rainfall data from the National Meteorological Service Agency (see section 6.2). If what farmers claim is true, it warrants a corresponding shift in land preparation to overcome excessive exposure of the soil. However, this is the issue to be determined between agronomists and farmers through *action research* supported by climatic data over a longer period.

During the qualitative work, I held interviews with farmers in their fields. I asked them how and why their responses to the statements on knowledge of soil erosion and soil fertility, and their perceptions of soil and water conservation and production (Table 6.6 and 6.7) were related to their field conditions. During those interviews, farmers showed me what they did, while confessing the shortcomings, which they said they would remedy in the future. Through non-participant observations I learned that some farmers did not carry out their plans to control some rills which they had agreed to during our discussion in the previous seasons. This method also gave me the opportunity to learn that farmers do different things in different plots, yet for different reasons. The point is that they always have reasons for their actions, be it shortage of labour, lack of motivation, or lack of other resources. Generally, I have witnessed the depth of farmers' knowledge about their fields. They know the history of each and every pocket of their land. Owing to this, they know which part of the plot suffers from erosion and why, where a lack of bunds has caused most problems and where drainage ditches should have been required. Erosion at the plot level may be explained by one or more reasons as shown in Table 6.8. That means that in some cases most of the major problems mentioned above may occur in the same plot, while in others, two or three of the problems occur in one plot, while none in others. This observation generally calls for plot-level measures where farmers themselves play a leading role, taking into account the farm and the watershed features.

Trends of soil fertility

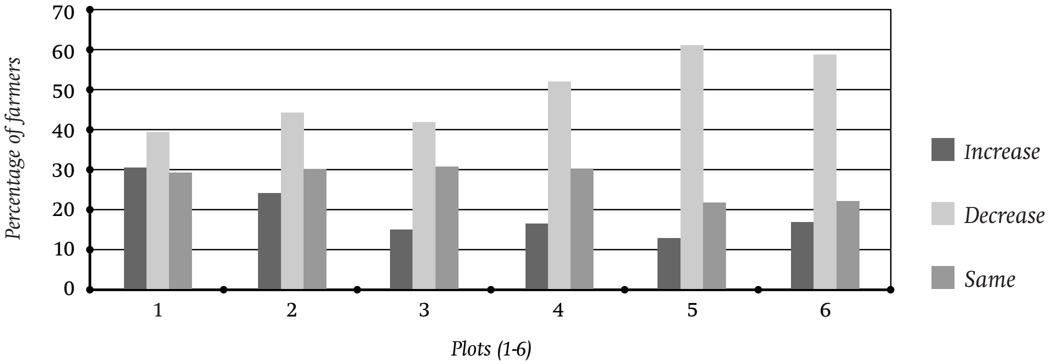
Farmers were asked to identify trends of soil fertility for each plot in their fields from 1990-2000 (Figure 6.1). With the exception of the upper *Darkua* plots where there is a substantial percentage of plots reporting increased infertility, in all other plots, the percentage of farmers with increased soil fertility declines as one moves from the residential to the outer fields (*Shoka*).

Eyasu (1997) has carried out a nutrient input and output balance of fields and farms in the study area. According to his findings, Nitrogen balances of most of the highland farmers in the *Darkua* and taro fields were either slightly positive or at equilibrium. At the same time, *Shoka* fields showed a pronounced negative N balances. The same study shows a Phosphorous balance that was close to equilibrium. In terms of socio-economic groups, rich [42] farmers had accumulated P in enset, taro and even in *Shoka* fields, whereas the poor farmers experienced a slight deficiency of P in the taro and *Shoka* fields.

Sheleme (2001) attributes the variations in soil characteristics from soil profile pits to differences in slope and soil management. His findings show that soil profiles of a convex crust and depression have deep dark surface layers with a relatively higher organic matter content than those at mid and top slopes. He also added that soil bunds have helped in the accumulation of soil at the lower border of the bunds, resulting in a deep 'A' horizon.

42 Wealth indicators used in this study were ownership of oxen, herd size, and size of landholding.

Figure 6.1: Trends of soil fertility from 1990-2000 in Wolaita area



The decline of soil fertility takes place for different reasons between households (Table 6.9). Farmers identified 'shortages of manure' and 'soil erosion' as the most important reasons in all six plots. The responses on soil erosion were significant for P1 ($p \leq 0.05$), P2 ($p \leq 0.001$) and P3 ($p \leq 0.01$), whereas the responses do not vary significantly in the lower plots. Farmers in the treated location faced soil erosion because of removal of soil bunds from their plots. Farmers' observations are consistent with experiments carried out on erosion rates in different plots of the area which show the importance of erosion in the decline of soil fertility (SCRP, 1996b; Eyasu, 1997). Erosion in plot 1 (under perennial crops) takes place because of runoff from the residential areas, such as pathways rather than by runoff built into the plot, which is insignificant, because of the permanent plant cover and high organic matter. Lack of opportunities to fallow land coupled with unabated erosion has aggravated the decline of soil fertility in *Shoka* plots. The high price of fertiliser has limited the use of commercial fertiliser as an alternative source. This problem is felt in all locations. Due to this problem farmers complain about 'tired' soil that is loose on the plough shear.

According to farmers' practices, an increase in soil fertility can be achieved by expansion of the fertile farm horizon (*Darkua*) towards the infertile zone (*Shoka*) and/or by targeting specific plots. Over the last ten years the increase of soil fertility in terms of average number of plots was highest for farmers in the treated catchment, followed by untreated, distant, and adjacent. The average number of plots with decreased soil fertility, over the same period, is highest in adjacent, untreated, distant and treated plots, in descending order. Note that the treated catchment shows the highest and the lowest averages for plots with an increase and decrease of soil fertility, respectively. This favourable situation among farmers from the treated catchment could be because of the soil bunds which could serve as an entry point to promote a participatory learning process on soil fertility management in the area.

In view of the soaring fertiliser price, the lack of rural financial markets, the decline of grass land, and the decline of productivity on the *Shoka* fields; the sustainability of whole system depends on the opportunities that help farmers to expand the horizons of the *Darkua* zone into that of the *Shoka* zone (Eyasu; 1997, 2000). For instance, providing livestock credit for poor families to own livestock, among others, to improve their manure supply.

Table 6.9: Farmers' reasons for decline of soil fertility, Wolaita, Ethiopia

Reasons	*Location*	*P 1*	*P 2*	*P 3*	*P 4*	*P 5*	*P 6*
Repeated Cultivation	Treated (%)	9	11	14	11	11	8
	Untreated (%)	2	7	13	13	11	9
	Adjacent (%)	4	-	14	14	11	4
	Distant (%)	4	13	21	17	11	3
	χ^2	3.286	4.868	1.986	1.439	0.001	2.530
	(^{p} value)	0.350	0.182	0.575	0.696	1.00	0.470
Lack of Manure	Treated (%)	20	17	25	20	19	11
	Untreated (%)	20	22	33	26	20	15
	Adjacent (%)	29	32	39	36	29	21
	Distant (%)	21	29	39	24	15	7
	χ^2	1.056	4.239	4.026	2.678	2.562	5.703
	(^{p} value)	0.788	0.237	0.259	0.444	0.464	0.127
Soil Erosion	Treated (%)	6	9	14	14	15	8
	Untreated (%)	11	22	35	28	20	13
	Adjacent (%)	7	18	25	29	18	11
	Distant (%)	22	37	38	22	12	5
	χ^2	9.641	17.037	11.867	4.311	1.590	2.618
	(^{p} value)	0.022*	0.001***	0.008**	0.230	0.662	0.454
Lack of Fertiliser	Treated (%)	6	6	11	14	8	2
	Untreated (%)	4	15	26	22	17	11
	Adjacent (%)	7	7	18	21	21	14
	Distant (%)	8	20	24	22	14	5
	χ^2	0.569	7.021	5.504	1.832	3.902	7.049
	(^{p} value)	0.903	0.071	0.138	0.608	0.272	0.070

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise (χ^2 test). Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

Farmers' expectations of and commitment to soil and water conservation

In the previous sections, it has been shown that farmers highly appreciate soil and water conservation in the production processes. In this section, the expectations and commitments are assessed.

The farmers' major expectations from soil and water conservation is increased crop production. They stated that soil bunds began to reduce erosion from the second year. After the second year, the difference between crop stands above and below the bund becomes visible. Farmers' observations of agronomic characteristics of crops on bunded fields include: germination length (early, late), growth rate within a week, leaf colour (greenish or yellowish), stem vigour, and production level. The crop stand above the bunds comes out better in all these agronomic characteristics as compared to the ones below the bund.

Regarding changes in production, farmers indicated that fields with bunds provide better yields that can be observed four years after the construction of the bunds. Increases in crop production by up to 50% were reported by farmers. They have indicated that use of fertiliser declines when there is a bund in a plot. An estimated reduction in the amount of fertiliser used was up to 50%. Even though it is difficult to be sure whether the increase in production was due to efficient fertiliser utilisation or because of reduction in soil erosion, some farmers argued that using the same amount of fertiliser on plots resulted in plots without a bund being less productive than plots with bunds. Some of them stressed their effort to maintain soil fertility using other means, including bund construction, because of increasing fertiliser prices from year to year. Amare (1988:81) reported that maize production on plots with soil bunds at Gunno was more than double that of plots without bunds. However, the effect of soil bunds on productivity needs much more careful analysis because of many intervening biotic and abiotic factors that affect land productivity.

In order to get an overview of the farmers' view, I asked them to identify their expectations from the soil and water conservation activities. They identified different combinations of expectations. Of the total 203 farmers, 40% expect better production and feed, reduced soil erosion and increased soil fertility. Another 27% focused their attention on increased production, soil fertility and reduced erosion. The remaining 33% of these cases opted for miscellaneous alternatives, ranging from a single purpose such as production, feed, soil fertility or reduced erosion to combination of these. Most farmers expect about 100 kg (total production) for their efforts in soil and water conservation from their entire fields. But there were few farmers who expect as much as 500 kg. The average expected additional production due to soil and water conservation was 144 kg.

In connection to this issue, I asked farmers about the number of days they would like to work on soil and water conservation measures such as soil bunds and diversion ditches. On average, they are willing to work for 21 days per year, though a few farmers would like to work almost the whole year through. The period that is most suitable for soil and water conservation structures is December and January when major farm operations are at their minimum. The 25th, 50th and 75th percentile for number of days to participate in soil and water conservation activities are 9, 15 and 25 days, respectively.

Farmers' practices in soil and water conservation

In the previous sections of this chapter, farmers' understanding of the biophysical processes on soil erosion, soil and water conservation and expectations from conservation measures were discussed. In this section, farmers' soil and water conservation practices are presented in order to assess the influence of their knowledge and perception on their land management practices.

Wolaita farmers do practise both biological and physical conservation measures, albeit with different emphasis. Table 6.10 presents profiles of some of these practices that are briefly discussed below.

Biological conservation measures are widely used in soil and water conservation practices. These include: manure, household refuse, mulching, live-fences, leaf litter and to a limited extent row-planting of multi-purpose trees.

The most common and accessible methods are manure and household refuse application that are the insurance of soil fertility in Wolaita. These inputs are applied to plots where crops that highly contribute to food security (enset, taro, yam and maize) are grown. As shown in Table 6.10, most farmers apply organic fertiliser in P1 and P2 that show significant differences ($p \leq 0.001$) across locations. The weight of manure application declines as one moves away from the homestead areas, mainly because of the crops grown on those plots. In all six plots, the percentages of farmers using this method in the treated catchment are greater than farmers from the adjacent and distant location, by twofold or more. A similar trend was observed in the other plots, some of which are significantly different from each other ($p \leq 0.05$). Farmers in the untreated catchment follow those in the treated catchment in terms of manure utilisation.

Table 6.10: Soil and water conservation practices, Wolaita, Ethiopia

Practices	*Location*	*P 1*	*P 2*	*P 3*	*P 4*	*P 5*	*P 6*
Manure	Treated (%)	43	39	22	17	9	5
	Untreated (%)	35	26	7	4	-	-
	Adjacent (%)	18	7	-	-	-	-
	Distant (%)	20	17	10	5	1	-
	χ^2	12.667	14.200	11.664	11.380	7.329	3.468
	(^{p} value)	(0.001)***	(0.001)***	(0.039)*	(0.016)*	(0.062) a	(0.325) a
Row-planted food trees	Treated (%)	3	3	2	2	2	-
	Untreated (%)	-	-	-	-	-	-
	Adjacent (%)	-	-	-	4	-	-
	Distant (%)	2	3	-	-	-	-
	χ^2	0.509	0.546	0.972	3.019	0.972	-
	(^{p} value)	(0.917)	(0.909)	(0.808)	(0.389)	(0.808)	
Flood water	Treated (%)	6	3	2	2	2	3
	Untreated (%)	9	9	2	2	-	-
	Adjacent (%)	4	4	-	-	4	-
	Distant (%)	10	10	8	3	-	-
	χ^2	1.497	3.371	5.851	0.212	3.019	1.982
	(^{p} value)	(0.491)	(0.162)	(0.050)*	(0.976)	(0.389)	(0.576)
Diversion ditches	Treated (%)	2	2	5	8	2	-
	Untreated (%)	2	4	9	9	7	7
	Adjacent (%)	4	14	14	11	4	4
	Distant (%)	34	34	27	14	2	1
	χ^2	43.930	35.421	17.033	1.919	2.638	5.111
	(^{p} value)	(0.000)***	(0.000)***	(0.000)***	(0.175)	(0.451)	(0.164)
Soil bunds	Treated (%)	11	12	12	14	6	6
	Untreated (%)	-	-	-	-	-	-
	Adjacent (%)	-	-	-	-	4	4
	Distant (%)	1	1	-	-	-	-
	χ^2	9.424	17.222	14.076	23.916	5.492	5.492
	(^{p} value)	(0.024)* a	(0.001)***	(0.003)** a	(0.000)***	(0.139) a	(0.139) a
Soil bunds with grass	Treated (%)	-	5	15	23	28	19
	Untreated (%)	-	4	4	4	2	9
	Adjacent (%)	-	-	-	-	4	1
	Distant (%)	3	4	3	1	3	1
	χ^2	1.206	1.300	12.339	30.018	34.703	22.570
	(^{p} value)	(0.752) a	(0.729)	(0.006)**	(0.000)***	(0.000)***	(0.000)***

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise (χ^2 test). The letter 'a' shows adjusted chi-square and p-values. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

The coffee plot (P1), which is next to the house, also receives animal urine channelled to the plot directly from the barn through the house wall. Composting, as prescribed by technical personnel, however, is not practised in the area. Very few farmers have had training on composting and even those who have, have not applied the training. According to the farmers, composting is tedious as it involves digging of holes and transferring the compost materials between the holes.

Application of manure and household refuse is mainly the task of women. Children of both genders assist women in this task. Men identify specific locations where organic matters should be applied. This is because of their close association with every inch of the field that helps them to know the fertility status of the whole farm.

Even though manure is the major means of soil fertility management, there is marked variation among farmers in the rate of its use. Of the total 231 farmers, 17% use manure in all of their plots, while those using it in part of their plot number 81%. The remaining 3% of the cases do not use manure at all.

When we look into livestock ownership patterns of these manure-user groups, 14% of 'non-users', 7% of 'use on part of the plots' and 13% of 'use on all of the plots' do not own livestock, not taking chickens into account. Most of those who use manure in part of their plots and those who use it in all of their plots own one to five heads of livestock, while a few of them own up to 11 heads of livestock. But, this issue needs further investigation.

During informal interviews, farmers said that access to manure in Wolaita is very difficult, as it is a very essential input in crop production. From these discussions it was learned that there was no chance of borrowing manure from relatives or neighbours. As one farmer put it, 'giving manure to someone else is like giving your door to your parents-in-law and being eaten by a hyena.' On this issue, a woman interviewed by Eyasu (1998:15) replied to a question with the question, 'would you give someone your life?'. As can be seen from the result of the survey, there are possibilities for access to manure without owning livestock at home.

The other factor that affects manure utilisation patterns is land size. There is no regular pattern between use of manure and the size of cropland for those farmers who own a below-average land size (0.62 ha). All farmers who have above-average cropland can cover only part of their plots. The general observation is that farmers with a small land size could increase the fertility of their land by using organic matter (Eyasu, 1997, 2000). Even though this observation is plausible, the other point is whether the increase in soil fertility would ensure their food security, something that is highly affected by the family size, among other factors.

Apart from shortage of manure, farmers also mention distance of plots and shortage of manpower to apply manure. This was mentioned even if the end of the plot is 150 to 200 meters away from their houses.

Live fences and high trees are very common in Wolaita. Live fences of mixed trees and shrubs are good sources of leaf litter that are regularly collected by both men and women, including children for incorporation into the soil. Leaf litter is an important source of organic fertiliser reported by 76% of 231 farmers. Green manuring is very rare, reported only by 4% of the farmers.

In addition, farmers plant rows of banana, mango, cassava, local hobs and citrus fruits for both soil conservation and the generation of income and food. However, this practice is at an early stage. It began only among a few farmers in an effort to replace soil bunds or to plant trees for soil conservation purposes at an erodable site. Some farmers mix food crops with suitable agroforestry plants such as *Cordia african*, *Croton macrostchyus* and *Erythrina brucei*. However, multiple storeys showing the vertical association of trees and crops is rare, with the exception of a few *Cordia* trees in coffee plots. Erythrina is particularly common in the live fences, unlike the other two trees mentioned above. Therefore, the green landscape of Wolaita is because of enset, coffee and live fences rather than agroforestry vegetation.

Plots with perennial crops, particularly enset are allowed to receive floodwater to increase moisture availability in order to ensure its vigour during the dry period. However, such farmers ensure that excess water is diverted away to the waterways to avoid run-off. Use of floodwater seems common among farmers from the distant location who farm in steep areas with a 70% slope, and followed by those from the untreated catchment.

The use of floodwater depends on the construction of diversion ditches, which drains excess water to the waterways. To that extent, diversion ditches are very common physical conservation measures, particularly among farmers from the distant locations. These farmers construct diversion ditches diagonally across their farms. The use of diversion ditches shows highly significant differences across locations for the first three plots (at $p \le 0.001$).

Soil bunds with and without grass cover are markedly visible in the treated catchment as compared to other locations in this study, obviously because of a continuous intervention in this catchment since the 1970s. Of the total 231 farmers in the sample, 82 (36%) reported use of soil bunds in their farms. Among these, 59% of them come from the treated catchment, whereas those from untreated, adjacent and distant location were 16%, 6% and 20% respectively. The presence of soil bunds shows a significant difference between locations and plots (see Table 6.10). Farmers in the adjacent and untreated catchments have constructed soil bunds on their own initiative. Unfortunately, these cases are too few to warrant a self-initiated critical mass for soil and water conservation in the area.

A few farmers have maintained a traditional bund that was gradually shaped out of a huge piece of land. Such bunds have existed since their forefathers. Some farmers have dug these bunds and incorporated them into their croplands.

The other widely practised conservation measure in the area is contour ploughing. While farmers plough up and down during the primary land preparations, the final plough is done following the contour, to minimise runoff.

Apart from the above specific conservation practices, farmers tend to apply a range of intensive land-management practices such as repeated ploughing, cultivation to minimise weed, burning of debris before planting and crop rotation to enhance soil fertility.

In the earlier part of this section, farmers' responses on selected knowledge and perception statements were presented (Tables 6.6 and 6.7). Later on, their current practices in soil and water conservation were discussed, which includes that of soil bund construction and maintenance. When we compare the farmers' knowledge and perception response with their response on use of soil bunds, the deviation in percentage was 30, 72, 79 and 81 for treated, untreated, adjacent and distant farmers, respectively. The reasons for the gap between knowledge and perception response and practice are discussed in the next section.

6.5.3 Soil and Water Conservation at Gunno and surrounding areas revisited

The Soil Conservation Project began testing soil and water conservation measures at Gunno with the purpose of identifying suitable conservation measures for the whole wet *Woyna Dega* agro-ecological zone. Alongside this, attempts were made to popularise soil and water conservation through the national extension system. To that effect, soil bunds were constructed by some Peasant Associations through food-for-work incentives.

As noted earlier (section 6.3), the SCRP was phased out in 1998 with a gradual transfer of the centre management beginning in 1996. In view of this, the present study is interested in assessing the changes in the land-management practices in line with the great effort made in this part of the country.

In the survey, it was discovered that 54% of farmers in the treated catchment who had soil bunds have removed one to four bunds. The number of bunds removed was 1, 2 and 4 (Table 6.11). Most farmers removed the upper bunds and the ones in the middle. Among these farmers, 15% have totally removed the soil bunds, while the remaining 85% have one to six bunds left in the their fields, though most farmers (77%) have less than four bunds.

The trend in the total sample also shows a similar situation. Out of 82 farmers in the total sample who had some bunds on their farms, 52% preserved all soil bunds, while the remaining 48% removed 17 to 100 percent of their soil bunds. Most of those who completely removed their bunds were located in the treated and distant locations, each accounting for 39% of the total. Farmers from untreated areas and adjacent to the centre both account for 11% each.

For both retained (A) and removed (B) soil bunds, farmers from the treated catchment significantly differ from the other three locations (at $p \leq 0.001$).

Table 6.11: Decisions on soil bunds, Wolaita, Ethiopia

Locations	*% of those who retained their bunds (A)*	*% of those who removed their bunds (B)*		
		No. of bunds removed		
		1 %	2 %	4 %
Treated	60	19	18	3
Untreated	94	4	2	-
Adjacent	89	4	7	-
Distant	93	3	4	-
	A	*B*		
F-value	22.418	11.802		
Significance	0.000	0.000		
LSD (A,B)	Treated	Untreated	Adjacent	Distant
Treated		***	***	***
Untreated	***		ns	ns
Adjacent	***	ns		ns
Distant	***	ns	ns	

*Note: ns, *** show non-significant and significant at p ≤ 0.001 for the F-test. Tukey's procedure was used to test the significance of differences between locations.*

Very few farmers started removing the bunds two or three years after they were constructed. Widespread removal, however, took place after 1990, mainly because of shrinking field activities by the SCRP. Farmers remove the bunds progressively. Some farmers are confident about their measures, while some of them regret removing the bunds after they observe rills, specially under heavy rainfall. Those who are confident about their action claim that they have not seen any flood passing at the point because of the protection from the upper bund or the perennial crops in the garden. Some farmers removed bunds simply because others who fall on the same contour or above them have removed them. When the bunds from above are removed, farmers who are at the lower altitude are affected by vigorous runoff.

More than half (51%) of those who have preserved their bunds come from the treated catchment. These farmers account for 46% of their stratum. However, the proportions of those who have preserved their bunds is higher for farmers from the untreated and distant locations. This difference is partly because of a deliberate construction among these farmers; i.e., the design is made according to their own judgement for space, there is a felt need to do something about the erosion problem, and above all there was no obligation.

Farmers have been advised to maintain their bunds periodically by raising their height by transferring the deposition on the basin onto the embankment as specified by Hurni (1986, cited in Gunten, 1993). In this connection, they have mentioned that the bunds would form a bench terrace in about 8-10 years. After two decades of constructing levelled soil bunds in the Zerwa catchment (treated), no bund has attained the stature of a bench terrace. This is mainly because of the lack of periodic maintenance of the soil bunds. Of the total 231 cases, only 10% reported some maintenance from time to time. Among these, 73% are from the treated catchment, followed by 14% from the untreated catchment, whereas there were none from the distant location.

The percentage of bunds removed was correlated with selected variables that were used in previous research studies in the Ethiopian setting (Amare, 1988; Bekele, 1998). These were: total number of livestock owned, area of cropland, economically active labour force, age of the household head, and family size (see Appendix 2). Cropland area, labour force and age were negatively correlated, while livestock ownership and family size were positively correlated though weakly correlated with the percentage of bunds removed. Unlike age and labour, cropland area was significantly correlated with percent of bunds removed ($p \leq 0.05$). This result denotes that the larger the cropland, the lower the percent of bunds removed and vice versa. To that extent it is consistent with farmers' views regarding competition with land. It is worthwhile to note, however, that the relationships in the sample show wider possibilities that are not fully reflected by these statistical relationships. For instance, the cropland size of those who preserved their bunds ranges from the smallest land size in the sample (0.13 ha) to 1.38 ha. Cropland size of those farms where the bunds are totally removed falls below the average land size for the sample (0.62 ha), with the exception of two farmers who had land sizes of 0.81 and 0.88 hectares. With respect to livestock ownership and family, the tendency is that those with more livestock and a higher family size tend to remove the bunds more often than others, partly for reasons of land competition.

Even though age of household heads was negatively correlated with percentage of soil bunds removed, some farmers of an average age of 40 and 25 years had removed 17% and 80% respectively. On the other hand, the average age of farmers who preserved 100% of their soil bunds ranges from 44.4-47.5 years.

The contribution of livestock to the farming systems regards the provision of traction power, manure and food security. The use of cash from the sale of livestock in crop production may affect the purchase of fertiliser and the organisation of labour rather than the decision on soil bunds directly.

Education, which is often cited as one of the explanatory variables in farmers' land-management decisions also shows an irregular pattern with regard to farmers' decisions on soil bund retention or removal. The general farming practice did however show some difference between illiterates and literates.

Constraints to construction and maintenance of soil bunds

Poor acceptance of soil bunds among farmers in Wolaita has been noticed both during the WADU and SCRP periods (Hailemariam, p.c; Belay, 1992b; Eyasu, 1997; Tilahun, 2001). This section presents farmers' reasons for not accepting soil bunds on their farms and why they fail to maintain them after their having been installed through food-for-work.

In spite of a high level of knowledge and positive attitude about soil erosion and soil and water conservation practices, not many farmers constructed and/or maintained the soil bunds on their farms. Care for the bunds and a range of complementary conservation practices were only taken in the first few years. According to a remark by a farmer, pointing to the SCRP staff, 'we left it, when they left it'.

As shown in table 6.8, the lack of bunds was a highly noted reason for the prevalence of erosion and the decline of soil fertility on their farms. In view of this, I asked farmers why they do not construct and maintain bunds if they so appreciate its use. In answer, farmers gave a range of reasons, most of which are applicable to the whole farm whereas some are more relevant at the plot level. In view of this, the two sets of reasons are presented in the consecutive tables (Table 6.12a and b).

Table 6.12a: Farmers' reasons for not constructing and maintaining soil bunds, Wolaita, Ethiopia

Reasons	*Locations*				
	Treated (% of farmers)	*Untreated (% of farmers)*	*Adjacent (% of farmers)*	*Distant (% of farmers)*	*χ^2 (^{p}-value)*
Soil bunds harbour mole-rats	9	17	4	2	11.342 (0.010)**
Soil bunds harbour weeds	2	7	4	-	5.466 (0.141) a
Bunds hinder ox-ploughing	11	30	-	14	14.717 (0.002)**
Soil bunds waste land	9	22	11	20	4.791 (0.188)
Shortage of labour	8	33	39	41	22.354 (0.000)***
Shortage of tools	3	-	4	1	1.956 (0.582) a
I do not know	2	17	18	22	13.090 (0.004)**

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise (χ^2 test). The letter 'a' shows adjusted chi-square and p-values. Sample size: treated 65, untreated 46, adjacent 28 and distant 92.*

In order to learn farmers' general opinions about the soil bunds they were specifically asked to identify if soil bunds have disadvantages. Of the total 231 cases, 80% identified five major problems. These include; high labour demand for construction, wastage of land, harbouring of mole-rats (*Heterocephalus glaber*) and weeds, and maintenance requirements. Farmers' responses show different weights for these five problems. Accordingly, 22% of the farmers mentioned all five problems, whereas 10% mentioned the first three problems as stated above.

Another 8% mentioned harbouring of weeds and mole-rats. The other half of those who observed some disadvantage in soil bunds, mentioned miscellaneous combinations of problems, each with small percentages ranging from 0.4-5%. The remaining 20% believes that soil bunds do not have any disadvantage. Some of these farmers underlined that the disadvantages of soil bunds should be tolerated in view of the protection they give to their land. They added that farmers need someone to 'teach' them (cases 94, 194 & 195). Most of the farmers who favour soil bunds come from the distant location. However, 22% of those who responded that bunds do not have a disadvantage have destroyed all of their soil bunds. The view on the disadvantages of soil bunds is shared by both farmers in the treated catchment who had direct experience and also farmers in the distant location, most of whom did not have any soil bunds. To illustrate, the latter group accounts for 43% of those who mentioned all five problems listed above, followed by farmers in the untreated catchment (28%).

When comparing the responses of treated and untreated (Table 6.12a), farmers from the untreated catchment seem to fear the negative effects of soil bunds more than others, including those from the treated catchment who experienced it. Among these responses, mole-rats and 'hindrance to oxen ploughing' were significant at $p \leq 0.01$.

Farmers' complaints about rodents and weeds were documented a few years after the soil bunds were promoted by the SCRP (Amare, 1988; Belay, 1992b; Herweg, 1993). However, their occurrence seems common among plots distant from homestead areas. Farmers reported that mole-rats expand in the field and damage crop roots including those of coffee. Traditionally, farmers destroy mole-rats by digging out their holes and killing them. Maintaining the bunds means allowing the rodents to breed further, threatening their crops. To that extent, the introduction of soil bunds has interfered with this traditional mole-rat control method. In addition, overflow enters into the bunds through holes that are created by the mole-rats and makes the bunds susceptible to damage. This is often aggravated by expansion of the cropping area close to the base of the bund. Some farmers cut the width of the bund to expand the crop's area and to bring down the fertile soil of the upper field to the shallow portion of the lower field. At an early stage, the project provided farmers with chemicals to kill the mole-rats, but this was ceased long ago. No one has ever tried to reconstruct another bund after removing the original one because of mole-rat or weed infestation. No action was taken by the project or any other body regarding the weeds, particularly running grasses. The best method known to farmers is uprooting the weed with hand tools. In the process, they destabilise the bunds.

Socio-technical factors such as incompatibility with the existing farm equipment (i.e., ox plough) and competition of bund space with cropland were mentioned by a substantial number of farmers. Those in the untreated and distant locations seem to emphasise these problems. Land preparation, particularly for teff needs a repeated ploughing. Because of this, they plough up and down several times to ensure that the soil is well mixed before they finally plough along the contour. In this case, the soil bunds hinder the up and down ploughing practices and prompt farmers to remove them.

A shortage of manpower was mentioned as a reason by 30% of the 231 farmers. Most of those who reported this problem come from the distant location, followed by adjacent, untreated and treated locations. The responses were significant across locations at $p \leq 0.001$ (Table 6.12a). As discussed in section 6.5.1 (Table 6.3), the number of economically active persons per family is higher for the treated catchment followed by the distant, adjacent and untreated catchments. However, there was no statistically significant difference between the locations with respect to an economically active labour force per household.

A few farmers mentioned the lack of tools and know-how for construction of bunds. The majority of farmers who mentioned these problems come from the distant villages.

Lack of know-how ('I do not know') to construct soil bunds was mentioned both during the group interview and in the survey. The response was significant at $p \leq 0.01$. Even though young farmers from the SCRP catchment did not have a chance to participate, older farmers participated in the food-for-work bund construction programme organised by the SCRP to treat one of the catchments. Even then, the need for technical support is often mentioned when farmers are asked why they do not construct bunds in their fields.

Lack of government aid in the form of food and tools was repeatedly mentioned in the series of group interviews. After I learned the general opinion of the community on this issue, I carried out a short dialogue on this point with farmers (see Box 6.1).

The other common practice of soil and water conservation in the area is building diversion ditches. However, there is no common effort to control flooding at the catchment level. Everyone tries to divert the flood from his/her land as much as s/he can, though without much success. Frequently mentioned problems in this respect is the lack of co-operation among community members (see also Alemayehu, *et al.*, 2001).

Box 6.1: Farmers' rationale about bund construction and maintenance

Researcher: Why do you have to wait for food aid when the bund will benefit you and only you?

Farmers: When we constructed the bund in the first place, it was only with a view of getting the food and tools. We did not appreciate the bund very much at that time and only recognised its advantages after a long time.

Researcher: I really do not understand why you have decided to leave your land without a bund or maintenance for 17 years, while waiting for government aid that is unlikely to come.

Farmers: In the past, those who were in the station were following it up like owners. So we were expecting food from them. After they left, we became careless too. If we get a person who will help us with food and tools, we will be ready again.

Researcher: Why do you not use the local labour groups to construct the bunds like you do for other farm operations?

Farmers: We lack food, which means energy, so we cannot feed the large labour party required to construct the bund. That is why the government gave us food in the past, and that was how we could construct the bund in one season. The government did it before, and they can do it again. The government can do any thing on this earth.

Researcher: How long do you have to wait if there is no food-for-work for this purpose?

Farmers: We know that we are losing, but there would not be any improvement on our side either. Finally, we need government support too, though we can also accept the government's ideas.

In view of this, I raised the issue in group discussions of why labour parties are not used for diversion ditches and soil bund construction. The tradition of using labour parties for such tedious jobs was discontinued a long time ago. In addition, labour exchange on these tasks is not possible because of the variation in the degree to which the problem prevails among farmers; i.e., some farmers have erosion problems whereas others do not. Use of community labour for such tasks labelled as tedious came to cease after widespread use of oxen instead of *gesso* (early 1970s). It was also mentioned that the erratic nature of rain also pushed farmers to focus on the ox-plough. The use of *gesso* for land preparation on steep slopes used to be a motive for organising communal labour parties.

The way farmers perceive the gradient of their farm and thereby the degree of its susceptibility to erosion affects their decision to construct the soil bunds. A large percentage of farmers responded that they did not construct soil bunds because they perceive their land as being flat (Table 6.12b). This response came from farmers in all four locations. However, there is a higher percentage of farmers from the untreated catchment than from the other locations, at least for the first four plots. The differences among the first five plots across locations were significant (at $p \leq 0.001$) for P1 and P5, (at $p \leq 0.01$) for P2 and 4 and ($p \leq 0.05$) for P3. The way farmers perceive the nature of their farm in relation to the erosion processes is an important issue to promote relevant erosion control measures. Perhaps the land that farmers think to be less susceptible to erosion hazards may from the technical point of view prove to be a more susceptible plot. One can also encounter farmers holding different views on exposure to erosion in seemingly similar land features.

Table 6.12b: Farmers' reasons for not constructing and maintaining soil bunds, Wolaita, Ethiopia

Reasons	*Location*	*P 1*	*P 2*	*P 3*	*P 4*	*P 5*	*P 6*
My plot is flat	Treated (%)	26	22	22	12	2	2
	Untreated (%)	57	50	44	33	22	7
	Adjacent (%)	54	43	43	32	29	7
	Distant (%)	24	26	24	13	4	2
	χ^2	20.906	13.185	10.098	12.666	26.311	3.906
	(^{p} value)	(0.000) ***	(0.004) **	(0.018) *	(0.005) **	(0.000) ***	(0.272) a
Steep slope	Treated (%)	-	-	-	-	-	-
	Untreated (%)	-	-	-	-	-	-
	Adjacent (%)	-	-	-	-	-	-
	Distant (%)	4	5	5	2	-	-
	χ^2	2.079	3.123	3.123	0.581	-	-
	(^{p} value)	(0.556) a	(0.373) a	(0.373) a	(0.901) a		

*Note: *, ** and *** show significance at $p \leq 0.05$, 0.01 and 0.001 respectively, non-significant otherwise (χ^2 test). The letter 'a' shows adjusted chi-square and p-values.*

A high gradient was identified as one of the constraints to the construction of bunds in the distant location (Table 6.12b) where forested land on Damota Mountain was converted to farmland. In spite of that, there was no adequate conservation support in place to help those who carry out risky farming. See Plate 6.3 for changing forest landscape.

Plate 6.3: The view of Waja catchment in the Damota Mountain, Wolaita

6.6 Conclusions

Farmers in Wolaita have a fairly adequate knowledge and understanding of soil erosion, its association with soil fertility (processes) and land productivity. They practise a number of traditional soil and water conservation (SWC) techniques that heavily depend on organic matter cycling and other biological measures. Farmers clearly indicate that manure is their insurance for soil fertility. Thus, access to livestock affects soil and water conservation since manure is the most important factor that influences soil fertility. Farmers state that there is an ongoing decline in soil fertility with a subsequent decline in productivity. They claim that this is due to: (1) an increase in erosion; (2) a decline in rainfall; (3) a decrease in landholding size that restrains fallowing; and (4) a shortage of manure due to a decrease in grazing land and low biomass in crop production that provides feed.

Soil bunds that were introduced to conserve both soil and water in an experimental catchment in the early 1980s, have shown clear physical water and nutrient conservation effects. Farmers confirm that using soil bunds reduces fertiliser consumption and ensures prolonged soil fertility. The few farmers who reported plots with increased soil fertility largely came from the treated catchment.

In spite of this perception farmers are reluctant to utilise soil bunds in their land-management practices. This reluctance already became clear from the very beginning of the SWC intervention in 1980s. Since then, there has been poor acceptance of soil bunds. Farmers who constructed bunds 15 years ago (through the food-for-work programme) do not maintain their bunds anymore. Even worse, more than half of the farmers in the experimental watershed have removed some bunds in the course of the years. A similar trend was observed in other catchments where soil bunds were introduced through food-for-work. As regards soil bund management, the proportion of farmers who preserved their bunds was highest among farmers from the untreated catchments, followed by those from locations distant to the experimental watershed as opposed to those from the treated catchment and farmers adjacent to the research centre.

There was limited association between farmers' land management behaviour and characteristics of households. It was observed that removal or maintenance of soil bunds takes place irrespective of age, education or livestock size. Cropland area is the only socio-economic variable that is fairly associated with bund management among common variables tested as explanations for land-management decisions. In addition, land tenure that is often linked with farmers' decisions on soil and water conservation practices hardly affected Wolaita's farmers' behaviour in soil bund management. However, the lack of secure land tenure plays its role in open access land in Damota Mountain. Even then, these farmers practise diversion ditches.

In view of the above the question arises why farmers do not use and even oppose the use of soil bunds. There are four explanations: (1) lack of participation; (2) the wrong use of the food-for-work incentive; (3) lack of attention to side effects; and (4) changing attitudes to labour co-operation.

Lack of participation

The soil bund was introduced with the researchers' understanding of erosion, whereas the farmers were mainly interested in food-for-work. The project staff that guided the introduction took the food-for-work as a panacea to enforce a breakthrough in conservation behaviour in the area but failed to involve farmers in the research and development processes. The project phased out without active farmers' participation, whereas their farms and the entire watershed became a field laboratory for scientists. What is more, in the interest of these experiments, farmers in the 'untreated' catchment had to destroy the previous bunds under legal pressure.

The wrong use of food-for-work incentive

The incentive of 'food-for-work' was not properly integrated into educational processes. At the end of the project it appeared that, in the absence of food-for-work, farmers were not willing to carry out either periodic maintenance, nor construction of new bunds. It is well possible that this food-for-work tragedy still has an impact on farmers' contacts with outsiders. In this respect, it is possible that farmers' exaggerate the seriousness of erosion and the decline of fertility and productivity, and also exaggerate about their confidence in the benefits of the use of SWC technology in the hope that a new project will bring incentives like food-for-work again. The nature of this study in Wolaita does not permit the independent verification of the mentioned seriousness of erosion and fertility and productivity decline.

Lack of attention to side effects

Farmers mention a number of side effects of the soil bunds. These are: (1) a waste of land; (2) harbouring of mole-rats; and (3) harbouring of weeds. In the eyes of the farmers, the soil bund has increased the risk of crop losses. The research-extension system did not make any attempt to show the value of the technology by giving farmers more information on the pros and cons of farming with and without soil bunds that might change farmers' perception of the side effects. Their major preoccupation was the collection of massive experimental data. Farmers were not able to find viable solutions on their own. So, apparently, the observed benefits from soil bunds failed to outweigh these side effects. Owing to the negative perception of the technology that continues to date, farmers' motivation towards adopting and maintaining it increasingly declined. This not only holds true in the experimental watershed but also in adjacent catchments and even in the steeper farming areas at distant locations. Note that farmers emphasise the side effects because of the shortage of land that compounds their responses in addition to their heavy use of organic fertiliser in deep soils.

Changing attitude to labour co-operation

Termination of labour co-operation for heavy land-management practices such as the construction of soil bunds affected farmers' perception on labour requirements. This termination may be considered as an evolutionary process after the expansion of the ox-plough. Lack of labour co-operation coupled with a lack of motivation led to less or a non-allocation of labour for soil bunds. However, the shortage of labour that is often given as an explicit reason for not maintaining soil bunds is not adequate in view of the relatively high proportion of economically active labour force per household, small-sized farm land, poor off-farm employment opportunities and minimum migration.

This study has shown that farmers in Wolaita are knowledgeable of soil erosion, its impact on crop productivity and the conservation potential of soil bunds. However, the observed benefits from soil bunds failed to outweigh the side effects so that there is no adoption of soil bunds in the absence of a food-for-work programme. Lack of participation and timely recognition of and combating side effects worsened or even may have created this situation.

What needs to be done in the first place is a verification of the mentioned seriousness of erosion, fertility and productivity decline. Essential is that this is done within a participatory learning process. Heavy dependence of the farming system on organic sources of soil fertility management may mask the importance of physical soil and water conservation options such as soil bunds. After agreement on the seriousness is achieved, solutions for the side effects should be developed using farmers' experimentation. Finally, the aim of soil and water conservation should be sought in an overall approach to increase productivity. A shortage of grass for animal feed (and hence manure), the lack of access to credit other than inputs and a high fertiliser price will not make the strategy for encouraging SWC practices easy.

However, it is the lack of information on how much farmers lose or gain under their traditional and alternative practices that is the major challenge to be faced if sustainable land management is to be promoted in Wolaita.

7 Farmers’ Response to External Intervention in Land Management, Maybar, South Wello, Ethiopia

Abstract

Intervention by the former Soil Conservation Research Project (SCRP) in Maybar, South Wello was studied using both qualitative and quantitative methods. The intervention focused on soil and water conservation (SWC) practices, which later included irrigated agriculture. The SWC practices consisted of physical conservation, area closure and biological conservation. Farmers in the area have a fairly adequate knowledge about their resource base and land-management practices. Their traditional farming system is characterised by a long fallow-based agriculture in flat and gently sloping areas whereas staggered structures are used in the steep uplands. Farmers first reacted negatively to the stone bunds introduced by the project. As time passed and soil fertility continued to deteriorate, they began to modify the original design, maintaining bunds that resulted from an innovative bund-management practice, ‘moving bunds’. Their responses to area closure, irrigation and biological conservation failed because of social, technical and institutional reasons. The study concluded that an improvement of the agriculture in the area requires diversification and intensification on one hand and in the long run minimisation of land pressure, on the other.

7.1 Introduction

Maybar is located in South Wello, about 14 kilometres southeast of Dessie town. The first rural intervention in the area was the ‘development through co-operation’ campaign known as *Zemcha*, that was carried out by university and high school students in the early 1970s. A targeted intervention took place after the largest famine ever in 1973, commonly known as ‘the famine of Wello’. The intervention was carried out in the form of food-for-work. The purpose was to reverse land degradation, and to achieve food self-sufficiency. The major contribution of` the food-for-work programme was to support the construction of soil and water conservation structures on arable land and hillsides, including afforestation or reforestation initiatives. This intervention was funded by the World Food Programme and implemented by the Ministry of Agriculture.

The external intervention at Maybar was intensified with the establishment of an experimental site by the Soil Conservation Research Project (SCRP) in 1981 that promoted soil and water conservation based on a focused research study. The major interventions carried out by the SCRP were: (1) physical conservation; (2) area closure (prohibition of both animal and human interference in the hills for a period of 3-5 years); (3) irrigated agriculture; and (4) biological conservation measures.

The overall aim of these interventions was to achieve a sustainable land management system in the Maybar area (Weigel, 1986b:48). The interventions were implemented as typical watershed management practices. To that end, soil and water conservation activities began in 1983 and reached their peak in 1987. The SCRP carried out all of its conservation work in collaboration with the MoA. However, by the end of the 1990s, most of the intensive conservation measures had been destroyed, and the region hardly differed from the other areas in the north where such intensive programmes had not taken place.

The purpose of this study is to understand how farmers make decisions about soil and water conservation (SWC). The practices introduced by the SCRP at Maybar are used as the starting point for analysing how farmers responded to interventions and to draw lessons for future interventions in similar situations, and to identify an entry point for supporting the farmers in the Maybar area further. These inquiries require a deeper understanding of the following issues: What is the farmers' understanding of soil erosion processes? What are the farmers' perceptions on soil and water conservation as a land management practice? What do they expect from soil and water conservation? What do they do to conserve their soil from erosion? What are their responses to and reasoning of each intervention?

Section 7.2 provides information on the location and population, historical background, land tenure, local institutions and the physical setting of the area. Background on the Soil Conservation Research Unit at Maybar is presented in section 7.3 where a description of the technical interventions is discussed. Section 7.4 discusses the methodology of this case study. Sections 7.5 and 7.6 present results and discussion, and the conclusion, respectively.

7.2 The study area

7.2.1 Location and population

Administratively, Maybar is found in Dessie *Zuria Wereda* of the South Wello zone (see map 1 in chapter 2). It is located about 14 kilometres southwest of Dessie town, which is the zonal capital. The area is named after a crater-like lake called Maybar. The lake covers an approximate area of 1.5 km^2 (Ketema, 1980:28; cited in Mulugeta, 1988).

The nearest rural town is Tossa Felena, which is located about five kilometres from the SCRP station. Government institutions such as an upper primary school, health post and the nearest market are located in this town. There is a primary school near Lake Maybar that services the communities in that vicinity.

The total population of the South Wello zone was 2.12 million in 1994, whereas the population of Dessie *Zuria Wereda* was 201,433. It is a densely populated *Wereda*, which is almost twice as dense as most of the *Weredas* in South Wello. In terms of its distribution, 99% of the population lives in rural areas (CSA, 1996).

7.2.2 Historical background

Socio-political history

South Wello is part of the northern political system of the *Amhara* nationality. The former Wello province that was divided into north and south Wello since 1989 represents a multiple human geography and a succession of different nationalities in the course of three millennia. As a result, *Oromos*, *Falashas* and *Agaws* in addition to the *Amharas* have inhabited Wello. Each of these ethnic groups has its own representation and geographic territory that is recognised in the recent Federal Government of Ethiopia. A muslim population that belongs to the *Amhara* nationality inhabits the specific study area, Maybar.

The former Wello province is one of the northern regions where periodic famine and local power struggle has taken place (McCann, 1987). While famine is not confined to the Wello province alone, the 1973/74 and 1984/85 famines have substantially affected the population of the region, which attracted the international donor community more than anywhere else in the country.

Wello was the main route for repeated expeditions to the north in the 19th and 20th centuries and was one of the most war-prone areas of the country. The peasant army, which did not have its own supplies for food and shelter often depended heavily on the rural people with serious repercussions for the properties of the peasantry along the expedition routes (Merid, 1986). As Maybar is located along the old route that joins Shoa, one of the centres of the *Amhara*'s hegemony, and Wello, the people of Maybar must have fallen victim to such pressures by the peasant army.

Land tenure

The succession of different nationalities in different parts of Wello has influenced land tenure. For instance, in the areas where *Oromo* nationality dominated, communal ownership of the grazing land and water points used to take place irrespective of kinship. In the areas where the *Amhara* institutions dominate, such as in the present study area, variants of land-tenure systems originated in the north have been institutionalised, where *Rist*[43] was the main form of land-tenure system (see Chapter 2). These include: *Gebbar Meret*[44], *Galla Meret*[45], *GinDibel Meret*[46] and *Hudad Meret*[47] (Gebre-wold, 1962). After the 1975 land reforms, land belongs to the state. This same principle was adopted after the change of government in 1991 (Chapter 2).

The Amhara National Regional State has recently issued a proclamation to determine the administration and use of rural land, in proclamation No.46/2000 (ANRS, 2000). Without

43 Rist is the right to claim a share of land based on kinship to ancestors held in common with other Rist holders (Cohen and Weintraub, 1975).

44 This is a form of land tenure whereby the farmer (*the gebbar*) pays *asrat* (a tenth of his produce) to the government after paying the principal land tax.

45 This is land given to soldiers for their service to the government or the local authorities. In principle, these soldiers were not expected to evict the *gebbars* as long as the *gebbars* are willing to pay the tenth of their produce, provide labour and other contributions to the soldier who became his lord (*melkegna*).

46 Owners of this category of land were obliged to go to war *in lieu* of paying tax. They also provide transportation of ammunition by pack animals.

47 This category of land mainly caters for the kitchens of the royal camp. These lands are fertile to ensure the supply of food items to the royal camp to feed the soldiers and the nobility.

going into the details of the proclamation, few issues can be said in relation to land tenure.

The proclamation serves a good starting point to focus on the rural land problem and it touches upon a number of operational issues. On the other hand, it bears directly on and potentially contradicts rights to and duties demanded from those targeted by the proclamation. Suffice it to mention a few articles along these lines: Article 5, sub-article 1 states that, 'any person with an age of 18 and above and who lives in the rural part of the region has the right to freely take possession of the land he/she uses for farming.' The provider of such land is an organ designated to execute the land administration. As indicated in article 6, sub-article 1, '... land is the property of the government and the people. Thus, shall not be subject to sale or exchange.' In this scenario one may wonder where does extra land come from to be provided for every new generation? Would this not worsen the existing unintended malpractice in farming? This point would be even more pronounced in the face of a substantial number of land claimants at the moment who are eligible for land distribution. Among several useful developments in the proclamation, article 6, sub-article 3 ensures the security of holding and user rights, and article 8 addresses issuance and possessing of ownership book. Article 10 deals with one of the bottlenecks of rural land in Ethiopia planted since 1975. It states that, 'so long as the act of giving land for free to farmers is maintained, redistribution of land shall not be effective unless the land distribution does not otherwise affect the productive capacity, requested by the community supported by the study and decided by law.'

Besides common judicial issues enforced by such official documents, the proclamation highly seeks 'environmental stewardship' from rural people, which is hardly achieved through rules and regulations. Certainly, practice will teach us all as time unfolds.

7.2.3 Local institutions

An important local institution in the area is *Kire*. This is a village-based association of which all family heads are members, to get help in organising funerals as well as for other social events such as weddings. The role of *Kire* transcends social support by including arbitration between husband and wife and all members of the community. Its role was much more crucial before the establishment of the Peasant Associations (PA) after the 1975 land reforms.

Kire was the highest local institution to arbitrate local disputes mostly excluding the loss of life. If someone files a complaint to the *Kire* leaders, designated elders scrutinise the case, which is settled by charging the offender. The fine depends on the level of the offence and the co-operation of the offender with elders who preside over the matter. If someone denies a case and there is no witness, the case is finalised with the local ritual system called *Bele.* The latter is the symbol of the local shrine in Maybar. Loss of property including farm products, live animals or other valuable property is settled in the same way. Because of their conviction to the spirit world, community members confess their wrongdoing and pay the penalty. If someone fails to pay the penalty he/she would be expelled from the community. The person will however not be accepted in another community either, because of the common understanding among the rural communities. *Bele* is still practised on private property. However, the community does not practise this to settle the frequent thefts from the community forests.

In addition to *Kire*, the community also has a local savings group known as *equib.* This is a main method of saving from the sale of butter and other small farm products.

7.2.4 Physical setting of the area

Topography

Maybar falls in the *Awash* drainage system at an altitude range of 2,500 to 2,800 masl. Two-thirds of the 9 km^2 of the catchment around the SCRP site is characterised by steep to very steep slopes (25-55% slope), which is a general topographic feature of the eastern escarpment of Wello. The remaining part of the catchment consists of moderately steep to flat hill bottoms (13-25% slope) with a varied proportion with other landforms, including the Lake Maybar catchment [48], which is the focus of this study (Weigel, 1986c).

Climate

The average annual rainfall at Dessie station, 14 km away from the study area, for the period of 1962-1999 was 1,150 mm (NMSA, 2000). The mean annual rainfall at the Maybar station was 1,211mm with an erosivity value of 420J/mh (SCRP, 1996c). The highest precipitation occurs in July and August. Rainfall in the study area follows a bi-modal pattern. The short rainy period (*Belg)* occurs in April-May and precedes the main wet season (*Kermt),* which takes place from July to September. There is no overall trend in the annual series at Dessie from 1962-1997 (Conway, 2000). The mean annual rainfall on a decade basis shows that the 1990s were the wettest decade (1,248mm) followed by the 1960s (1,232mm), the 1980s (1,025mm) and the 1970s (1,106mm). The years 1993-1998 were particularly wet.

The major problem of rainfall at Maybar is its distribution rather than the total amount. The *Belg* rain is particularly erratic in terms of its onset time and distribution.

The mean annual minimum and maximum air temperatures are 11.5 ^{0}C and 21.5 ^{0}C respectively (SCRP, 1996c). There is little variation in the temperature of the region based on the climatic conditions of Dessie from 1961-1990 (Conway, 2000). Temperature records at the Maybar station for the period of 1981 to 1993 also show no annual variation, unlike the monthly temperature that shows some variation from month to month (SCRP, 1996c). The warmest months are from April to June, while the coolest months are from November to February. The hottest period occurs between March and May.

Soils

The soils of the Maybar area are affected by relief land use and vegetation (Weigel, 1986c). More than 50% of the soils of the Maybar station are shallow Lithic Haplic Phaeozems followed by Lithosols (25%), very shallow Haplic Phaeozems (15%) and some moderately deep to deep Haplic Phaeozes (10%).

Land use, farming patterns and crops grown

Agriculture in Maybar is rainfed, with a mixed farming system dominated by cereals. According to Westphal's classification system (1975), the area is in the grain plough complex farming system (see Chapter 2). Typical land use of the area shows crop production on flat and gently sloping uplands and grazing on some parts of the uplands and in swampy flat areas. There is a traditional practice of hay production during the dry period, mainly for dairy animals and oxen. Natural vegetation is found on the uplands and in the gorges. The dominant tree species in the uplands and in the gorges are *Juniperus porocera*, and Eucalyptus. There are a few stands of *Olia africana* and *Podocarpus gracileor*. Trees are not permitted to grow in and around the main crop areas. They are regarded as a safe harbour for birds and rodents that attack crops. So, an ideal field is considered to be a clean plot of land without trees. In addi-

48 In the rest of this chapter, the name Maybar is used instead of Lake Maybar catchment.

tion, fencing is not established between individual farms. Live fences are used along the path to protect the field from stray animals.

Farmlands are divided into the homestead plot (*Guaro*) and outer fields (*Ersha*). While *Guaro* is often adjacent to the house, *Ersha* is located and often scattered in the neighbourhood or distant from the village. This pattern of land ownership was inherited from the land tenure system rooted in the region that provides land to 'descents'[49] (Cohen and Weintraub, 1975). Ownership of land at different elevations helps farmers to grow crops for different purposes according to the suitability of the land to different crops over the various seasons.

Villages are either located at the upper limits of potentially cultivable land or on the dividing ridges, overlooking the entire area, including the lake.

The main crops grown in the area are maize, teff, barley, emmer wheat, peas, lentils, horse bean, and haricot bean. Among these crops, lentil, peas and emmer wheat can be grown on steep slopes during the *Belg* to supplement production from the main cropland. Only very short seasonal fallow periods are observed.

Socio-economic variables related to land management practices are discussed in section 7.5.1.

7.3 The Soil Conservation Research Unit at Maybar

7.3.1 Inception and termination

The Maybar research station has been functional since 1981. It is one of six such research stations that were established by SCRP in Ethiopia co-financed by the Swiss and Ethiopian governments. The site was identified by one of the senior SCRP management team members. The land on which the station premises were built was obtained from a farmer with compensation. The project has attracted the farmers by buying construction materials from them and providing wage labour. The project is remembered by many for its food-for-work component, which saved many lives during the 1984 drought and the employment opportunity for some during the early days. The Maybar station was handed over to the Amhara Regional National State after the mid 1990s.

7.3.2 The Maybar research site

The Maybar research station is located at 39^0 39'E and 10^0 59'N and 2,500 masl. The research station covers the Kori catchment that covers an area of 116 ha. It is one of the small catchments of Lake Maybar, which drains to the Awash drainage system, via the Borkena River. The project designated the areas outside the Kori catchment as 'outside' the catchment.

According to Weigel (1986c), in 1982 there were 35 households within the Kori catchment and 112 households outside the catchment. The population density in the catchment of 1.16 km^2 was 138 inhabitants per square kilometre. The average family size was 4.2 persons. In 1988, the population density at the Kori catchment was 220 persons/km^2 and 300 TLU/ km^2 for livestock (Mulugeta, 1988).

49 These are members of a lineage who are entitled to a land unit, through either parents, from elders controlling the allocation.

7.3.3 Description of technical interventions

The intervention at Maybar, unlike many other places presents a unique integration of land management practices intensively supported by research and extension activities. In this section, four major interventions are discussed. These are physical conservation, area closure, irrigated agriculture and biological conservation. How farmers responded to these interventions is revisited in section 7.5.3 after assessing farmers' knowledge and perception of the biophysical environment and their understanding of the erosion processes.

Physical conservation

The SCRP, in collaboration with MoA, began treating the Maybar catchment with stone contour bunds in 1983. Later on, farmers modified this bund by mixing it with soil. At the beginning of the 1987, all the crop areas were treated with bunds. The work was fully supported by food-for-work. At the beginning, farmers were not interested in the food-for-work programme itself, but participation increased with a shortage of food in the area. The project technicians, however, were making efforts to convince the farmers about conservation. The Development Agents of the MoA who work with technicians of the project, reinforced the construction of the stone bunds in the area. The construction of the stone bunds resulted in a lower width of the field between the bunds than was the farmers' practice. While the extent to which stone bunds were constructed in the entire watershed is very considerable, in the small Kori catchment alone, 54 km of stone-faced contour bunds were constructed between March and July 1983 (Hurni, 1984; cited in Kassaye, 1997:59).

Farmers' education on soil and water conservation emphasised the value of the permanent bunds. These bunds should be maintained every year in order for the height to increase until it becomes a bench terrace. The width at the top of the stone bund was technically determined to be 50 cm.

Area closure

Prior to the 1975 land reforms, the hills were held by individuals and were used for upland crop production and forests. In those days, the land size per family was much bigger. Hillsides were not exposed to erosion. For instance, there were only 11 households in Abo Ager village, which has now grown to about 60. Due to private ownership of land, no one was cut trees from another person's woodlot. In addition, the local institutions and the rules were in full force.

Following the land reforms, landless people began to get access to land. New families were in need of wood for construction. The source for all wood needs were the old private woodlands, which were said to be landlords' wood. As a result, the large indigenous trees were destroyed. In response, the military government introduced 'community forests' planted through mass mobilisation.

In addition, the SCRP introduced area closures to achieve soil and water conservation at the watershed level. As a result, the steep lands that were not suitable for agriculture were sealed off. The closures remained in force for 3-5 years until 80% of the natural grass cover had regrown (Hurni, 1986; cited in Kassaye, 1997). In the process, an ecological plan for Maybar was prepared to achieve a sustainable land use pattern (Weigel, 1986b). Conservation of the upper catchment began in 1983 according to the SCRP's original plan. In a short while the work extended to the entire Maybar catchment and was completed in 1987 (see below). All farmers who were covered by the enlarged conservation plan used to belong to one PA (Maybar), which was later merged with two other adjacent PAs.

The drought of 1984 brought a new situation in the area. Many families have lost their valuable assets. As a result, the central government decided to resettle the drought-stricken people into sparsely populated areas of the south, west and southwest of the country. A number of families were sent to the resettlement, while 174 households remained at the three villages of Maybar namely, Abo Ager, Aba Lucho Ager and Jerjero. Though the resettlement was not envisaged when the project started, the SCRP took this opportunity to implement the agro-ecological plan it had developed (Weigel, 1986b).

In order to implement the plan, land redistribution was carried out which involved 174 households from three villages. Individuals who did not have land in the irrigable area received land through the redistribution. The latter was decided in the presence of the government representative from Dessie *Zuria Wereda* and the Peasant Association. The land distribution involved three types of lands, viz. irrigated plot, uplands and grass field. Had it not been for the resettlement, the land redistribution would not have taken place in the project area alone.

The SCRP has trained farmers in area closure and zero-grazing techniques, afforestation, and introduced irrigation (see below). Farmers were allowed to cut and carry the grasses rather than grazing the animals in the sealed off areas. Six individuals were recruited from the PA to guard the enclosed area. These individuals were paid in food grain for their services.

Irrigated Agriculture

Irrigated agriculture at Maybar was initiated by the SCRP because of the 1984 drought. When it began, it was believed that it would lead to more intensive agriculture that would help minimise the pressure on the land, while improving the livelihood of the people. The source of water for irrigation was Lake Maybar. The irrigable area was 27 ha. The irrigation system combines a motorised pump and surface irrigation using gravity. Therefore, the project imported a 60 horsepower pump and a capacity of 50 ls^{-1}. The pump was donated by a Swiss relief organisation. After the pump arrived at the site, the project discussed the matter with the *Wereda* administration. The latter used the provision of the irrigation pump as an incentive to carry out community work in the same catchment, which was consistent with the project's intentions. The kinds of work carried out were digging an irrigation canal, hillside terraces, rural road construction, and reforestation to protect siltation of the irrigation canals.

Before the project introduced irrigated agriculture, there was no practice of using the water from Lake Maybar for irrigation nor was there a means because the lake is at the bottom of the major cultivated area (see cover photo). However, very few farmers were growing onions using small streams from the marshy areas scattered in the crop area. This situation has been reported to expand slightly after the experience of the 1985 drought. What is surprising is that farmers on either side of Maybar catchment use small-scale irrigation. Farmers from Albore area located in the eastern part of the lake irrigate from the outlet of the water. Additional irrigation channels were under construction, along very steep hills in another village.

In 1985, all farmers in the catchment have grown vegetables such as onions, potatoes, and carrots using irrigation. In addition, they have used the water to irrigate small cereals. The seeds for the vegetables were provided by the project and the MoA. Use of irrigation in the area has created unprecedented enthusiasm among the community. Potatoes became abundant. People shared the production of vegetables, specially potatoes according to the tradition whereby sharing and gifts are common among neighbours, friends and kinship. With the onset of the following season's rain, everyone returned to their rainfed practices, thus ending this enthusiasm. As a result, the heavy-duty irrigation pump has been standing unused for over 15 years.

The Maybar PA has been paying the monthly salary of the guards who watch over the pump since the third year of the project. I shall come back later to the reasons for the termination of the irrigation project.

Biological Conservation

The SCRP's biological conservation programme at first focused on area closure, reforestation and grass cover on the stone bunds. In the late 1980s, experiments were carried out at the Maybar station. The experiment focused on alternative planting methods of maize, teff and horsebeans. The main purpose of the experiment was to test the effects of biological conservation techniques on erosion control and yield improvement. Among the alternative planting methods experimented with Vetch (*Vicia dasycarpa*) inter-row planting with maize, without ridges, showed a very large increase in supplementary fodder, and substantial reduction in runoff and soil loss compared to the farmers' practices. In addition, observations were made on different forage plants such as alfalfa, phalaris, rhodes grass, clover, pigeon pea and tree lucern (Kassaye, 1997).

7.3.4 Runoff and soil loss results

Soil erosion experiments at Maybar were carried out in the Kori catchment. The terms runoff and soil loss were used to denote the overland flow and soil particles leaving the test plots respectively. Corresponding parameters for the catchment level were river discharge and sediment yield. The main features of the test plots and erosion results are given in Table 7.1.

Table 7.1: Average results of erosion experiments (1982-93), Maybar, South Wello, Ethiopia

Particulars	*On-site effects (plots)* [50]						*Off-site effects*
	Plot 1	*Plot 2*	*Plot 3*	*Plot 4*	*Plot 5*	*Plot 6*	*(Catchment)*
Slope (%)	16	64	43	37	64	64	various
Land-use type	crop	grass	grass	crop	grass	grass	various
Runoff (mm/y)	191	55	90	103	111	211	323
Erosion (t $ha^{-1}y^{-1}$)	36	16	21	32	4	48	13

Source: SCRP Data Base (SCRP, 1996c).

Soil erosion at the *Kori* catchment was highest between the months of March and August, corresponding with the period of highest erosivity (SCRP, 1996c). The mean runoff on the cultivated test plots was 103-191 mm/y while the resulting mean soil loss was 32-36 t $ha^{-1}y^{-1}$ (Table 7.1). Runoff at the plot level was rated as low to very low [51]. The soil loss was moderate. Maize and horse bean were the dominant crops for plot 1 and plot 4, respectively.

Except for a variation in size, plots 2, 5 and 6 were located at the same location. Higher runoff and soil loss from plot 6 as compared to 5 were considered due to some errors (SCRP 1996c). It was also noted that 'the presence of limited transport conditions at Maybar lead to similar material loss within a length of 15 m'.

50 Note that the area of the test plots (1-4) is 30 m^2 (2x15) and the area of the micro plots (5 and 6) is 3 m^2 (1x3).

51 These comparisons are based on the ranking among the SCRP station (SCRP, 1996c). For runoff: very low is < 200; very high is > 500. For soil loss: very low is < 10; very high is > 100. For river discharge: very low is < 100; very high is > 500. For Sediment yield: very low is < 1; very high is > 20.

Soil and water conservation experiments involving both graded and levelled structures were carried out on an area of 180 m^2 (6x30). The methods were grass-strip, graded and level *Fanya Juu*, and graded and leveled bund. These five methods were compared with local practices as a control. The result of the experiment from 1986 to 1989 showed that soil loss from runoff was considerably reduced by all measures. Production of all the treatment plots were, however, lower than the local practice (control). Slight improvements, but still lower than the local practices, were observed under dry periods due to moisture conservation.

Based on this experiment, sustainable land management practices in the area were recommended. These consisted of: steep slope cover by forest and grass, cultivation of gentle slopes with adaptable soil and water conservation that fits the moisture regime of the area; i.e., excess water drainage during heavy rainfall and conserve the moisture during shortage of rain.

The river discharge was high in the months of August and September, whereas the high sediment yields occurred in the months of March and April due to less crop cover. The mean annual river discharge was 323 mm/y while the mean annual sediment yield was 13 t $ha^{-1}y^{-1}$ (Table 7.1). Both the river discharges and the sediment yield were considered as high (see footnote 51). 'The annual rate of sediment yield seems to have reached a lower level as of 1986, with the exception of two years (1988 and 1992) during which river discharge was high' (SCRP, 2000b:56). These changes were attributed to the shift of the closed off area in the catchment to grazing and farming. The pattern of the annual river discharge between 1982 to 1992 requires further explanations by analysing the catchment dynamics [52].

7.4 Methodology of my study

7.4.1 Unit of analysis

The area of study is the lake Maybar catchment that includes the SCRP research site (*Kori* catchment). The unit of observation was the catchment itself, whereas the units of analysis were the households, household members, farm plots and livestock.

7.4.2 Sampling

A list of all farmers who own land in the Maybar catchment was prepared by the SCRP technicians who worked with the community for over 15 years. This work took four days. The farmers included in the study are from three Peasant Associations, viz. Maybar *ena Defati* (83%), *Abawid Ager* (14%) and *Wilde Ager* (3%). The total number of farmers in the Maybar catchment was 182. In order to capture the distribution of the land management practices and the associated reasons, 120 farmers were planned for the interview. Due to logistics and rainfall, a total of 107 farmers were interviewed. The selection of farmers was carried out using systematic random sampling. Of the total, 100 (94%) were male, whereas 7 (6%) were female.

52 For instance, the river discharge shows 406 mm in 1983 and suddenly drops down to 176 mm in the following year, and rises to 303 mm and 439 mm in 1985 and 1986 respectively. Interestingly, the 1987 figure drops to 145. More or less similar trends appear in the remaining years, though there is incomplete data. From this, one may say that the general pattern is two years of a relatively high river discharge followed by a relatively small discharge. Why?

7.4.3 Methods of data collection

The data collected aims to assess the distribution of farmers' responses in the Lake Maybar catchment[53].

The data for this case study were collected from both primary and secondary sources. The primary data sources include informal individual interviews, group interviews, observations, and measurements of bunds and plots and a questionnaire survey. The secondary data were collected from published and unpublished sources.

The survey was carried out after one and a half years of qualitative data collection on the specific study area and zonal level. During the qualitative phase, in-depth interviews combined with plot measurements were conducted with a group of 30 farmers. These farmers were selected on the basis of plot observation rather than the usual practice of selecting farmers from a residence list. This was carried out by repeated transect walks in the crop areas and across the villages to find out variations in the observable land management practices. The variations found were: presence or absence of bunds, height of the bunds, removal of bunds, movement of bunds and maintenance of bunds. Interviews were held with farmers owning the specific plots. Views from individual interviews were discussed in groups. Thereafter, the information from the qualitative phase was thoroughly reviewed to finalise the survey questionnaire.

7.4.4 Methods of data analysis

The analysis of the qualitative data was enhanced by an exploratory approach that guided the fieldwork to progressively uncover farmers' strategies and reasons. The relevant qualitative information was integrated with the quantitative data for better understanding of the issues covered in the study.

The survey data were entered into SPSS (version 10.0.7). The data were thoroughly checked by the researcher before the analysis by directly comparing all 107 cases with the original questionnaire. This procedure took a considerable time. Due to the nature of the research questions and the design of the sample (one sample), the analysis of the survey data is limited to descriptive statistics and measures of association.

7.5 Results and discussion

7.5.1 Socio-economic situation of farmers in Wello

Household characteristics

The majority of the farmers interviewed had married (94%), except for one farmer. Among the remainder, five were widowers and one was separated. The average family size was 5.5 persons (Table 7.2). About 20% of the families have the average size, whereas about 30% fall below the average size. The remaining 50% exceed the average, with a maximum of 13 persons for few families.

The average age of the sampled farmers was 53, with a minimum and maximum age of 18 and 78 respectively. Relatively high average age is due to shortage of land for young farmers

53 Note that this study treated the entire Lake Maybar's watershed rather than the SCRP's Kori catchment which many studies also refer to as Maybar catchment.

who have to depend on their parents for land. Therefore, they did not qualify for an interview, as they do not own an independent farm.

Table 7.2 shows major household characteristics that are related to farmers' land-management decisions. The discussion in the remaining part of this section is partly based on this table. Note that percentages used in some parts of the discussion may not add to 100% when the interest is on the specific response rather than the distribution of the sample.

Table 7.2: Household characteristics, and access to resources, Maybar, South Wello, Ethiopia

Characteristics	*Values*	*Characteristics*	*Values*
Family size (mean)	5.5	Cropland (mean in ha)	0.78
Age of household head (mean)	53	Grassland (mean in ha)	0.20
Dependent family members (mean)	2.4	Forested land (mean in ha)	0.15
Economically active members (mean)	3.1	Total land (mean in ha) [54]	1.01
Migration		Livestock owned (mean) [55]	8.0
Temporary (%)	35	Use of fertiliser 1998 (mean kg)	5.2
Permanent (%)	15	Use of fertiliser 1999 (mean kg)	1.4
Education of household head		Visits by extension agents	
Illiterate (%)	42	Yes (%)	45
Basic education (%) [56]	36	No (%)	55
Grade 1-8 (%)	17	Access to credit	
Grade 9-12 (%)	5	Yes (%)	27
		No (%)	73

Economically dependent age groups[57] (children 0-14 and elderly above 64) range between zero to three, with an average of 2.4 persons. Of the total, 11% of the families did not have dependents. In about 58% of the families, the number of dependents ranges between one and three. In about 20% of the families, this number increased to 4 persons. Those with more than four dependent family members were 12 %. Most members of the dependent age group are children below 15 years of age. The number of economically active persons ranges from one, in female-headed and single male households, to 8 in male-headed households. Of the total, 89% of the farmers have one to four economically active family members, of which one-half are the parents. The average of the economically active persons is 3.1. The dependency ratio varies from nil to three persons per family. About half (54%) have less than one dependent, while about one-third (29%) have more than one. The remaining 17% have just one dependent.

The livelihood of farmers in Maybar depends on farming. With the exception of one farmer, who is sometimes involved in petty trading, all other farmers in the sample depend on farming only for their livelihood. There are hardly any off-farm and non-farm employment opportunities in Maybar (see also Ludi, 2002). Out-migration is 35% and 15% for temporary and permanent migrants, respectively. Male temporary migrants total 87%, while all of the permanent migrants are male. Remittance income is obtained by only a few individuals (6%).

54 The total land figure does not include the communal land to which all farmers' households have access.
55 This figure excludes chickens.
56 In Ethiopia, basic education refers to the literacy programme whereas grades 1-8 refer to formal elementary education.
57 Note that in Ethiopia, children as young as seven years of age and the elderly above 64 years of age actively participate in agricultural activities.

Most of the farmers in Maybar area are illiterate (42%), followed by those who have followed basic education and religious school (36%). The remaining 22% have had formal education with a maximum of grade 9. Most of these individuals quit school a long time ago and have been farming for many years now. Formal education of those with lower grades is undermined by lack of access to reading materials and to mass media. The number of farmers who own a radio is 15% of the total (N=107).

The Muslim religious group, which constitutes of 98% of the sampled farmers dominates the community of Maybar. The remaining 2% are Catholics. The regular religious holidays are Wednesdays and Fridays. Farm operations that are not carried out during these days are ploughing, weeding, cultivation and harvesting of the main crops. However, it is possible to go to the market.

Land ownership and land fragmentation

The average total land size is 1 ha. The average for cropland is 0.78 ha. The grassland and forested land cover 0.19 ha and 0.15 ha, respectively (Table 7.2). The total land ranges between 0.25 ha to 2.5 ha per owner. Thirty percent of the sampled farmers own land below the average size, while 32% own just the average land size. Those who own land in excess of the average number 38%. Ownership of cropland ranges between 0.13 ha to 1.5ha. Of the total, 10% and 65% of the farmers do not own grassland and forested land, respectively. This is partly because of a shift of the grass plots to crops that was reported by 22% of the farmers.

The land parcels owned by farmers are scattered in the watershed covering both the flat and uplands. The majority of the farmers (90%) own 1-4 plots, while the remaining own up to seven plots in addition to the grass pastures and woodlots when applicable.

Most of the farmers obtained the land from their parents and the land redistribution of the 1970s and 1980s. The other source of land includes periodic redistribution by the Peasant Associations, purchase and/or lease from other farmers. There was marked instability of land ownership in the Maybar area since the land reforms of 1975. During this period, 65% of the farmers experienced a reduction of their land ownership, 8% experienced an increase while the remaining 27% remained the same. The main reason for the decline of the land size was redistribution by the state (90%). The other reasons include sharing with children and brothers, and land degradation. Sharing of land with children is becoming difficult for parents due to the low productivity on the existing land. In spite of that, 51% of the families expect to share land with their children (males) over the next ten years. The number of children who expect such an opportunity ranges from one to four per family. In 84% of the families, there are one or two children for such land distribution. These families are confident to be able to share from their present land holding within the next ten years, which is indicative of the farmers' planning horizon. Very few cases of conflict between parents and children (male) were reported because of a delayed marriage that is indirectly linked to land inheritance.

Farmers basically know that the land belongs to the state (84%) and they have the right to use it in return for land tax. They also know that the state has the power to take away the land for various reasons (e.g., redistribution, school, etc.,). These situations, however, did not change farmers' traditional beliefs of what they call 'my father's land'. Therefore, there was no strong indication of land insecurity that deters them from undertaking the common land management practices, even though some of their actions are not fully free from risk-aversion strategies (see also Ludi, 2002). However, there was a marked difference between the arable and non-arable lands, including trees (see section 7.5.3 for further discussion on this issue). During the survey, farmers were asked whether the present ownership of land affects their decision on their land–management practices. Of the total, 97% replied that they did not face any problem. The group and individual interviews also came up with similar results with the exception of clarification on their points of view and the implicit uncertainty about the fate of their children.

Use of external inputs

External inputs were not common in Maybar until the 1990s when the government launched a package approach. The major external inputs that reached the community through the programme were cereal seeds and fertilisers.

In spite of the government package, farmers still depend on their traditional seed sources; namely, their own seed savings and the local market. The local market is an important seed source as farmers regularly exchange or sell seed grains in the weekly open market at Tossa Felana. Farmers who used seed from government sources are very few due to their low level of participation in the package programme. Those who did obtain seed through the package programme did so only once.

More than half of the farmers at Maybar do not use fertilisers at all, against 44% who have used them at least once. Among these, 25% have used only Urea, 28% only DAP, while 47% used both Urea and DAP fertilisers. Farmers' use of fertilisers was assessed for the years 1998 and 1999 crop seasons. Of the total farmers, 32% have used fertiliser in the years 1998 and 1999. Quantities of fertilisers used by each farmer vary from 2 to 50 kg. Those who used more than 10 kg per season do not exceed 25% of the sampled farmers. The mean of Urea fertiliser used in the year 1998 and 1999 was 11.2 kg and 8.6 kg respectively. The mean of DAP fertiliser used in 1998 was 10.5 kg, whereas this figured dropped to 6.3 kg in the following year. The drop is mainly because of the rising fertiliser price from year to year.

Labour organisation and farm tools

Farmers depend on family labour for their farm operations and social purposes. When the farm work has to be done in a relatively short period of time or when a lot of work is to be done, farmers organise a labour party. The other source of labour is assistance from relatives and friends. A labour party is organised primarily for harvesting (81%), including threshing. The next important farm operation that requires a labour party is cultivation (hoeing) (58%). The other farm operations done by a labour party are seeding (39%), weeding (24%), land preparation (19%) and bund maintenance (18%). Farmers do not prefer a labour party for maintenance of bunds because of the skills and patience required for bund maintenance (see section 7.5.3). Outside the farm operations, house repair is done by a labour party (50%).

In Maybar area, labour parties are classified according to the number of people involved and the duration of the work. *Debo* is the common form of labour party that involves 10-20 people. *Deb*o is organised for all of the farm operations listed above. At the end of the day there is a feast at the house of the organiser of the party. *Wenfel* is organised for digging the upland with hand tools, for cutting grass and for splitting wood for house construction. Women organise themselves into *Wenfel* to transport harvested materials and straw to the homestead areas. The number of people is determined by the volume of work. In terms of duration of work, *Ware* is work for half a day, usually, for weeding. *Yemewaya* is work that would take the whole day.

A typical farm tool in the grain-plough farming system is the plough that is used for both land preparation and hoeing. Hand tools with metal tips are used for digging of steep lands that are not convenient for the ox-plough. However, such practices are very rare, particularly nowadays.

Trends in crop production

The average yields of maize, horse bean, barley and teff from 1986 to 1993 were 2.3, 1.9, 1.6 and 1.2 t ha^{-1} (SCRP, 1996c). According to farmers in Maybar, the trend of crop production has been on the decline for many years now. In view of this I asked farmers how they judged the trend of their production during the last ten years. Of the total sampled farmers, 97% reported decline, 3% the same situation. There was no case reporting increased production (see also Yohannes, 1999; Ludi, 2002).

Food from their own production covers family needs for 5-7 months for many farmers (see also Zealbowesen, 1998:37). The remaining months are covered by purchasing from the local market or by food aid in years where crop failure is recognised by the government. The cash for the purchase of food grains is often obtained by selling livestock, wood or borrowing from relatives and friends. In years 1999 and 2000, 88% of the sampled farmers have purchased food. The average number of months during which grain was purchased was 5. Grain sold in the local market originates from other regions, at times as far away as the western part of the country through the marketing channels. However, small farmers also sell very limited amounts to meet other family needs or to exchange for other grains or pulses.

The reasons for the decline in crop production are indicated in Table 7.3. Note that drought and shortage of rain in Table 7.3 show specific farmers' observation on how weather affects their production system. In this context, drought refers to a prolonged absence of rainfall, whereas shortage of rain refers to its erratic nature whereby crops are affected due to little rainfall or its interruption after the onset.

Farmers' ranking shows the importance of climatic factors and soil fertility (see also Ludi, 2002:244). It is interesting how farmers perceive soil erosion, which is least ranked. This is mainly because of the perception of researchers who often included 'soil erosion' in the lists of response, whereas farmers perceive the problem in terms of soil fertility, rather than soil erosion. Farmers do not talk about soil erosion unless it occurs in the form of rills, gully erosion and landslides (for farmers' perception on erosion processes, see 7.5.2). For this reason, researchers often blame farmers. '... In effect, the farmers' perception of soil erosion is still low. Let alone perceive erosion as a life threatening problem, they do not even rate it among such problems as pests, weeds, untimely rain, and hail.' (Kassaye, 1997: 58-59)

Table 7.3: Rankings of farmers' crop production problems, Maybar, Ethiopia

Problems	*Rank*
1. Decline of soil fertility	3
2. Pests	5
3. Diseases	6
4. Drought	1
5. Shortage of rain	2
6. Soil erosion	7
7. Shortage of land	4

Farmers take collective measures to minimise their risk of pest and bird attack. Farmers in the adjacent plots discuss which crop to grow the following season. These discussions are held at social meeting places, such as the praying time, markets, river points, during ploughing, etc., The other critical decision in line with this is the sowing time. This decision is often made by knowledgeable farmers whom the rest follow, at least in some practices. These farmers have their own basis for judgement to make such decisions. Wondering about this situation I followed up what farmers would do in the *Belg* of 2001 at Maybar (Box 7.1).

Box 7.1: An account of indigenous knowledge about soil moisture for sowing

> All *Belg* fields were prepared thoroughly. What was expected was a reliable rainfall to start sowing. There were few showers in the previous days, but no one started sowing in the entire watershed. One morning in the same week, I suddenly saw a farmer sowing, assisted by another fellow farmer. I joined them immediately and asked the owner of the field why he started to sow while others did not start yet. He replied that 'they will start as soon as they see me.' Explaining my point, I asked him what prompted him to start the sowing. He just collected the soil from the ploughed ground and pressed it between his palm and threw it away about 3 meters. Then he picked up a clod and told me that that unbroken piece was a sign for the presence of enough moisture to start sowing.

Livestock production system

With the exception of one farmer, all farmers in the sample own livestock. The animals raised in Maybar are cattle, sheep, goats, donkeys, horses, mules and chickens. Among ruminants, cattle are the most abundant species, followed by sheep. Of the total, 66% own one cow and 15% own two. Nearly half of the farmers (47%) own one ox and 36% own two. Farmers who do not own an ox amounted to 17%. The other important animal in the farming system is the donkey, owned by 41% of the farmers. Ownership of donkeys is crucial for the farmers' livelihood strategy. Farmers who own a donkey can rent it to someone for a sum of money that varies with the distance and the type of load or carrying firewood to the market to sell. Mules serve the same purpose. Adding all species of animals owned, excluding chickens gives an average of 8 heads of animals per household. When sheep and goats are excluded the figure falls to 4.8.

Farmers start livestock production through family gifts, purchase, or shared animal raising. In shared raising, one partner contributes the stock while the other manages it in return for use of the service and sharing of the offspring. What applies in each case depends on the initial agreement between the two parties. Among 107 farmers, 37% participated in shared animal raising between 1999 and 2000. Animals commonly *shared in* or *out* are cows, heifers, sheep, horses and occasionally other animals.

Animal production in the Maybar area is based on open grazing on communal grazing land, hillsides, marshy areas and aftermath grazing. Hay is used as a supplementary feed in dry periods and at night. Farmers obtain hay from two sources. These are their own grass plots and communal grassland. The latter is protected during the wet season for hay production whereas it is used for open grazing during the dry period. The management of the grasslands is carried out by the community through village-level committees.

Animal production is deteriorating on the one hand because of the decline in grazing land and low biomass production, and on the other because of disease (Table 7.4).

Table 7.4: Farmers' prioritisation of livestock problems, Maybar, Ethiopia

Livestock problems	*Rank*
Disease	3
Shortage of forage	1
Drought	2

Livestock marketing plays a great role in the dynamics of livestock ownership and management in Maybar. The sale of livestock is due to a range of reasons that vary from household to household, but with considerable commonality. For instance, the purchase of food for the family, the purchase of family cloth, a shortage of feed, and for house construction are the most common reasons behind selling different species of animals, though house construction often requires selling one's oxen. Other reasons such as the replacement of a mule or donkey, or young animal for fattening were part of the explanations for sale of animals, to mention few.

Access to information and credit

The main information source for agricultural development in the community is the extension service of the Regional State. Soil and water conservation practices were assisted by the SCRP during the early stage of its intervention. Since the launching of the new Extension Intervention that was modelled after the Sasakawa Global 2000, in 1994/95, the focus of the extension system was on the distribution of seed and fertilisers on credit. The extension service's portfolio includes livestock and natural resource conservation.

Extension agents contact farmers on an individual basis, though farmers who have suitable plots in adjacent locations are teamed up for demonstration. Almost half of the farmers have been visited one or more times for implementation of the current extension programme. Access to credit, however was very limited as only 27% of the farmers obtained credit.

7.5.2 Farmers' knowledge, perceptions and practices of soil and water conservation

Most of this section is devoted to the major issues related to soil erosion and soil and water conservation. Discussion on area closure, irrigated agriculture and biological conservation are treated under farmers' practices at the end of this section.

Farmers' knowledge and perceptions on soil erosion and soil and water conservation

Farmers' knowledge and perception of their environment provide essential information for understanding their land management practices. As illustrated in Chapter 3, there is no clear-cut association between *knowledge, action, attitude* and *perception.* The land management of farmers in Maybar varies according to the biophysical characteristics of their plots, such as soils, slope and land use and also their socio-economic situation such as access to labour, land size, ownership of oxen. One can see a good farming practice on a given plot, but the reverse on an adjacent plot or elsewhere in the catchment. More interestingly, such variations are observed on plots of the same household.

During the qualitative study phase, I carried out 30 informal interviews involving several farm plots that show different farming practices. Following that, I designed a formal survey involving 107 farmers in order to know the proportion of farmers' knowledge and perception on the biophysical environment and human interaction in the Maybar watershed. This was to better understand their land management behaviour as discussed in the subsequent sections. To this effect, I used similar knowledge and perception statements used in Wolaita (Chapter 6). The statements were measured on a scale of three categories: (1) not clear, (2) disagree, and (3) agree. This scale was thoroughly tested during the qualitative phase. The distribution of farmers' responses is given in Table 7.5.

Table 7.5: Farmers' responses to statements on knowledge of soil erosion and soil fertility, Maybar, South Wello, Ethiopia

Statements	*Not clear (1)*	*Disagree (2)*	*Agree (3)*
1. Steep lands are prone to erosion.	-	-	100
2. Overgrazing exposes land to erosion.	8	3	89
3. Land with poor vegetation cover is easily eroded.	8	1	91
4. Continuous cultivation reduces soil fertility.	5	1	94
5. Soil erosion reduces soil fertility.	-	-	100
6. High population pressure can increase land degradation.	-	-	100
7. Farm bunds have to be maintained regularly.	1	-	99

Owing to the steep nature of the landscape, farmers in Maybar fully appreciate the erosion problem on steep lands (Table 7.5), particularly after the expansion of hillside agriculture. However, their emphasis to soil fertility over soil erosion seems to understate their knowledge on erosion (cf. Table 7.3), which is not the case. Long ago, hillsides were used alternatively for grazing and upland cereal production rather than for crop production on a continuous basis (see below). Occurrence of soil erosion is depicted by small rills in the farm, and accumulation of silt on the grass or roadside after the rain. The effect of overgrazing is also well known to them, even though few farmers cannot see the direct link between overgrazing and erosion. Farmers are also able to distinguish between the livestock in terms of erosivity of their hooves. They consider cattle with their sharp and even hooves as erosive as compared to equines that have rounded hooves with a blunt hoof edge.

The role of the vegetation cover in protecting soil from erosion is common knowledge coined in the local proverb: *Yemeret libisu zaf, Yesemay libisu damena,* which literally means, 'tree is the cloth for the earth, while the cloud is the cloth for the sky'. However, their observation is limited to the cover *per se*, without a full understanding of the role of the root structure in water infiltration and protective ability of the crop cover from splash erosion [58]. This is also true for field crops. Crops are however classified in terms of their effect on the soil nutrients. Some crops are considered as nutrient depleting (teff, wheat, oats) and some as nutrient enriching (maize, legumes) crops. In this case too, they do not understand how removing the crop residue would affect the soil nutrient levels and how legumes enrich soil fertility apart from their leaves. In spite of that, farmers consider this observation in their crop rotation practices.

The very fact that farmers began fallowing before the intervention by modern agricultural science resulted from their direct observation of a decline in crop yield on land that has been

58 Belay (1998) argues that lack of knowledge among farmers on the utility of crops in erosion control may negatively affect the possibility of controlling erosion through agronomic methods.

cultivated continuously. They expressed this fact with many analogies. For example, in comparing the power of an ox, which has not ploughed for certain seasons with the one that ploughs continuously. They cultivate every season due to a shortage of land, which they explained as being connected to population pressure. Traditionally, there were two types of land, *Belg* and *Mehir* land. *Belg* land was cultivated in October and November with residual moisture, called *Eritib Ersha* (wet land). This land is sown in March-April for *Belg* crops and harvested in June/July. Thereafter it is fallowed until the next *Belg*. The *Mehir* lands were cultivated in the dry period and sown at the onset of the main rainy season, *Kiremt*. These lands too were sown only once a year. On top of that, cropping on uplands is carried out with a traditional soil conservation measure called *Dib*. This was efficient, allowing for frequent cropping. The produce they used to obtain from this pattern of farming was sufficient for the family. Some plots were left for a longer fallow period of up to ten or more years, depending on the food availability. During the last 30 years, this situation has changed. The type of land owned changed because of land tenure system changes introduced since the 1975 land reforms. Since then, access to flat- and uplands gradually changed. These changes, coupled with a decline in crop productivity, increased family size and decreased land size due to inheritance-limited farmers' *adaptive land management* practices (Röling and Jiggins, 1998) and led to continuous cultivation. Under this situation, farmers are forced to convert the grasslands to croplands. Of the total of 107 farmers interviewed, 22% have shifted an average 0.2 ha of land from grass- to cropland. A number of farmers specifically mentioned that buying grass was better than buying grain. They hoped that their animals would get something from the crop residues too. These are some of the farmers' reasons that are hidden to outsiders. Some farmers even suggested support from the government to minimise the number of people who depend on land. They need jobs for their children who cannot make a decent living on the remaining land. Their philosophy about this is that 'those who have education go to town, and those who have strength go to Jimma,' their common distant migration site located in western Ethiopia, over 700 km away.

In the early 1980s, continuous bunds were introduced. Unlike the traditional stone bunds that are constructed on very steep plots and garden plots, the introduced bunds need to be maintained to meet the engineering design recommended by the soil conservation experts. Farmers of Maybar, fully accepting the new bund, have even introduced an innovative modification of the bund that suits their farm realities (see section 7.5.3). As a result, bund construction is now accepted as one of the soil fertility maintenance strategies of the farming system in Maybar.

After discussions with farmers about their knowledge on soil erosion and soil fertility management discussed above, their perception was also assessed using the same levels of scale. These were: (1) not clear, (2) disagree, and (3) agree. The findings of this measurement are given in Table 7.6.

Farmers of Maybar have learnt the importance of bunds from their long-term observation of those constructed through food-for-work on lands traditionally cultivated without a bund. They now speak from their own field experience that plots with strong bunds have better productivity than others. This is clear from a complete agreement with statements on this issue (Table 7.6).

For farmers, the family is responsible for the future of their children and grand-children. This is clear from the institution they have established (inheritance) that has been functional since time immemorial. Land was one way of capital accumulation before the land reforms of 1975. Parents buy land as a gift to their children. It is not only that they fallow land for future generations, but fallowed land is also seen as a saving for the future. In addition, *Dib* is seen

Table 7.6: Farmers' perception of soil and water conservation and crop production, Maybar, South Wello, Ethiopia

Statements	*Not clear (1)*	*Disagree (2)*	*Agree (3)*
1. Soil and water conservation increases crop production	-	-	100
2. We have to maintain soil fertility for the future generation.		8	92
3. We have to feed the present generation instead of thinking for the future.	3	79	18
4. A high production now is preferable than obtaining the average for the next five years.	8	74	18
5. Soil and water conservation is farmers' responsibility.	1	2	97
6. Farmers should be paid for soil and water conservation in their farms.	9	51	40

as a storage place of soil for future generations. Therefore, they do not plough the *Dib*. Their perception reflected in Table 7.6 is consistent with their practice as rooted in their land management. By the same token, the majority of farmers opposed the idea of focusing on the present generation as compared to the future and a higher production now rather than the average for the next five years (item 3 and 4, Table 7.6). It is not farmers' intention nor a practice to reach a short-term goal of family needs, but it is an inevitable choice they are confronted with due to unfavourable circumstances (see section, 7.5.3).

Owing to their observations over nearly two decades, farmers in Maybar now highly agree with their responsibility for soil and water conservation. However, they are still not fully freed from their ties with the food-for-work and related payments. Note that 40% of them were in favour of paying farmers for soil and water conservation practices on their farms. During the discussion, some of them pointed out that they needed assistance from the government through construction tools and technical assistance rather than food. Food would only be desired only when they face crop failure.

The state and cause of soil erosion

Soil erosion is a common phenomenon in the agricultural system of the Maybar area. The problem of erosion was perceived by 76% of the 107 farmers interviewed. The qualitative interview with 30 farmers before the survey also confirmed the same. However, the nature and occurrence of erosion vary from plot to plot and also within a plot as vividly explained to me by farmers. In order to build on the discussion on knowledge and perception, I discussed the causes of erosion complained about by the farmers. These causes were then presented in the survey instrument to assess farmers' response in the watershed. Among the most important causes for soil erosion, 20% of the farmers mentioned water erosion; 10%, poor management; 64%, steep slopes; and 36%, unspecified 'natural causes.' In view of the nature of the landscape in the area, the choice 'steep slope' seems logical. However, quite a substantial proportion (36%) of them did not specify which natural causes.

The subsequent question was why their land was exposed to one or more of these causes of soil erosion. Therefore, farmers were asked to identify why erosion occurred in their plot. The number of plots covered in the survey was 399. These plots are scattered in different locations in the watershed, and identified by different names by the farming community. However, the number of plots in some locations were very few, mostly 1-6. Therefore, plot locations with at least 10 plots were selected for the analysis of farmers' reasoning. This selection led to 229 plots (57%) out of 399 being included, involving all 107 farmers. The purpose of developing this selection procedure was to see similarity and difference of farmers' response on location-specific problems and conservation practices (Table 7.7 to 7.9)[59]. Some descriptions of these locations are given below.

Guaro (L1): These are the plots located adjacent to the house. As residential areas are mostly situated in the upper and middle locations of the catchment, more than 50% of these plots are located in moderately steep, to steep slopes.

Yedo (L2): This location is found between Abo Ager and Addis Amba villages stretching from the foothills down close to the Office of the research station. Farmers classified this location as moderately flat to moderately steep.

Liygenda (L3): This is the area located above Abo Ager village, which is part of the encroachment into woodland. Sixty percent of the plots in this location are in moderately steep, to steep slopes.

Meda (L4): As the *Amharic* name implies, this is the name given to the farm area adjacent to the Lake Maybar, hence 'flat'.

Aygebir (L5): This farm area is located adjacent to the office of SCRP research station due south. Due to the effect of the bunds, farmers consider most plots within this location as flat. Actually, the slope drops gradually and intercepts the L4 (*Meda*)

Golbo (L6): This farm area is nearer to Jerjero village in the north, below the road to Tossa Felana. Immediately above the road is the state forestry zone where 'fertile floods' originate, harvested by farmers in the upper part of the area.

Denu (L7): This farm location is close to Lake Maybar, on the southern side.

Atarimesk (8): This farm area is located north of the SCRP's station office. It is close to the peak of the landscape looking down upon Lake Maybar at around 2,700 masl.

The major reason that farmland was exposed to erosion was lack of diversion ditches that affected plots from all farm locations (Table 7.7). 'Lack of bund' was reported for less than a quarter of the farm locations with a small percentage of plots, with a much higher proportion in Aygebir (L5). Some farmers from this location have removed their bunds with some replacements in the form of 'moving bunds.' (see section 7.5.3). Damaged bunds were also reported for Denu (L7). According to the farmers' views, the necessary measures were taken in the major farm areas apart from constructing more diversion ditches. The need for diversion ditches was emphasised because of deforestation on the hillside that aggravates the runoff from the upper slopes.

59 Note that the logic of analysing farmers' land management problems and practices from the point of view of the plot location was also followed in the Wolaita case (Chapter 6).

Table 7.7: Farmers' reasons for soil erosion Maybar, South Wello, Ethiopia

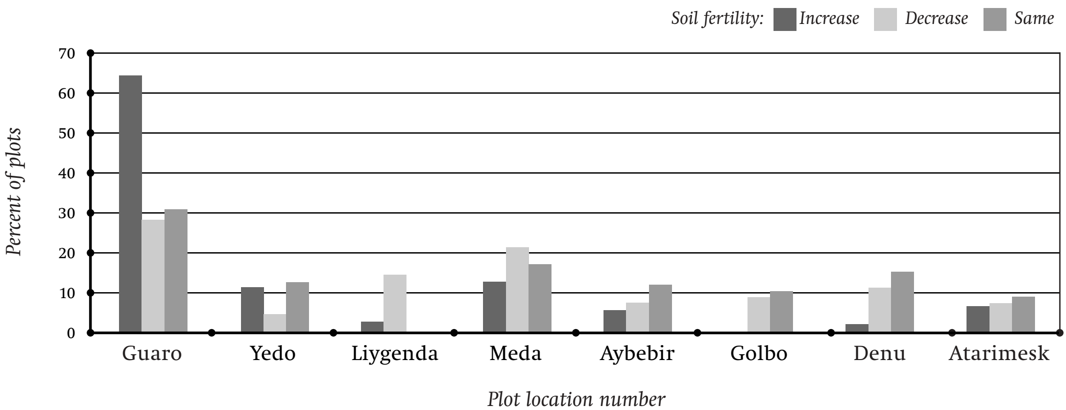
Reasons	*Responses in percent*[60]							
	L1 n=102	L2 n=22	L3 n=11	L4 n=37	L5 n=14	L6 n=11	L7 n=18	L8 n=14
Lack of bund	4	-	-	-	21	-	6	-
Steep land without bund	9	-	-	-	14	9	-	-
Damaged bunds	1	-	-	-	7	-	17	-
Lack of diversion ditches	26	14	46	8	29	9	17	21

Note: L1= Guaro, L2=Yedo, L3=Liygenda, L4=Meda, L5=Aygebir, L6=Golbo, L7=Denu and L8=Atarimestk

Trends of soil fertility

Soil fertility is a central issue in soil and water conservation. To that extent, my discussion addressed the trends in soil fertility of different plots among farmers who participated in the qualitative phase. Farmers showed me interesting variability of plots in terms of their soil fertility and therefore, difference in crop stands. They often mentioned three descriptive categories for soil fertility. These were 'increased', 'decreased,' and 'the same'. Following this observation, I included these categories to assess farmers' views on the trends in soil fertility for the period 1990-2000. On this basis, the fertility of 399 plots covered in the survey show 32%, 33% and 35% for increased, decreased and the same, respectively. From the farm location point of view, the Guaro plots, which are close to the house are more fertile. The proportion of plots in the Guaro location had increased soil fertility by more than six times than in other locations (Figure 7.1). The proportion of plots with increased soil fertility was low at Golbo (L6), Liygenda (L3), Denu (L7) and Aygebir (L5) locations. Here, fertility declined and at best maintained the same levels.

Figure 7.1: Trends of soil fertility in selected areas of the Maybar catchment, South Wello, Ethiopia



60 Percentages are calculated based on the number of plots in each of the eight locations (L1 to L8).

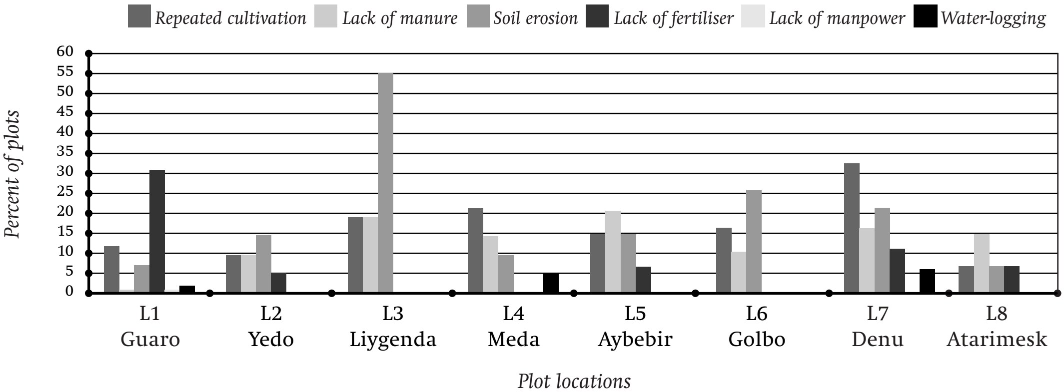
Table 7.8: Farmers' reasons for decline of soil fertility, Maybar, South Wello, Ethiopia

Reasons	*Responses in percent* [61]							
	L1 n=102	L2 n=22	L3 n=11	L4 n=37	L5 n=14	L6 n=11	L7 n=18	L8 n=14
Lack of bund	4	-	-	-	21	-	6	-
Steep land without bund	9	-	-	-	14	9	-	-
Damaged bunds	1	-	-	-	7	-	17	-
Lack of diversion ditches	26	14	46	8	29	9	17	21

Note: L1= Guaro, L2=Yedo, L3=Liygenda, L4=Meda, L5=Aygebir, L6=Golbo, L7=Denu and L8=Atarimestk.

Decline of soil fertility occurs for various reasons as clearly stated by farmers. Based on the farmers' reasons for the decline of soil fertility in the area, a similar question was addressed in the survey instrument. Results of the survey are summarised in Table 7.8 and Figure 7.2.

Figure 7.2: Farmers' reasons for decline of soil fertility, Maybar, South Wello, Ethiopia



As indicated in the survey results and by the group discussion with the farmers, the soil fertility problem of farmers in Maybar is a vicious circle of land degradation. Farmers are forced to cultivate their limited holding without fallowing the land due to the need to produce family food. Cultivation is carried out with removal of almost all crop residues, without either adequate additions of manure or other sources of organic fertiliser. In the worst case, some plots do not have bunds or even if they have, they may not be high enough to protect the soil from being removed. In some cases, between-bund width is so wide that erosion builds up from the plot itself, due to removed bunds to ease land scarcity. As will be shown in section 6.5.3, these problems emerge from farmers' coping strategies to offset the shortage of land. Plots at L3 (Liygenda) have often lost their fertility due to soil erosion by water. Commercial fertiliser is not available nor is there adequate knowledge among the extension agents as to which fertiliser would be effective where. Farmers who were forced [62] to participate in the

61 See footnote 60.
62 During the fieldwork of this study, extension agents were simply marking a plot for the next season's extension demonstration. They usually select the land in collaboration with the PA leaders. Farmers are then expected to co-operate.

extension package between 1998-2000 complained that the extension agents wanted them to use fertilisers on relatively better plots, which induces crop logging on some plots and aggravates weed problems on others. Shortage of labour was not indicated in the group discussion, as reflected by least-response in the survey. A few plots in some locations face water-logging when there is excess rain due to the lack of a proper drainage system.

Farmers' expectations from soil and water conservation practices and their commitment
Physical conservation by a continuous bund[63] in gentle and flat areas introduced a new practice into the farming system (see also Yeraswork, 2000). Farmers' expectations from this technology are: better production (98%), better forage (34%), reduced soil erosion (70%), and increased soil fertility (56%). Even though most of these objectives are interrelated, it was interesting to learn about distinct objectives for their actions.

Farmers explained that increased production was achieved through control of erosion with the help of bunds. The speed at which a given plot improves its crop production depends on the bund management. Under favourable situations, farm plots began to show results in no less than two seasons. Their estimate of increase in crop production from fields under soil and water conservation practices was in the order of 50-70%.

Most farmers expect between 100-500 kg of total production from their soil conservation efforts, more specifically bund construction and maintenance. The average expected additional cereal production from bund management was 220 kg. The average number of days they are willing to allocate labour to bund construction and maintenance was 32 days per year. Few farmers reported their willingness to work for more than half a year. Farmers preferred using the slack period (December-February) for bund construction, modification and maintenance.

Farmers' practices
This section gives an overview of farmers' practices. The purpose of this discussion is to link the farmers' knowledge and perception in land management and to give some background to their reaction to the introduced practices presented in section 7.5.3.

The physical conservation structures known in the area are *Kab, Weber, Dib* and stone mulch. *Kab* is built from stones on the steep areas and in the homestead plots, which are often in steep areas. *Weber* is constructed in the farm with a width of 20-30 meters depending on the slope gradient. Farmers leave a strip of land at the desired location uncultivated, which is reinforced with debris and stones during periodic farming practices. This structure holds soils that are moved down in the process of ploughing and water movement. Grass is allowed to grow on it for better stabilisation. Apart from minimising soil movements on the farm, this also delineates the land of one owner from the other. On the hillsides, the structure called *Dib* is created from the irregular shape of the land to protect the soil from water erosion. This structure has an irregular shape and length. It is created by shaping the outcropped land during farming operations. Therefore, it is not continuous nor does it follow a contour. Unlike contour bunds, it is convenient to turn oxen at points without much difficulty. A stone mulch is created by scattering different sized stones in the field in an irregular pattern to protect the soil from being washed away. In order to minimise the space taken by these stones, farmers anchor them with their sharper end. Very big stones are removed aside during oxen ploughing and returned after sowing. As with crop covers, farmers appreciate the protection of stones in relation to soil movement only, without understanding its effect on the rain splash,

63 Indigenous physical conservation (*Kab, Weber* and *Dib*) are typically staggered structures, even though *Weber* could be fairly continuous depending on the landform.

which is very important in fields without continuous bunds. Contour ploughing, diversion and drainage ditches are used in combination with the above-mentioned structures[64].

A continuous bund was originally introduced with grass cover on relatively wider bund width. In the process of adaptations of the practice (see below), some farmers have narrowed the bund width to the extent that no grass can grow on it. However, bunds with grass cover are still widely seen in the catchment, though there is variation between plot locations (Table 7.9)[65]. Out of the total 399 plots surveyed, 51% have bunds with or without grass cover. In terms of households surveyed, 36% of 107 farmers do not have a bund in any of their plots. Farmers who do not have bunds in their farm use combinations of other soil and water conservation practices discussed above according to their suitability to their household resources.

Table 7.9: Soil and water conservation practices, Maybar, South Wello, Ethiopia

Practices	*Responses as percentage*							
	L1 n=102	L2 n=22	L3 n=11	L4 n=37	L5 n=14	L6 n=11	L7 n=18	L8 n=14
Diversion ditches	36	36	36	30	43	27	39	36
Stone and soil bunds without grass	19	32	9	16	14	18	6	7
Stone and soil bunds with grass	59	73	64	54	43	64	83	86
Earthen bund (*Dib/Weber*)	21	-	9	14	7	-	22	-
Leaf litter	8	5	9	8	-	-	28	14
Fertiliser	14	18	-	19	14	18	11	-

Note: L1= Guaro, L2=Yedo, L3=Liygenda, L4=Meda, L5=Aygebir, L6=Golbo, L7=Denu and L8=Atarimestk.

Table 7.10: Farmers' comparison of Dib/Weber and the introduced stone bund, Maybar, South Wello, Ethiopia

Particulars	*Dibi/Weber*	*Bund*
The amount of grass produced	High	Low
Capacity to hold soil	Low	High because it is continuous
Wastage of land	Less (because of more grass)	More
Continuity	Not continuous	Continuous
Ease of modification	Not easy	Easy
Harbouring rats/moles	Less	More because of the stone
Strength	High	Low
Labour requirement for construction and maintenance	Low	High

64 For different features and performance of the indigenous conservation methods, see Belay, 1998 and Yohannes, 1999.
65 Note that this table presents farmers' responses on the 229 plots, which are within the eight selected farm locations.

As can be seen from Table 7.9, bunds with or without grass are the dominant physical conservation practice in the study area. As a result, I asked farmers to compare *Dib/Weber* and bunds to better understand their rationale for shifting to stone-based bunds in spite of their resistance in the early days of its introduction (Table 7.10). As can be seen in the table, farmers opted for the bunds in favour of its capacity to hold more soil, despite its disadvantages as compared to the traditional methods. This shows how much the soil matters to the farmers.

Most of the manure is used in the *Guaro* plots that are located around the residential areas. Use of manure in distant plots is the exception rather than the rule. Even then, cattle dung is separated and dried and used for cooking. It is also used for plastering the house. Droppings from other animals and household refuse are also used for improving soil fertility. Contrary to common knowledge, which says that farmers shifted to burning dung because of scarcity of wood, the use of cattle dung for fuel was a common practice in the area since time immemorial (McCann, 1995). Cattle dung is preferred to wood for heat and more importantly to keep the fire going through the night to be restocked the next morning. Presently, however, cattle dung is one of the few options that farmers have for light and source of energy.

Manure is applied by women and children onto the *Guaro* plot. Men use donkeys or mules to transport it to distant plots. Of the total 107 farmers, 94% used manure in part of their plots, 2% in most of their plots and 4% did not use manure in recent years. The majority of those who use it in part of their farm do so in the *Guaro* plot. Their reasons for not using manure include lack of manure, distance of the plots, lack of a donkey or mule and shortage of manpower. Therefore, availability of manure alone does not guarantee its use. In view of this, farm size is not related to the extent of manure use. Most plots are located in fairly close proximity to the residences. Farmers' estimates show five minutes to about an hour for most plots.

Residue burning and green manure were not reported, while leaf litter was reported for very few plots. The source of leaf litter is limited to plots that are adjacent to the footpath, residence or community forest. In the past, fallowing was one of the soil conservation strategies that is nowadays reduced to inter-seasonal fallow.

Use of fertilisers is another new land management practice in the area. However, fertiliser use is far from taking root in farming systems in the area (see section 7.5.1).

Farmers do not practise area closure. Hills are sources of woods, farm tools, games, grazing, hay, honey, herbal medicine, scenery, spiritual place, etc.,

Generally, farmers apply a combination of soil and water conservation (SWC) practices to maintain soil fertility. However, most of the surveyed plots (70%) were under one of the common conservation methods, of which 60% consists of stone bunds. About 20% of the plots was under two types of SWC methods, whereas the last 10% consists of four to eight different conservation methods. This is an indication of farmers' efforts to integrate different SWC methods into their farming systems when they find it necessary and they are able.

A comparison of farmers' practices with their responses to the knowledge and perception statements in Tables 7.5 and 7.6 shows that farmers' practices are consistent with their knowledge and perception. Out of 107 farmers, 90% of them practise SWC as expected. Further analysis of bund management with size of the cropland among those who practise SWC does not show a significant variation among land-ownership classes.

7.5.3 External interventions at Maybar: achievements and constraints

Physical conservation

Farmers did not accept the stone bunds during the early period of their introduction. This was because the speed with which the construction of the stone bunds took place did not give farmers the opportunity to *internalise* the benefits of the stone bunds. The original design was a bund constructed from stones that was poor in retaining water. These bunds served as a permanent shelter for rats that had used the bushes before. The rats even increased their habitat range as a result of the continuous stone bunds that stretch deep into the farm away from the bushes and live fences. The other immediate problem was the spread of weeds across the stone bunds. In addition, unusually narrow inter-bund intervals did not allow farmers to ox-plough conveniently. A higher number of bunds per plot also means a larger amount of wasted land. As the work was carried out hastily by and with farmers who were not convinced, a substantial number of bunds were destroyed in the following seasons, littering the farm areas with stones.

Due to these immediate problems, farmers' complaints mounted in the subsequent years, though in tacit protest because of the authoritarian[66] nature of the Peasant Association (PA). Firstly, farmers began to modify the stone bunds by mixing the stone with layers of soil as filler. Some farmers removed alternative bunds to ease the ploughing and to destroy the rats, making it possible to see erosion in the farm plots at different spots. Having seen the damage caused to their farms, they began to replace the removed bunds, though sometimes in a different location from before. This marked the second and major modification of the use of stone bunds in the area, the 'moving bunds' (Yohannes, 1999). This began when farmers started distributing the soil that was accumulated under the bunds to the lower part of the plot, which often lacks soil. Distribution of soil locally called Y*ebidir Afer* (meaning 'the borrowed soil') is the main reason for moving the bunds. The number of farmers who reported this practice was only 19% of 107 farmers, which is not substantial. However, the significance of this practice is not in the number of people who practise it now; rather, it is in the confidence-building and facilitation for the acceptance of the continuous bunds in the entire watershed that became dominant, as shown in Table 7.9. For farmers' bund management practices see plates 7.1, 7.2 and 7.3.

Moving bunds began as a 'blessing in disguise'. The pioneering farmers adapted the practice from three farmers, who had been given some land belonging to another farmer who was sent to the resettlement. Prompted by the condition of their access to the land, these farmers ploughed all of the land including the *Dib* that is not traditionally ploughed. They achieved a very good production from the land, particularly the *Dib*. After observing this practice, a few farmers in Abo Ager began to distribute the soil that was accumulated behind the bund and to reconstruct the bund. They decided to make use of the deposited soil because of the land insecurity that prevails in the region (Yeraswork, 2000: 214-215). Destruction of traditional structures such as *Kab* and *Weber* to use the accumulated soil is a known practice in the farming system (Belay, 1998:11; Yohannes, 1999). Through this process, the practice of 'harvesting soil' was widely copied by other farmers and became farmers' knowledge in the area. This was a major farmer innovation in bund management. This work was accomplished by moving the bund 2-6 meters below the original bund. It became popular after the change of government in 1991 when control of the bunds by government agents ceased.

Farmers follow certain criteria to move bunds. Some of these criteria are outlined below.

66 Peasant Associations are mandated to implement the government's action plans at the local level. In view of this, those who fail to co-operate do not get access to services channelled through the PA and will be subject to imprisonment.

Age of the bund
Bund age is determined by the amount of soil accumulated above a bund. On average, a bund accumulates adequate soil from 2-5 years depending on the location. Their usual indicator is crop stand at different locations in the bund (above, below and middle). This emerges from their day-to-day observation of their farm plots.

Conditions of the upper bund
In order to remove bunds, farmers observe conditions of the upper bund, mainly the border bund (*Weber*) with other farmers. If the upper bund is strong enough to protect the runoff from their farm, they move the next bund or more.

Flood incidence
They look at the historical occurrence of flood in that farm location before a decision to move a bund.

Slope variation
They take into account the slope variation within their farms and the entire watershed to judge the severity of flood if it occurs.

Rat/mole or weed control
A farmers' decision to move a bund is also affected by the presence of rats/moles or weeds in the bunds. The timing for moving the bunds is therefore affected by the extent of these problems. Plots close to the village and bushes are particularly susceptible to rats.

Uneven soil distribution
When the soil depth is affected because of the bund position, farmers move bunds selectively to balance the soil distribution in their farm. In others words, when some bunds hold a greater proportion of soil as compared to others, those bunds are moved to distribute soil to other plots through water movement and ploughing.

Strength of the bund
When the original bund is not strong enough to hold an adequate amount of runoff and soil, farmers move that bund and construct it in a new location.

On the whole, the *moving bund* practice increased the *utilisation* of stone bunds in the area. This had been discouraged by the SWC experts and the government agents who considered it as a rejection of the technology rather than as an adaptation. Due to their own adaptation of the bund, farmers in Maybar have now *internalised* it within their farming system (see also Yohannes, 1999). Most of them confessed that they used to resist bund construction because of its disadvantages. Because of that, they were exaggerating the observed problems such as rats and mole to destroy the bunds. Over time they have reduced the negative side of the technology by strengthening its positive sides. They now know that their land would turn to stone very quickly without those bunds. Stating this situation, one farmer said that bund construction is now *Yewideta Gideta* [67] (necessary). As a result, bunds surpassed the traditional conservation techniques such as *Dib* and *Weber* with their coverage of the cropping areas.

67 The farmer meant that bund construction is inevitable under the present farming practice which they have maintained in order to protect the soil from erosion.

Plate 7.1: Stone bund moved for utilisation of the accumulated soils (note that the plot is located near the residential area)

Plate 7.2: A moved bund in the lower slope (note that the upper bund was left intact)

Apart from the bund-moving practice, farmers also remove some bunds when they find it desirable. Accordingly, 14% of the 107 farmers removed 33-50% and in one case 100% of the original bunds in some plots. Most of the farmers removed one bund per plot, while very few of them removed two to four bunds per plot. Farmers remove bunds for various reasons. These include: ease of ploughing (48%); distribution of the soil 14 (%); destruction of rats (14%); and 24% for a combination of the above reasons. One farmer removed the middle bund in one of his plots, having an area of 0.14 ha. His justifications were that the upper bund was strong enough with a height of 90 cm. The border bund (*Weber*) had a height of 1.4 meters covering the length of 45 meters. Such situations are widespread in the Maybar catchment.

Farmers' decisions are often related to their socio-economic backgrounds, which are likely to influence their decision. In this study too, notwithstanding the farmers' rationale as explained above, a few variables were selected to assess how they might relate with the farmers' decision to remove the bunds. Thus, the percentage of bunds removed was correlated with the age of the household, livestock owned, labour, family size and cropland area (see Appendix 2). Among these variables, age, labour and cropland area had a negative correlation with the percent of bunds removed, though this was only significant for age ($p \leq 0.05$). The number of livestock owned and family size on the other hand positively, but not significantly correlated with the percent of bunds removed, indicating land pressure. Unlike age, the negative tendency of cropland area and the percent of bunds removed are consistent with farmers' practices. Even then there was no strong correlation.

Plate 7.3: Fields with selective moving of stone bunds

In addition to either removal or movement of the bunds, farmers also adjust the width of the bund to allow for the increase of the crop area even if it is a few centimetres over a length of the bund. The width of the bunds was reduced from 50-70 cm in 1984/85 to 30 cm in 1999. However, there are some bunds whose width is close to 1 meter. These kinds of bunds are those which are reinforced on the *Weber.*

Maintenance of the bund was reported by 94% of the 107 farmers surveyed. Those who reported no maintenance did so because of a plan to remove the bund, the strong condition of the bund and a plan to replace it with *Dib* and diversion ditches. As there is no compulsion to maintain the stone bunds by the government, farmers allocate time and labour to maintain the bunds in their farm. Because of the poor quality of the work, farmers do not appreciate the campaigns that were organised by the Extension Agent and the Peasant Association to maintain the bunds in the area. They would prefer community co-operation for the maintenance of hillside bunds. In their farms, they prefer to do it alone or in co-operation with a few farmers who know each other well.

With the exception of four plots that belong to different households, other plots in the moderately steep, to steep area did not become bench terraced. However, this does not mean that all the bunds are movable or that doing so would be desirable due to slope and location.

Some bunds are reinforced on a massive *Weber,* which are not easily movable.

Farmers' strategies are consistent with a recent cost-benefit analysis, which compared the introduced with the adapted SWC designs at Maybar, Anjeni and Andit-Tid, in the Amhara region (Ludi, 2002). NPV (Net Present Value) was used in this study to compare these two methods of SWC under different erosion conditions (sheet and rill erosion and sheet erosion only), different slope gradients, labour costs (with and without subsidy), with and without fertiliser use. This was carried out in a special case where soil depth has already decreased to a critical level of 10 cm, where crop production has to be given up. The CBA (Cost-Benefit Analysis) of this study shows that the introduced SWC is profitable only if slopes are gentle (≤ 8%), or steeper (≥ 31%), with additional fertilisers and in some cases only if labour costs for both construction and maintenance of the bunds are subsidised. Ludi explains these unfavourable conditions of the introduced SWC by the fact that an annual soil loss rate at Maybar is low whereby small yield reductions are tolerated as compared to the higher proportion of land occupied by conservation structures and high labour costs.

The preceding findings quantify farmers' economic criteria that, among others, take into account the land occupied by the conservation structure. These are entered into the Decision Tree in terms of crop production from that piece of land. However, this is only one of the several criteria which farmers consider in their decisions about soil and water conservation. These include: technical conditions of the plot (see criteria for bund moving), plot location, land size and labour availability. Thus, farmers do not necessarily decide according to costs or benefits alone.

Area closure

With the area closure, the entire uplands that are not suitable for agriculture due to slope and prior degradation were treated with forest and hillside bunds. Following that, a marked reduction in runoff and gully stabilisation began to be seen in the entire catchment of Lake Maybar, which was also confirmed by farmers during group discussions.

At the time of the change of government in 1991, a massive destruction of conservation efforts took place. The conservation was implemented through mass mobilisation. The community primarily cut down trees, but also removed conservation structures directly and indirectly by allowing their animals to trample them.

The destruction did not spare even the nursery at Tossa Felena. The forest in the closed area was the target of everyone from within the area and distant villages. The guards assigned by the MoA were not in a position to protect the mass destruction. The scene became a typical case of a 'tragedy of commons' (Hardin, 1968), more specifically the 'tragedy of open access' (after Warren, 1991).

After the change of the military government in 1991, the army of the former government was retrenched and the ex-soldiers came back to their home areas. In addition, people who were sent to resettlements also came back to their place of origin. This influx led to a claim on land, particularly among those returnees from the settlements whose land had been distributed to others in order to implement the agro-ecological plan. In order to solve this problem, the Peasant Association leaders firstly asked farmers to share land voluntarily with their compatriots. In return, those who shared land with returnees were given a plot of land in the hillside for pasture. As this measure was not sufficient to accommodate all returnees, the Peasant Association began to re-allocate the land in the formerly closed areas. This measure ruined the community forest area. Widespread grazing in the closed area began in 1991 and continued until the fieldwork of this study was completed at the end of 2000. The PA leaders distributed land for returnees without responding to the requests of many youth, who are now also eligible for a farm plot. There are young farmers with families who still depend on their parents' farm for subsistence as well.

Opening up of the closed areas to grazing and agriculture aggravated the erosion in the catchment, which resulted in a widening of the gradually narrowing gorge. Large stones and heavy siltation were visible along the embankment. At times of heavy rainfall, the adjacent fields become littered with stones and silt.

In early 1991, the operation of the station was interrupted for a few months, as the signs of hostility against the project became more overt. The Research Assistants returned to the station in June 1991. They resumed the work with support from the officials of the new government. Farmers around the catchment area invited the Research Assistants for a meeting to discuss their interest in grazing their livestock on the hillsides to ease their livestock feed problem. During the discussion, the Research Assistants advised the farmers to use their best judgement in view of the past conservation efforts and what they had learned together. In spite of that, the farmers continued to graze in the closed area until 1997. This ruined the hillside bunds and the vegetation by both animal and human interference. In fear of a repeated plea by the Research Assistants to the management of the PA to protect the hillside as in previous years, some farmers went directly to the *Wereda* Administration to get permission to graze animals in the closed areas. Following that, the *Wereda* Administration sent an expert to demarcate the community and the state forests. According to the ruling, the former one was to be managed by the community and the latter to be managed by the MoA. However, farmers do not distinguish between the two. This demarcation legitimised grazing on the hillside that the project had been protecting up until 1991. Farmers were happy with the decision of the expert, as they did not accept the idea of the area closure from the very beginning. After the closed area was reopened, grazing was prohibited during the wet season on the hillsides and other grasslands in order to grow hay. The grass was divided among farmers. Management of the wet season grass was carried out by a village (*Got)* committee. This committee has three members, one from each village.

In 1997, the government issued a decree on the use of community forests. According to this decree, the Peasant Association can levy a service charge to cover running costs for the Office Administration. To the resentment of the farmers, the PA management began to charge them for use of the grass from the areas demarcated as a community forest through the farmers' own efforts.

Farmers have been planting and still plant trees, mainly eucalyptus, on their land. This practice is of course more because of their confidence in the local institution, *Kire,* rather than being a tenure issue only. As shown above, the open-access state forest and nominally closed access community forest are suffering from over-exploitation by individuals. This is a clear example of where the land tenure system of the country negatively affects natural resource management. Insecurity of holdings on arable land is by far less than on the non-arable land. This is aggravated by poor participation of the community. Therefore, the community does not apply the local control mechanisms to protect the 'community' and state forests. According to a *Kire* leader and other informants, *Bele* is not applied on the community and state forest because everyone would be affected by the curse (cf. Section, 7.2.3).

The main reason for the illegal utilisation of trees in both community and state forests is the lack of a defined utilisation mechanism for the rural people besides planting (Alemneh, 1990). The element of the tragedy of the commons is clearly reflected in the case of the forest. Many farmers use tree species, which they either do not own or of which they have few stands. At times, one could see fresh heaps of wood behind houses covered with grass or straw. Then I asked farmers with whom I had developed a rapport where the source of such wood was.

Laughing at my observation, two farmers confided in me that the trees came from the nearby forests. When I asked why, one of them said: 'if I do not cut it, others will'. This indicates a clear absence of rules and regulations for access to the benefits of trees planted, which jeopardised the tree production in the area and also hold true for the entire country.

Irrigated agriculture

The irrigation facility was used only for one cropping season, in 1985. In 1993 the project handed over the pump to the three villages in the Maybar PA that were involved in the land distribution. After the handing over, some members of the Abo Ager village suggested to use the pump for a flourmill. On the other hand, the Tossa Felana town requested to use it for power generation. These proposals were not realised on the grounds of technical difficulties. Thereafter it was suggested to sell the machine. The latter option was not implemented primarily for lack of an official document, which was not traced nor known to have existed when the machine was brought to the area. In the end, the machine has continued to stand unused for many years. This was in spite of the repeated requests from the projects and visitors from Addis Ababa and elsewhere, advising the community to use it for irrigation.

In 1997, the three PAs were merged into one. These were Maybar, *Defatit* and *Albore*. With knowledge of the condition of the pump, the new villages entered into the claim on the pump's proceeds, if and when it is possible. And yet, the people who have a direct prospect for its use did not show any interest at all. It is worthwhile to indicate that farmers from Albore, which is located in the eastern part of Lake Maybar irrigate their farms from outlets of the lake. What is even more interesting is that these people are regularly maintaining about 3 km of irrigation channel that was constructed along the hillside. And the water distribution is managed by a local water-use committee.

The common explanation given by farmers for not using the pump after the 1985 season was that the water from the pump burns the field crops. According to the information from the research assistants, that is impossible. In addition, inability to cover the running cost and logistics was also mentioned by few, in spite of an overt lack of motivation to restart the pump by different parties. In view of this, I continued searching for more subtle explanations that shed light on the farmers' reactions to irrigation. To this end, I held intensive interviews with the research assistants, youths and elders in the community. Finally, I held group discussions in all three villages focusing on this point. After this triangulation, the following issues were concluded (see also Ludi, 2002:281-283).

1 *Noisiness for the Maybar Shrine*

The pump is placed opposite the Maybar Shrine (*Shehochu*). The noise it creates during operation was believed to have been 'disturbing' the spirits. The legend about the lake says that it was given to one of the earlier religious leaders to use for cleaning during praying, which was explained by some elderly to show the link of the lake with the spirit. There was a difference of opinion between the elderly and the youths on this issue. The religious leaders clean demons from sick people by directly dipping people in the lake on the opposite side of the pump site.

2 *Fear of eviction*

There was a rumour that the state could lease the land to an investor if irrigation was developed in the area and a producers' co-operative established, which had a bad reputation during the time of the socialist government. Fear of eviction is likely in view of the insecure land tenure in the region, and the direct experience of so many families who were sent to resettlements.

3 *Obstruction by neighbouring villages*

The villages below the lake, which view the lake as a table above them feared that the water outlet would be lessened, particularly during the dry period if it is used with a motorised pump by farmers in the lake catchment. Because of this they are said to have discouraged the use of the pump by spreading different kinds of rumours (cf. no.2 above). In addition, prospects of the sale of the machine raised a mixed opinion in the community.

4 *Reclaiming for land*

Land redistribution, which took place when the agro-ecological plan was implemented, affected some families more than others. There were farmers who did not have a piece of land in the irrigated site (70 farmers) but obtained land after this land redistribution. Some families who had to exchange their upland in return for land in the irrigated site did not do so after the control was relaxed. This has left some resentment among those who associate the transfer of their land with the irrigation initiatives. Therefore, they resist the continuation of the irrigation with the prospect of getting their land back.

In spite of these reasons, the project did not make a concerted effort to resolve this deadlock against continuing the irrigation practices for over 15 years, a situation that could have brought a different scenario to the watershed. In the absence of an alternative to their growing problem of food shortage, farmers returned to the uplands in pursuit of their short-term goals for their families and livestock, which has meant the end of the agro-ecological plan.

With these findings, I decided to contact the concerned bodies to take the necessary measures to utilise the lake for irrigation. The process and the outcome of this effort is given in box 7.2.

Box 7.2: Office back to office on irrigation in Maybar, South Wello, Ethiopia

At the end of my fieldwork in early 2001, I contacted the *Wereda* Administration and Agriculture Office, the Zonal Office of Agriculture, and the Research Assistant of the former SCRP station to inform them of my finding about the irrigation in Maybar. Subsequently, I organised a meeting, which they all appreciated. During the meeting we discussed what should be done to restart the irrigation programme and who should be involved and so on. Following that, I contacted the SIDA representative in Dessie and an NGO in Kombolcha in the presence of the expert from the Zonal Office of Agriculture and the research assistant to discuss the possibility of financing the irrigation activities. Both offices expressed their willingness to assist the initiative in matters of their capacity. Following that, a team of five persons including the SIDA representative (expatriate) went to Maybar in March 2001 to view the situation and discuss it with the farmers. After that, the team decided to prepare a budget for the pump renovation to be financed from the SIDA fund. Unfortunately, no action was taken until May 2002 when I inquired into the latest development in this matter. The main reason was that the individuals who agreed to prepare the budget failed to do so. Coming back to square one, I finally left the matter by appealing to the Zonal Administrative Head, whom I believe will link the matter with a country-wide new development initiative, which claims to decentralise the development management at the *Wereda* level.

In view of this, I wonder when that lake will be utilised for irrigation again, that at least those families with access to irrigation will be able to improve their food security without soil mining or other land degrading farming practices.

As can be seen from the foregoing discussion, the shortcoming is not only on the project side. The local authorities also lack vision and more importantly the good will and initiative to solve local problems. One means to break the deadlock on the irrigation issues is to openly discuss with the villages concerned and to offer the upland parcels to those who have shared land from their irrigated area with others. The religious leaders should also be approached for their blessing to the irrigation initiatives as part of their role.

Biological conservation

The research on biological conservation at Maybar ended up with a pessimistic conclusion. Even though some biological conservation methods prove to be complementary to the physical conservation measures, the recommendations were not feasible under the existing farming system and socio-economic conditions of the farmers in the area (Kassaye, 1997).

Farmers who hosted the biological conservation experiments expressed their appreciation for the forage plants they had tried. But there was a lack of seed to continue with the production of Vetch even though the farmers adapted it to their own method of planting. The other forage plants were partly less adaptable to the area, and the animals that graze in the croplands after harvesting, damaged the vegetation that showed some vigour. The other problem was that moles and rats were attracted to the introduced grasses. Therefore, farmers abandoned the grass from the fields and continued with the local grass species. Grass cover on the stone bunds was removed with the shrinking bund width. The pigeon peas were damaged by oxen during ploughing. In the end, the entire biological conservation effort made on cultivated land was lost and became history. Forage plants planted in the closed areas failed partly because of adaptation to the area and partly because of the opening of the area to animal grazing. The major causes for these losses are lack of a controlled livestock production system, lack of suitable forage species, lack of alternative sources of forage and lack of farmers' participation.

7.6 Conclusions

In the early 1980s, interrelated land-management practices were introduced in Maybar catchment by the SCRP. Apart from the bund, other interventions, namely area closure, irrigation and biological conservation were a complete failure. The bund survived because of farmers' adaptation of it. It became a widespread practice after the rigid control of the bunds was removed after 1991.

Farmers in Maybar have a very thorough understanding of their natural resources, their limitations and potential to agriculture. They have knowledge of soil erosion and its impact on soil fertility and thereby crop production. Their agricultural practices were dependent on an alternative fallow system between the flat lands and the uplands. This practice was undermined by population pressure and tenure insecurity. The upland indigenous physical soil conservation practices (*Dib/Weber*) became less effective due to continuous cultivation. Use of manure outside the adjacent plot (*Guaro*) is an exception rather than a rule. In addition, use of other organic matter is very rare in the area. This is mainly due to the perception of the community, which labels fields without trees and shrubs as a good farm. According to farmers, soil fertility is declining due to repeated cultivation, lack of manure and soil erosion. On the other hand, their responses on the overall trend of soil fertility between 1990 and 2000 show no change at the watershed level, while variations between plots remains.

The introduced bund was modified by farmers and according to their resources, indigenous knowledge, in response to land pressure, technical, economic and social criteria. The modifications involve mixing stone with soil, bund movement, reduction of bund width and removal of alternative bunds. Over time, it has become a routine farming practice that suits the increasing hillside agriculture. Farmers now regard bund construction as a necessity.

Farmers' bund management practices do not show a major difference because of socio-economic variables such as age, education, livestock ownership, labour and family size. However, the intensity of modification varies with the size of cropland.

Interventions on area closure, irrigation, and biological conservation failed because of social, economic, technical and institutional reasons.

Social

From social points of view the project did not take into account the local institutions such as the spiritual centre (*Shehochu*), which is located at the edge of Lake Maybar. Its influence in the community and the relationship with the lake was very important for the changes in the area. In addition, past experience of the farmers in irrigation should have been assessed, at least, after the famine of 1984 when irrigation was first introduced.

Economic

The land issue is central to the failure of area closure and to some extent to irrigation and biological conservation. Some people got access to flat land while others lost such rights because of the resettlement and land redistribution carried out specifically in Maybar. This situation would continue to work negatively on all the interventions related to land. Farmers did not accept area closure because they did not have an alternative for their livestock. As irrigation was associated with land redistribution, those who 'gave' land to others hoped that stopping the irrigation would bring their land back. There is also the issue of equity for the pump among the neighbouring villages. Growing forage crops on the cultivated land means competition with crop production that is hardly accepted by farmers.

Technical

The project did not think of biological conservation on cultivated land until the late 1980s nor did it develop technical options that fit into the existing farm tools and farming practices. With respect to irrigation, farmers did not have genuine participation in the plans because of the emergency situation in which irrigation was introduced. As a result, the subtle reasons behind their resistance that limited the use of irrigation later were not revealed nor assessed by the project. This could have been avoided if a participatory approach had been employed in the initiative.

Institutional

land security was not reliable both at the local and regional level. The resource was left with open access that exposed it to bad utilisation. As the 'community forest' did not involve the community, the community did not follow its rules to protect what they see as government forest. This development led to an uncontrolled destruction of trees. The decree that was issued by the government in 1997 about the utilisation of community forests has even aggravated the problem.

What should be done?

In order to achieve sustainable land management and livelihoods, a two-pronged approach could be followed. These are intensification and diversification on one hand and a minimisation of land pressure through non-farm employment, on the other. In the short run, rehabilitation and promotion of the irrigation facilities is feasible as many families have irrigable land. In addition, utilisation of manure in distant plots is a feasible action for intensification. Alongside irrigation, other rural development components such as credit, road improvement, family planning and education should be carried out. In the long run, most of the young generation and some of the new families should go out of direct farming and carry out non-farming activities. In addition, means to involve some rural community into the formal and non-formal employment sectors should be sought, for example through skills training.

8 Discussion

8.1 Introduction

This chapter attempts to bring together the major findings of this study with the purpose of understanding soil and water conservation behaviours of farmers in Ethiopia. The study used a design that deliberately included case studies of two areas in which a major soil and water conservation project, the SCRP, had intervened by introducing erosion-control measures using food-for-work as an incentive. Major issues arose from studying the impact of the SCRP that help us to understand how farmers manage their land. The study also looked at Konso, perhaps the most famous example of indigenous soil and water conservation practices in Ethiopia. Comparing these different case studies have given some insights into a wide range of farmer behaviours and reactions to intervention.

This study has operated at different levels. It compares case studies (watersheds), households, and fields or plots. It is hoped that my study allows for drawing some vital conclusions to influence future SWC policies and strategies in Ethiopia. Soil erosion is, of course, nothing new to Ethiopia. The empires of the Egyptian pharaohs were, after all, based on the annual load of silt deposited by the Nile, silt that for the most part came straight from the Ethiopian highlands. In modern times, erosion has, however, become vastly accelerated by human activity. The Abay River, widely known as the Blue Nile, could now more appropriately be called the 'brown' Nile because of the millions of tonnes of fertile soil it carried away every year. Land deterioration in Ethiopia is out of control and perhaps one of the major threats to the opportunities of the country to become part of the developed world instead of a permanent basket case. Hence this study attempts to better understand how farmers' practices and erosion are related. Land use by farmers is not very amenable to regulation, fiscal policy or other intervention. It is of extreme importance to understand the *reasons* that farmers have for using the land in certain ways. This study has looked at these reasons. This discussion chapter revisits the research questions formulated in Chapter 1:

1. What are farmers' responses to the introduction of SWC measures?
2. What are farmers' knowledge and attitudes on soil erosion and soil and water conservation?
3. What do farmers do to conserve soil and water on their farms?
4. What are determinants of soil and water conservation practices among small farmers within and across socio-economic and agro-ecological environments?
5. How can constraints to promote soil and water conservation be overcome?

Section 8.2 highlights the problematic situation of Ethiopia and some of the responses the country takes to redress it. Section 8.3 then presents the main conclusions with respect to farmers' reactions to the interventions. Section 8.4 draws together the conclusions that can be gathered from the study of Konso, the indigenous SWC practices. Farmers' knowledge and attitudes with respect to soil erosion and SWC are presented in section 8.5. This is followed by a discussion on farmers' practices in SWC (section 8.6). Determinants of soil and water conservation among small farmers are presented in section 8.7. The discussion in section 8.8 deals with possible suggestions to solve constraints to promote soil and water conservation in Ethiopia, which includes specific policy implications. The final section of the chapter presents issues for future research.

8.2 Ethiopia: a country prone to erosion that has needed to take measures to redress it

Ethiopia is a mountainous country with a substantial proportion of its land (45%) in the highland zone at more than 1,500 masl. Due to this physical feature, the country is highly prone to erosion. A very high population growth, limited expansion of the opportunities for off-farm employment, severe droughts and extreme poverty combine to form a worrying scenario of continued soil degradation.

The country has not been food self-sufficient since the 1973/74 famine. It has faced similar famines in 1984/85 and 1993/94 (Markos, 1997:89). As I write this thesis (fall, 2002), millions of Ethiopians again are starving as a result of the recent famine that has hit many African countries. The food problem is associated with land degradation, population pressure, a low level of technology, ill-conceived policies and poor institutional services. The state has taken up the 'land degradation triggered by the population pressure' thesis with a vengeance. This view is referred to as 'a generalised Malthusian narrative' (Keeley and Scoones, 2000; Hoben, 1996; Dessalegn, 1998). The state's position has been reinforced by large-scale studies carried out in the country such as the EHRS and location-specific erosion and runoff studies by the SCRP (Chapter 1).

With consensus on the causes of the food deficit and land degradation in the country, the state has commissioned large-scale soil and water conservation activities that focus their attention on the food deficit regions of the northern, central and eastern parts of the country. These initiatives, implemented by the MoA, have been supported by the WFP programme, several NGOs and other multilateral organisations. As a result, about 15% of the country that needed to be under appropriate conservation measures was covered in the 1980s. The other key partner in the conservation initiative was the Soil Conservation Research Project (SCRP) that became a technical arm of the conservation movements in the country. In addition to assisting the national conservation programme, the SCRP has been carrying out an intensive

SWC action research project in small catchments to generate information and appropriate technologies. Based on the initial diagnosis of the problem that was believed to be a technical problem, the SCRP and its associates embarked on technical solutions. During the nearly two decades of its operation, the SCRP carried out several activities in Ethiopia. The major ones are:

- establishing research stations in different agro-ecological zones;
- producing an extension handbook on soil and water conservation for extension agents (first edition in 1986, then reprinted in 1995);
- supporting nation-wide food-for-work implemented by the WFP and MoA with technical matters;
- generating data and producing several scientific publications, including a textbook in the official language (Amharic) and a video film in English;
- collecting long-term data on soil loss and runoff in different agro-ecological zones (these data form a resource base that makes Ethiopia unique among developing countries);
- testing and adapting soil and water conservation measures that are technically effective; and
- training about ten high level professionals in the area of soil and water conservation and assisting several national and expatriate graduate students.

Unfortunately, these interventions have not taken root in the farming systems they targeted, nor did they change the extent of land degradation in the country (Hoben, 1996; Yeraswork, 2000, Alemneh, 1990; Stahl, 1990). Farmers' negative reactions to the interventions became more pronounced after the downfall of the military government that had been enforcing the conservation measures through an administrative and authoritarian machinery that reached down to the grassroots level.

This study was initiated to study the farmers' responses to the SWC interventions in greater detail and to compare the intervention scenes with indigenous SWC practices developed over four hundred years by farmers themselves. Hence I start off this discussion chapter with trying to answer the first research question.

8.3 Research question 1: what are farmers' responses to the introduction of SWC measures?

The SCRP's impact was studied in two areas: Wolaita and South Wello. The Wolaita people started agriculture in the lowlands and later on moved to the highlands. Their production system was garden-based and featured perennial and root crops in addition to cereals and pulses. The hand tools were soil friendly. The rich and deep soils of Wolaita did not necessitate agroforestry in the same way as Konso, where the shallow soils pose a higher level of crop production risks. The garden plots were productive for the low population size and the integrated crop-livestock production system produced sufficient manure for sustainable production. In view of this, the Wolaita people did not widely promote physical structures for soil-fertility management in the highlands. Their labour organisation focused on soil and crop management practices and social activities rather than bund construction.

Nowadays, things have changed considerably with the move to the higher grounds and expansion into the land traditionally used for grass production. Labour organisation is reduced to seasonal farm operations due to the use of ox-ploughs and the small farm sizes. As in Konso, livestock in Wolaita now needs to be controlled because of the limited free grazing areas and because of the perennial, root and spice crops. Farm fields are fenced and trees are an integral part of the farming system. Live fences, and farm trees provide multiple uses to farmers, including production, conservation and soil fertility. However, many of the attitudes and practices of old persist. Deep soils allow the Wolaita people to ignore the danger signals.

Wello developed an ox-plough, cereal-farming system that favours plain and gently sloping areas, which suit the main farm tool, the plough. In view of this, physical SWC structures were limited to uplands and garden plots, adjacent to the residential areas. As shown in Chapter 7, these farming practices are effective only under a long fallow system. Sole cropping became the dominant feature in Wello due to the influence of the plough that is used for land preparation and cultivation. In this system, trees are not appreciated in and around the farming areas. Trees belong to the bushes or hills, not to the farms. In view of this, it is not easy to promote biological conservation measures in the Wello system, unlike in Konso and Wolaita. Livestock production in Wello is still extensive in terms of its management. Because the Wello farmers had nothing left needing protection after the crops were harvested, the age-old practice of after-math grazing was permitted and continues to date, making the initiatives of biological conservation measures impossible to realise (7.5.3). Nevertheless, the Wello people are still very much aware of the fragility of their environment. They live in a famine-prone area and need to spend a great deal of attention on soil fertility. In other words, Wolaita and Wello had very different farming systems in which very similar SWC practices were introduced from the outside. Yet the two areas reacted similarly in some cases, though very differently in others, to the intervention by the SCRP. In this conclusion chapter we highlight some of the main results.

8.3.1 Soil erosion vs soil fertility

Researchers and extension personnel tend to emphasise soil erosion for which physical soil movement is a central issue. In this case, the solution is a physical barrier that maintains soil in its original place. For farmers, soil movement is not that apparent unless rills and gullies are created. Their concern with soil is its fertility that they measure using different indicators. They see its colour (dark or light/white), they compare the trend of crop stand and yield, and they see its physical characteristics such as weight on the plough shear and plough depth, stoniness and the like. Based on this observation, they refer to soil fertility rather than to soil erosion. Therefore, they tend to give soil erosion a lower priority than soil fertility when ranking crop-production problems. In Wolaita, soil erosion was ranked fourth while soil fertility was ranked second. The corresponding figures for Wello were seventh and third. This view does not mean that farmers are not concerned with erosion as some scientists want us to believe: 'The personal perception of local land users is generally inadequate where erosion is concerned. Sheet and rill erosion on steep lands are generally perceived as processes, but in most cases not as hazards threatening agricultural production.' (Kebede and Hurni, 1992: 4). To this they add that: '...one should not forget that local wisdom coexists with ignorance'. Implicitly, this means that knowledge transfer must come from outsiders. In my view, the shortcut to a common understanding is to approach soil erosion through soil fertility, following the reasoning of the farmers, who are, after all, the ultimate decision-makers on land use. In their view, soil fertility takes precedence over erosion. The entrance point to their minds and hearts is through soil fertility.

8.3.2 Side effects of SWC practices

What farmers do or not do is not without reasons. In fact, their reasons are rational from their own points of view. When they are encountered with a new practice, they always assess its many sides. One of these aspects is the relative advantage. They enquire as to whether the new practice solves their problem at cost and how great this cost is to their livelihood.

Farmers in Wolaita and Wello have thoroughly assessed the side effects of the contour bunds introduced on their farms. They compared the stated soil erosion problem and the losses caused after the installation of the contour bunds. These include: land taken up by the bund (an amount that reaches up to 25% depending on the slope); weeds and rats breeding in the bunds; and inconvenience to the ox-plough. To this, they add the annual maintenance required, that claims a separate labour organisation to their own practices that are mostly carried out together with the annual farm operations.

Outsiders, in their single-minded concentration on soil erosion as a single target variable, tend to overlook these multiple impacts on the livelihoods of the farmers.

8.3.3 Differential reaction to bunds

At the early stage of the intervention, farmers' responses to soil and stone bunds in both Wolaita and Wello were the same. As farmers were not convinced about the SWC practices at the time of their introduction, they emphasised only the side effects and the temporary food provision by the project. Implementation of the practices was based on problem assessment by outsiders, without worrying about farmers' knowledge and attitudes. The food-for-work programme used as an incentive allowed for a total neglect of the educational process and gave space to a top-down approach.

As time went by, farmers' reactions to the introduced bunds began to diverge in the two locations. In Wolaita, 54% of the farmers in the treated catchment had removed one to four bunds by the time of this study (end of 2000). In addition, 15% of them removed all of the bunds installed under the food-for-work programme. In the entire study area, 48% of the farmers removed 17-100% of the bunds on their land. The proportion of farmers who preserved their bunds is higher for untreated and distant locations, than for the treated and adjacent catchments. Of the total farmers, only 10% reported maintenance of their bunds. Removal of bunds after a number of years shows a 'dis-adoption' of the technology that is basically different from a decision not to adopt from the beginning. Such dis-adoption merits special attention (Moser and Barrett, 2002).

Growth of the negative attitude to *soil bunds* in Wolaita is due to two main reasons. Firstly, the research and extension systems were not and still are not proactive in providing farmers with the necessary information to compare the advantages and disadvantages of fields with and without soil bunds. Such information would have been worthwhile because farmers cultivate steep land under heavy rainfall (1,300 mm), which partly occurs during times of low vegetation cover, making farming prone to erosion. Secondly, farmers themselves did not take initiatives because of the relatively high soil depth (Weigel, 1986a), heavy reliance on organic fertiliser and the use of commercial fertiliser on outer fields (*Shoka*) that conceal the negative effects of erosion on crop production. Therefore, given the information available to the farmers, their behaviour is rational. Soil erosion or declines in soil fertility did not reach a threshold level to motivate farmers to accept soil bunds.

In Wello, farmers reduced their negative attitudes towards the *stone bunds* some time after their introduction. They began to actively experiment to find out ways to minimise the side effects they observed in the technology, such as waste of land, harbouring of rats and weeds, and providing an obstacle to ox-ploughing. In the process, farmers were able to appreciate the benefits of the bunds that were becoming indispensable as their agricultural zone stretched into the steep lands and fallow periods declined, leading to a 'vertical' expansion which is a third stage of evolution [68]. Their experimentation resulted in the 'moving bunds' strategy, which changed farmers' perceptions of the introduced bund. The 'moving bund' was the farmers' own innovation. This bund-management practice involves the destruction of an old bund and constructing a new one in a selected site on the same plot. The soil 'harvested' from the old bund is distributed over the entire plot (Section 7.5.3). Movement of bunds was facilitated because of the mixture of stone and soil whereby they could easily move the stones to a new location. Note that this would have been much more difficult if only soil bunds had been involved, as is the case in Wolaita. This practice also shows farmers' interest on soil fertility rather than in keeping the soil in its original position according to the scientists' design. Hence, farmers in Wello are now voluntary adopters of bunds. However, the types of conservation methods applied by each household are based on the resources available and on plot characteristics (section 7.5.3). These features should be taken into account in intervention processes. At the time of the study, 86% of the farmers preserved their stone bunds with a 94% maintenance rate.

8.3.4 Conclusion

The SCRP's 17-year intervention failed to meet its main objective, 'to develop and promote ecologically sound, economically viable and socially acceptable conservation measures' (Tesfaye, 2002) [69]. Besides falling short of its objectives, the process of its implementation and its end results confirm that the history of intervention world over, as ascertained by many anthropological studies of development discourse, has a 'techno-reductionist' character (Ferguson, 1990; Escobar, 1995; Grillo and Stirrat, 1997). Thus, the project phased out with a narrow technical achievement that did not lay an adequate foundation for sustainable land management, as intended (see also Waters-Bayer *et al*., 1998). The major weaknesses were:

- a uniform, narrow technical intervention that does not take into account socio-economic variations;
- virtual lack of use of the standard socio-economic data it collected to modify its technically oriented action over the years that displays a typical gap within monitoring and evaluation efforts;
- soil and water conservation technologies that proved inferior to local practices in terms of crop production; i.e., they lacked short-term benefit to farmers;
- a single-minded focus on collection of soil erosion and runoff data, not taking into account other factors;
- in Wolaita, treatment of the community as an experimental plot, dividing it into 'treated' and 'untreated' sections (see section 6.3.2 for details);
- failure to integrate indigenous land-management practices from the beginning;
- lack of a participatory approach and heavy reliance on food-for-work;

68 Alemneh (1990:28) divides the evolution of agriculture in northern Ethiopia into two. The first stage is 'outward' expansion in which new or fallow land is brought under cultivation. The second stage is 'inward' expansion, which involves cultivating the same land more intensively without fallowing.

69 I have also personally discussed with one of the former managers of the SCRP who in retrospect agreed with my arguments on the shortcomings that I point out in this chapter.

- failure to establish working linkages with the national research and extension system. Even though it was housed in the MoA, the project created its own space run by an independent management team, which later backfired, to the destruction of its very existence;
- failure to create an adequate human capacity in the country that would help continuation of the work that has now lost a national level momentum; and
- lack of sensitivity to the local institutions and changing policy environments.

8.4 Lessons from Konso: the role of the 'soft' side of land

Soil and water conservation has long been regarded as a mere technical issue whereby conservation engineers were requested to lay down contour bunds, check dams, waterways, etc. This focus neglects social, cultural, economic and institutional aspects that are increasingly being considered to be just as crucial as the technical options (Röling, 1997; Gonzalez, 2000, Mazzucato and Niemeijer, 2000). These studies have shown that technical (*hard*) options are viable only when they are embedded in suitable institutions and other *soft* aspects of land use. The Konso case brings out the importance of these aspects with a vengeance.

The Konso people started terrace-based farming probably about four centuries ago. Their terraces cover hundreds of square kilometres, their design and height being the most amazing part of the artefacts. They built the terraces because of the environment, which is characterised by low rainfall, and by rugged and steep terrain that is highly susceptible to erosion. They were forced to live in this territory because of political and biophysical factors (malaria and hot weather). The dominant farming system in Konso is a hoe-complex where only hand tools are used for all forms of farm operations. Emergence of the ox-plough in part of Konso is a recent phenomenon.

SWC in Konso is of an integrated nature, based on the stone terraces built during the last 400 years. The terraces are supported by tied-ridges, thrash lines and agroforestry practices, while soil fertility is augmented by fallowing, manuring and minimum tillage, among others. These 'hard' practices are supported by an elaborate set of institutions invented by the Konso society over the centuries to allow for the intensive system of land use.

In the first place, Konso society has developed mutual labour organisations that are instrumental for creating and ensuring the continuity of the terraces. What is even more amazing is the treatment of watersheds to capture floods for irrigation that is hardly thinkable in most arable farming systems of the country. Labour is not only a mere factor of production, it is also a result of social organisation.

In the second place, the long fallowing system and balanced use of the bush and farm areas was ensured through a traditional population-control method achieved through the practice of *Fereyuma,* which prohibited marriage before the age of 30-35. Culture and institutions allowed and still allow for different modes of access to land that support land-use practices that are consistent with the environment.

Owing to the integrated SWC, Konso people moved to controlled grazing and fencing practices far earlier than the Wello did, and perhaps many other societies, in order to protect the terraces and the perennial crops from being damaged by animals. These practices allowed a widespread agroforestry system developed by farmers. These practices are supported by local rules and regulations rather than a central planning and control system.

The watershed-management practices and care for trees highly benefited from the spirituality of the Konso people who regarded certain forest bodies as sacred. Their utilisation was possible only with the blessing of the religious figures.

All in all, SWC in Konso is not only a 'hard' set of technical practices, but it also necessarily comprises the binding and facilitating 'soft' elements that ensure the successful and continued performance of the hard practices. All these soft elements are an essential feature of Konso's agriculture. It is worthwhile to note that the recent deterioration of Konso's terrace agriculture is partly due to the collapse of some of the soft elements. For instance, the abolishment of the *Fereyuma* since 1974 led to a rapid increase in population that affects the fallowing system, land use (bush vs farm) and farm size. Also, a food shortage due to the lack of rain and poor soil fertility disintegrated the complex system of labour organisation.

The Konso case is comparable with the *Ifugaos* of the Philippines (Gonzalez, 2000) and the *Wakara* of Ukara Island in Africa's Lake Victoria (Netting, 1993) who independently constructed a chain of stone terraces. Although these systems are also under threat because the institutions required to sustain them cannot be maintained in modern society, they, as does Konso, teach us that sustainable land use cannot be created without attention to the soft side of land-use practices.

8.5 Research question 2: what are farmers' knowledge and attitudes with respect to soil erosion and SWC

Farmers in Konso, Wolaita and Wello have an adequate knowledge of soil erosion and SWC. Their attitudes towards the latter are positive with the exception of the Wolaita farmers who still maintain negative attitudes towards the side effects of the soil bunds introduced by the Soil Conservation Research Project.

In Wolaita, farmers from the four catchment areas used in that case study were exposed to a number of questions during this study. Regarding statements intended to measure knowledge of soil erosion and soil fertility, responses of farmers in the treated catchment differed significantly on certain points from the other three locations (untreated, adjacent and distant) (Table 6.6). Their responses to the statements on perception also follow the same pattern (Table 6.7). However, overall, the knowledge and awareness of issues related to erosion and SWC was very high in Wolaita, approaching a 100% level. Scores on knowledge and perception statements of Wello farmers showed similarly high results (90-100%).

From this outcome, it can be concluded that farmers in the two study areas were not different in terms of knowledge and perception of soil erosion and soil and water conservation. The case of Konso farmers also confirms the same observation. In other words, a lack of knowledge is not determining farmers' soil and water conservation practices. They seem very well informed.

8.6 Research question 3: what do farmers do to conserve soil and water on their farms?

As shown in detail in Chapters 5, 6 and 7, SWC practices in the three study areas show some distinct features. The SWC methods observed in the three case study areas include adaptation, dis-adoption and continuation of practices.

Konso was and still remains an integrated system based on stone terraces. Wolaita by and large continues with its indigenous practice that is dominated by a biological conservation system based on organic matter. Use of soil bunds is very limited. Wello has shifted from crop and soil management in flat and gently sloping land supported by long fallow periods to contour bunds that include stones (Table 8.1). Indigenous physical conservation was and still is used on steep land. Contour stone bunds cover at least 60% of the land of the sampled farmers. It was introduced in the early 1980s and further adapted by farmers.

At the plot level, farmers use a combination of SWC practices according to their opportunities. Diversities of SWC methods at the plot level are highest in Konso, followed by Wello and Wolaita, in that order.

Use of commercial fertilisers is limited. The survey at Wolaita and Wello shows that respectively 68% and 44% of the farmers have used fertiliser at least once in their farms. Wolaita farmers use more fertiliser than Wello farmers because the former group was exposed to this input since the early 1970s. Fertiliser utilisation in Konso is the lowest among the three areas. Low fertiliser use is due to the high price and poor rainfall conditions. When fertiliser consumption among farmers is lower due to higher fertiliser prices, their acceptance of land-competing conservation technology will be lower as well (Bekele, 1998).

Table 8.1: Major soil and water conservation practices in Konso, Wolaita and Wello, Ethiopia

Study areas	*Practices*
Konso	Stone terraces Tied-ridges Thrash lines Agroforestry Minimum tillage Manure (extensive) Diversion ditches
Wolaita	Manure (extensive) Soil bunds (limited) Diversion ditches Live fences
Wello	Diversion ditches Stone bunds Traditional Earthen bunds (*Dib/Weber*) Manure (limited)

8.6.1 The relationship between farmers' knowledge, attitude and practice in SWC

Farmers' knowledge on and attitudes to SWC have a basic, but limited role in determining their practices. Semgalawe (1998:127) in her study on household adoption behaviour regarding soil conservation in Tanzania found out that 'the perception of the soil erosion problem is not a necessary condition for using effective soil and water conservation measures as anticipated. Neither does the perception of the soil erosion problem determine the level of conservation investments among adopters.' However, Bekele (1998) in a similar study at *Andit Tid*, Ethiopia, reported a positive and significant relationship between farmers' decisions to retain conservation structures and their perception of soil erosion.

Decisions on a given practice requires suitable biophysical and socio-economic environments, in addition to adequate knowledge and favourable attitudes. When these factors are not in congruence, farmers' practices show divergence from their knowledge and attitudes. This situation came to pass in the Wolaita and Wello cases. In Wolaita, farmers who agreed to the knowledge and perception statements by almost 100% showed variation between the four locations in the use of soil bunds, ranging from 30 to 81% (section 6.5.3). In Wello, thanks to the farmers' learning process, the deviation was only 10% (section 7.5.3).

Moreover, one season's use of irrigation in Wello did not guarantee the continuation of the practice let alone a mere knowledge, showing the complexity of change processes. It is worthwhile to mention that in Wolaita, 22% of farmers who responded that 'soil bunds do not have disadvantages' removed 100% of the bunds (6.5.3). This observation hints that one cannot establish a clear casual link between knowledge and attitudes on the one hand and practices on the other. This means that practices are affected by factors other than knowledge and perception, which brings us to the next research question.

8.7 Research question 4: what are the determinants of soil and water conservation practices among small farmers within and across socio-economic and agro-ecological environments?

8.7.1 Land tenure and SWC

There is no strong evidence for the negative effects of land tenure[70] on investment in soil and water conservation practices where this study was carried out, particularly on arable land (cf. Yohannes, 1999). However, the negative effects on SWC are more pronounced on the non-arable (communal) land such as hillsides, roadsides and grazing land. Grazing land is shrinking in size while the incentive mechanism for livestock ownership to increase one's stock remains the same. As discussed in connection to the risk perception (below), farmers are reluctant to construct permanent conservation structures on land for which they have no sure title. The situation for arable land is different. Farmers in Wolaita continued with their traditional farming practices such as the planting of perennial trees, application of organic matter on both *Darkua* and *Shoka* fields under the land tenure system that has existed since 1975. In Wello too, farmers designed a mechanism to minimise their loss on soil conservation investment, but did not cease to maintain existing bunds after they realised their effectiveness in minimising soil erosion. However, frequent land redistribution programmes that were carried out in the Amhara region created enough doubt among farmers on the security of their tenure. As indicated earlier, the situation of Konso is different because of a more stable land-tenure system. Scoones and Toulmin (1999:62), on the basis of a comparative study from 12 countries in sub-Saharan Africa, state that '… providing farmers with security over access to land, are rarely mentioned within the documents on which this comparison of case study sites has been based.' Note that one of these case studies is Wolaita.

Much of the literature on land tenure in Ethiopia argues on the basis of an economic assumption without taking into account differences in land use in different parts of the country. Many experts claim that farmers do not invest in soil conservation without secure land tenure (Merid, 1986; Amare, 1977; Dessaglegn, 1994; Zemenfes, 1995; Yigremew, 1999). The history of land tenure before 1975 and after differs in north and the south (Chapter 2). Therefore,

70 Note that land tenure in Ethiopia is characterised by state ownership whereby farmers have usufruct rights.

it is not appropriate to generalise on the impact of land tenure in the entire country. Besides this, it should be noted that land tenure is only one of several variables that affect farmers' land-management decisions (Lapar and Pandey, 1999).

8.7.2 Incentives for SWC

The most common incentive for rural people to adopt the external soil and water conservation practices was food-for-work. However, this programme has been heavily criticised not only in Ethiopia, but also elsewhere in the world (Giger, 1998; Reij, 1998).

In this study, it was found that the shortcoming was not in the scheme *per se*, but in the general patterns of its deployment. The criticism waged against food-for-work here emphasised the farmers' reactions to the introduced SWC methods that included afforestation and area closures without scrutinising the underlying reasons for farmers' negative reactions. The farmers' negative reactions to the SWC structures in the early days were in response to side effects, land competition, change of land use, land insecurity, forced measures and faulty designs (section 6.5.3 and 7.5.3). The community was persuaded to participate through a food-for-work programme without creating the sense of ownership and learning. Instead, the food-for-work campaign conveyed the message that both the land and the bunds belong to the government. Owing to this, farmers commonly stated: 'They gave us food to construct the bunds, let them give us food for maintenance too.' This dependency *syndrome* was implanted because the implementation was carried out on the basis of technical diagnosis of experts, which was not understood by the farmers. The history of their land-management practices and indigenous knowledge were not taken into account.

In spite of all this, I would say that food-for-work has been a blessing in disguise in Ethiopia. Had it not been for food-for-work, the proclaimed soil erosion rates in the study areas and perhaps in the whole country, could have been much higher and the erosion damage more pronounced. Therefore, I would suggest continuing to support local people to undertake land-management practices that ensure land maintenance for future generations. This is, however, not to suggest a reinforcement of past mistakes, but rather to redress it by linking conservation with poverty-reduction strategies within a learning process. I would argue that mere withdrawal without helping farmers to be self-sufficient is not only unwise, but also expensive in terms of resources and social stability of the country, at least in the long run. The state is expected to pursue this policy on behalf of the present and future generations (de Graaff, 1996). In a nutshell, much has changed over the last three decades to think of withdrawing and leaving everything to the market forces. The most important issue to keep in mind, however, is that the practice will only be supported if it is accepted by farmers (Giger, 1998), which can be guaranteed by the incorporation of a farmer learning process into conservation incentives.

8.7.3 The role of local institutions in SWC

Local institutions are the cornerstones of local development whereby they initiate and ensure local dynamics (Hounkonnou, 2001). The way people organise their day-to-day life affects the environment within which they live. This is produced and reproduced in the mode of their local economy that is affected by a mixture of the social network and the formal exchange mechanisms of the market forces. Mazzucato and Niemeijer call this a 'cultural economy'.

This is based on the notion that people apply a mixture of allocative principles emerging from both the local institutions and the external market economy. These principles result from the cultural and historical contexts in which institutions develop (Mazzucato and Niemeijer, 2000).

This study has identified some cultural elements that fit into the cultural economy that affect land-management practices. These are: access to land, crop and livestock sharing, indigenous institutions, and mutual assistance and labour exchange. These elements are outline below.

Access to land

Land has played a crucial role in the institutions of the communities of the three case study areas in different ways (Chapter, 2, 5, 6 & 7). Land could be given away as a gift or borrowed in return for other favours or services to the landowners. In the past, these transactions created social networks that had far-reaching consequences on the way farmers managed land. Availability of land to others helps to maintain the traditional practices of land management such as fallowing, which minimised land mining. In addition, it minimises expansion of farming into unclaimed bush or hillsides, which could have aggravated the land-degradation process at much lower population growth rates. Nowadays, access to land is limited to leasing arrangements that were allowed since 1991. As land becomes scarce, local institutions adjust to this change through crop and livestock sharing arrangements, as discussed below.

Crop and livestock sharing

When either of the major factors of production (land, labour and capital) is in short supply, the society creates ways to adjust to these situations. These adjustments are often overlooked in the rural intervention programmes that often clash with local resource-sharing mechanisms. Sharecropping has become one of the means to augment food production when either land or labour/oxen is in short supply. Shared livestock rearing also takes place when land or capital is in short supply. These sharing arrangements are based on mutual trust and are backed by local rules in case a dispute arises.

Indigenous institutions and mutual assistance

Rural communities still depend on long established mutual assistance organisations. This assistance includes: support during bad and good times, financial grants and borrowing. These organisations are common in all case study areas in spite of differences in nationality, geographic location, language and religion. This assistance essentially provided the rural people with an insurance system. To that extent, these forms of assistance are the pillars of the rural economies. Without such mutual assistance, people could have drained their assets to cover their expenses. This in turn jeopardises land management due to increased migration which removes labour, a lack of traction power, a shortage of manure and the selling of land piece by piece. The role of indigenous institutions transcends day-to-day mutual assistance. They include local governance, which encompasses all functions of society. These functions were shown by the *Xela* in Konso, the *Idiriya* in Wolaita and the *Kire* in Wello (Chapters 5, 6 and 7). In each case, there are mechanisms to reinforce natural resource management and conflict resolution. The power of these institutions has greatly diminished since the establishment of Peasant Associations after the 1975 land reforms. And yet, PAs are very ineffective in ensuring natural resource management, as illustrated in Chapter 7.

Labour Exchange

Labour exchange plays a crucial role in land management. Besides getting the job done, households use labour as a means of transaction to obtain other productive resources (see Semgalawe, 1998; Lapar and Pandey, 1999). In all three cases, there were indigenous labour organisations with or without reciprocal labour exchange, though they are stronger in Konso (Chapters, 5, 6 & 7). The most important issue with respect to labour exchange is the stage and type of land-management practice in the farming system. More specifically, what are the kinds of jobs carried out with available labour? Unlike Konso, where terrace maintenance and construction is in the portfolio of farm operations for which labour is organised, Wolaita and Wello farmers do not organise labour for bund construction and maintenance. In Wolaita, it is desired to bring bund construction into routine farm operations, whereas Wello farmers preferred not to use external labour to undertake such a precise job, but do it by themselves or in a small group of friends.

Labour exchange in Konso has remained stable until recently, when it weakened under the threat of food shortages. Wolaita and Wello have been influenced by the substitution of the ox-plough. As a result, heavy work that involves hand tools has almost been abandoned in Wolaita. Being in the heart of the system where the ox-plough developed, Wello farmers did not enter into widespread heavy work on steep lands using hand tools.

8.7.4 Household's socio-economic characteristics and SWC

A range of household variables is commonly tested to explain farmers' land-management behaviour (Amare, 1988; Bekele, 1998; Zealbowessen, 1998; Ludi, 2002). These include: age of household head, family size, cropland area, livestock owned, labour, access to food, education and risk perception.

One of the critical farmer behaviours with respect to the introduced bunds was the dis-adoption or removal of the bunds after many years. The relationship between socio-economic variables and bund removal was tested using data from Wolaita and Wello. Accordingly, cropland, labour and age were negatively correlated with the percent of bunds removed, whereas livestock ownership and family size were positively correlated. Of these variables, only age and cropland area were significantly related to the removal of bunds (at $p \leq 0.05$). The empirical observation shows that the statistical relationships between percent of bunds removed and cropland, family and livestock size are consistent with the actual farmers' practices. There are some farmers who removed some bunds because the land became too small for their large family size, or because of large numbers of livestock needing a greater production of crop residues instead of putting energy into maintaining more bunds that occupy land. The following paragraphs elaborate on the relevant variables.

Cropland area

As indicated by a fairly strong negative correlation between cropland size and percentage of bunds removed, land availability seems to be the most important factor that guides farmers' decision on their choice of SWC methods (see Cramb, *et al.*, 1999; Semgalawe, 1998; Bekele, 1998; Baidu-Forson, 1999). The average total landholding size in Konso, Wolaita and Wello was 1.2, 0.6 and 1 ha per household, respectively. Shortage of off-farm and non-farm employment is aggravating this problem, causing many families to expect to share land with their children. In Wolaita, families who expect to share land with their sons added to 54% whereas the corresponding figure for Wello was 51%.

Age
Even though age is negatively and significantly correlated to percentage of bunds removed, an overview of descriptive statistics and empirical observation do not show a clear pattern of variation in the SWC practices considered in this study. As shown in section 6.5.3, age of farmers who removed bunds and preserved bunds falls over a wide range. In addition, what is considered in the analysis is household age only. Moreover, it is contrary to the contribution of day-to-day learning of farmers, which improves with age. Of course, there are technologies that are less observable and complex for people under less exposure and who are old (Van den Ban and Hawkins, 1996:101), from which SWC methods are no exception. For instance, farmers cannot see the biophysical and chemical processes that take place in soil erosion and SWC. Their constructs do not go to that level, but develop more or less comparable knowledge from the most observable parts of the phenomena that are very close to their day-to-day experience (see Cramb, *et al.*, 1999; Semgalawe, 1998; Baidu-Forson, 1999).

Labour
The negative correlation of labour availability with percentage of bunds removed does not reflect farmers' practices. What farmers do or do not do is dependent on motivational factors, among others, rather than a mere presence of labour in the household. No amount of labour would make people do what does not motivate them. On the other hand, the scarcities of off-farm employment, relatively low migration rates, and small farm size per family do not suggest the importance of labour in farmers' responses in this regard (see Cramb, *et al*., 1999; Semgalawe, 1998).

Livestock ownership
In this study, livestock ownership affects family income, which has a direct relationship with family food security (see below). With respect to soil and water conservation, livestock provides dung for soil fertility; that is, if use of manure is widespread in the farming system (Eyasu, 1997; Alemayehu, *et al*., 2001). The income from the sale of animal by-products and live animals by and large goes toward the home and other expenses (sections 6.5.2 and 7.5.2) rather than to farm investment. Konso is an exception to these observations. Farmers in Konso invest in labour organisation, which also includes physical soil and water conservation methods rather than the soil and crop management practices alone, as in the cases of Wolaita and Wello. The issue is: do farmers invest in soil and water conservation? If so, how does livestock ownership contribute to that decision? These and similar questions should be answered based on actual on-the-ground situations rather than merely through inferences from relationships from the statistical results.

Access to food
Nowadays, many families are not able to meet their food needs from their own production. Due to this, they depend on external sources of food for a minimum of five months. They get food by working for other farmers in their neighbourhood, earn daily work in nearby towns, sell wood, sell their animals, and occasionally get support from food-for-work and aid programmes. Lack of food for the family directly affects their labour and energy levels to work on their farms. This was shown in the Konso case where shortage of food has threatened the traditional labour organisation that is instrumental to the legacy of maintaining the stone terrace. Thanks to FARM Africa's food provision, many kilometres of terraces were maintained, rural roads and ponds constructed, to mention a few. Indirectly, shortage of food forces farmers to carry out land degrading practices irrespective of their knowledge.

Education

Most of the farmers interviewed were illiterate. For instance, in Wolaita and Wello, those who have attained up to secondary school were 28% and 22% respectively. These farmers either quit school over ten years ago or were recent dropouts. Some of them are dependent on their parents while most of them have their own plots. There was no variation between literacy and illiteracy rates in terms of SWC practices. The farming practice common in the area applies to each, with few variations that are affected by household socio-economic characteristics. The same holds true for the Konso case. However, during group discussions in Konso, it was revealed that educated farmers who have followed farmer-training programmes better understand the functions of nodules in the legumes, for instance.

Risk perceptions

Risk in agriculture emerges from biophysical and socio-economic environments (Ruthenberg, 1985). This study has shown that shortage of rainfall hampers construction and maintenance of terraces as exemplified by the case study in Konso (Chapter 5). In Wolaita, loss of crops due to the side effects associated with soil bunds such as wastage of land, mole-rats and weeds were the main sources of risks. Variation among farmers from different watersheds was reflected in the increased incidence of mole-rats and hindrances to ox-ploughing (Table 6.12a). More interestingly, the risk perception prevails among farmers who did not have a soil bund on their farm, including those from the distant location. Even though the situation was improved later, Wello farmers also reflected similar side effects from the stone bunds. With the exception of Konso where there has been stable land tenure, insecurity of land tenure contributes to farmers' risk perceptions, which alter their land-management practices. This was seen on hillsides that were shifted to agricultural land in both Wolaita and Wello. In these cases, it was widely observed that farmers refrain from investing in durable soil and water conservation structures, apart from annually constructed structures such as diversion ditches. Farmers' risk aversion behaviours, though mistakenly considered to be a resistance to change, are rational in view of what they can perceive (Ruthenberg, 1985:20).

The message of the preceding discussion, related to socio-economic variables, is to draw our attention to the way farmers actually make decisions instead of concluding from the behaviour of the statistical model or the relationships among variables. The most important and practical thing is whether and how two or more variables influence farmers' decisions. This approach would make such studies more thrustworthy for policy actions.

8.7.5 Characteristics of SWC technology

As already illustrated in the preceding sections, farmers' decisions on SWC are affected by several factors. Characteristics of SWC technology also play their role in such decisions, which merit attention in intervention. The typical characteristics of technology are observability, complexity, divisibility, compatibility and relative advantages (Rogers; 1983, 1995).

Observability and complexity

Observability and complexity of a practice hinder or enhance farmers' ability to understand the practice and its process of implementation, and more importantly its end results. That is, when farmers cannot understand the essence of the practice, either due to complexity or lower observability, they cannot visualise its outcomes. In this respect, farmers in Wolaita and Wello, unlike their counterparts in Konso, did not understand the watershed management design. This is partly due to poor farmer participation, resulting from the focus of the SCRP on technical data collection, which neglected the crucial socio-economic diversities. Thus, farmers were not able to understand the process and how it would affect their plots and ultimately their livelihood. Farmers' risk perception as discussed earlier partly stems from the fact that the practices did not allow farmers to assess their fates adequately.

Divisibility

Divisibility is a characteristic that is considered with respect to factors of production; that is, the tools and other physical inputs and labour. With respect to SWC, divisibility commonly affects labour organisation. In Wolaita, the disappearance of labour co-operation for heavy farm operations has limited the construction of diversion ditches, which is an accepted practice. The same holds true for watershed-level conservation activities, in addition to other factors, e.g., land tenure. Apart from other limiting factors, the running cost of Wello's irrigation pump and the maintenance of an irrigation channel that covers 27 ha of land raise the divisibility issue.

Compatibility

Compatibility of a practice to the existing farming system is essential to its acceptance. Looking at the technologies or practices that were introduced into Wolaita and Wello, the earlier or continued resistance by farmers was due to a lack of an ex-ante assessment of the introduced practices. Soil/stone bunds in Wolaita and Wello were not compatible with the ox-plough. This led farmers to modify it to fit their farming practices.

In Wello, pigeon pea and vetch were destroyed because of ox-ploughing and livestock grazing during the dry period. Introduced grass species attracted rats and were therefore abandoned by farmers. Animal grazing also destroyed forage species planted in the area closure. In addition, its incompatibility with the existing land-use system and to the shortage of land and insecure land tenure contributed to its failure. Furthermore, irrigated agriculture in Wello failed partly because of the lack of social factors (religious institutions and convictions) and partly because of land tenure and shortage of land.

Relative advantages

Any decision taken by farmers is weighed against their evaluative frames of reference, which indicates the relative advantage of a given practice. Soil and stone bunds were compared with the existing soil fertility maintenance practices and faced rejection both in Wolaita and Wello, though the situation has gradually changed in the latter case because of farmer adaptation. Bunds waste land, they require labour to construct and maintain them, they have side effects such as weed and rat infestations which increase the risk of crop loss. Such is farmers' economics, which is oftentimes neglected by outsiders. Note that this is closely linked to the socio-economic variables, as discussed earlier under household characteristics.

8.7.6 Physical factors

Physical factors are well established in the soil-erosion process and for SWC, serving as a foundation for the technical options. In what follows, physical characteristics that played an important role in shaping farmers' SWC decisions are outlined below.

Topography
This study indicates that farmers take SWC practices more seriously when they are farming on steep land. Farmers in Konso started a unique SWC system because their landscape is dominated by steep slopes. Farmers in Wello began to take erosion seriously with their movement up the slope that also affected the situation downstream. As indicated earlier, such is not the case among farmers in Wolaita even though some of them farm on steeper lands than others (soil depth, organic matters).

Rainfall
Konso is the area of low rainfall (551mm), whereas Wolaita (1,314 mm) and Wello (1,211mm) are high rainfall regions. In all cases, however, the erratic nature of rainfall affects the farmers' production systems by reducing yields of both crops and livestock to the extent of complete failure of crop production, not only for a season, but also for consecutive years, such as in the case of Konso. In the latter case, however, moisture conservation takes precedence over erosion, even though erosion increases with slope gradients. Erosive rainfall of course alerts farmers to take on conservation measures.

Soil factors
Soil is the medium that is the foundation of all of the factors discussed above. Ultimately, it is what matters to the farmers most. Its depth affects farmers' SWC both negatively (Wolaita) and positively (Wello and Konso). Deep soil in Wolaita conceals the level of erosion. Thanks to the unseen biophysical and chemical processes, farmers continue to complain about soil fertility, though they tend to give more weight to shortage of rainfall for declining yield. In Wello, while the rainfall perception is the same to that of farmers in Wolaita, shallow soil depth brings erosion into greater focus than in Wolaita. In Konso, soil and water are taken very seriously due to the climatic and physical factors.

Summing up: determinants of soil and water conservation
This section summarises determinants of SWC based on the discussions in the preceding sections. This study found out that SWC can be affected by the following factors (Table 8.2):

Among variables discussed in section 8.7, the determinants of SWC in the case study areas are land size, livestock ownership, family size, risk perception, land tenure on non-arable lands, labour organisation, characteristics of technology, indigenous institutions and physical factors (see also Table 8.2).

This shows that farmers' soil and water conservation are affected by the interplay of social, economic, institutional and technical factors. Even though some factors are more important than others under a given situation, attention should be given to all of them in order to *understand* what farmers do in soil and water conservation.

Table 8.2: Summary of determinants of SWC in Konso, Wolaita and Wello, Ethiopia

Relevant variables	*Practices*
Macro-institutional variables	
Land tenure	1
Incentives	2
Extension services	1
Micro-institutional variables	
Access to land	3
Crop and livestock sharing	3
Indigenous institutions	3
Labour organisation	2
Household characteristics	
Knowledge and attitude	1
Family size	3
Land size	3
Livestock ownership	3
Risk perception	3
Characteristics of technology	
Observability and complexity	2
Divisibility	2
Compatibility	3
Relative advantage	3
Physical factors	
Topography	3
Rainfall	3
Soil factors	3

[*] This summary is based on a scale of 1-3, where 1=low, 2=medium and 3=high. The score was given by the researcher himself based on the discussion in the relevant sections of this chapter.

8.8 Research question 5: how can constraints to promote soil and water conservation be overcome?

In the earlier parts of this chapter, we discussed farmers' responses to interventions, their knowledge and attitudes on soil erosion and SWC in relation to their practices. Then we presented an overview of determinants of farmers' soil and water conservation practices. Now we come to suggestions for improvement and future research. The discussion on these issues starts with two key points that have been reiterated throughout the study. These are the outsiders' views on technological options to soil and water conservation; i.e., biological vs physical conservation and indigenous vs formal knowledge.

8.8.1 Biological vs physical conservation

Large-scale SWC projects implemented in Africa since colonial times end in failure (Scoones, *et al.,* 1996). The dominant conservation methods promoted in these projects regarded physical conservation. Owing to this, scholars nowadays discriminate against physical conservation measures in favour of biological measures (Young, 1997:55-56; Hudson, 1993; Stocking and Abel, 1992). The most commonly mentioned reason is the cost related to the initial construction and periodic maintenance. As shown in the cases of Konso and Wello, the issue was not that of cost or labour, but farmers' motivation to keep up with the practices. Once they perceive and understand the benefits of the practice to their livelihoods, they will undertake it irrespective of the technical cost-benefit analysis.

Even though one measure dominates the others, farmers in Ethiopia practise a combination of both physical and biological practices. The proportion of biological and physical conservation methods was altered over time, due to changing internal and external situations. Therefore, these practices do not displace each other (Herweg, 1993; Yohannes, 1999: 57; Ludi, 2002:237). However, an intervention can focus on one of the measures depending on the comparative advantages in the farming system. In Wolaita, farmers are reluctant to practise physical conservation measures due to soil depth and their soil fertility practices. Therefore, they tend to focus on biological conservation measures. In Wello, biological conservation is very difficult if not impossible, under the existing farming system. This issue is what was neglected by the SCRP when it initiated biological conservation practices at Maybar, Wello, leading to its dismal failure (7.5.3). At the moment, the emphasis is on physical conservation, but the research and extension system should do its best to provide farmers with a basket of choices for conservation that fits their resources and household objectives. Such a basket of choices can at best be developed through participatory on-farm research in addition to incentives for changing the cropping system, rather than pushing what outsiders see as appropriate.

8.8.2 Indigenous vs formal knowledge

Nowadays, there is widespread appreciation for the integration of indigenous and formal knowledge. The issue is: at what stage is an external intervention appropriate? While there is no blueprint as to the right time and place for an intervention, it can be said that an external practice would be appropriate only when farmers fail to solve their problems. This means that farmers themselves should be able to perceive their problem, not the outsiders. This dilemma can be overcome by changing an age-old dichotomy between the technology system (research, extension and farmers). This can best be done through joint learning arrangements where all these parties are involved under one umbrella. The soil fertility status of farms in Wolaita was studied (Eyassu, 1997) which showed agreement with farmers' observations. Such analysis should have been an ideal basis for a participatory action-learning process with farmers by introducing practices that improve soil fertility, taking the original level as a yardstick. Should the outsiders have a new idea or practice, they should face the challenge of making farmers understand it first before pushing the practice on them. This is one of the major shortcomings of soil and water conservation in Ethiopia (Belay, 1998; Yohannes, 1999).

The next section of this chapter elaborates on the key issues indicated above by spelling out the policy options related to land management.

8.8.3 Policy implications of the study

On farmers' participation

Many of the shortcomings in the food-for-work projects, including the SCRP, were due to the low level of local people's participation in the design, implementation and evaluation of the projects. A similar project culture has continued in the country where the present Extension Intervention Programme is no exception. Farmers who are not using fertilisers are pushed into participating in the project rather than motivated to do so. This problem occurs partly because of excess quotas enforced on the development agents. When these agents are short of farmers to willingly participate in their demonstrations, they use the power of the PAs to involve them in the demonstration. The development agents and their supervisors should learn to take low participation as a challenge to be met through educational processes rather than using the power at their disposal to effect what they need. This is however not to state that this is the case everywhere. There are regions where farmers hardly grow certain crops without fertilisers because of an 'addiction' of the soil to them stemming from the 1970s.

Accountability of projects

Ethiopia and its farmers have seen dozens of projects since the 1960s. The general trend has been that activities flourish during the lifetime of the project when staff morale is at its peak and running costs are available. However, a few years after the project closes, the situation is almost back to square one. The organisational history of the SCRP confirms this gap in the country. Both the Ministry of Agriculture and the research organisations did not challenge the project to be integrated with its national counterparts, which later proved to be disadvantageous for the project.

It appears that the country has learned little to date to change this situation. The national counterpart organisations are not strong enough to ensure accountability of projects. Research and extension organisations hardly act beyond their traditional operations. The regional and zonal offices are tied to the routine targets. The administration that has all the power either lacks vision for development, or when it does have vision, it drives genuine development activities beyond the limits to achieve its political goal. This was seen in the co-operative era of the socialist government and it continues today by the democratic government in its 'package' approach.

Diversification of production and income

The results of this study show that the resource base in the study areas is deteriorating to provide an adequate livelihood for rural people who mainly depend on agricultural production.

Notwithstanding relentless efforts by Ethiopian farmers to make ends meet, agricultural intensification as advocated by Boserup (1965) and her associates is unlikely under the present Ethiopian conditions, unless a 'threshold' of the theory requires much more human tragedy to trigger intensification. In this regard, it is worthwhile to note small land size, widespread soil erosion, removal of organic matter, poor use of inorganic fertilisers, high fertiliser price, vertical expansion of agricultural lands, forest degradation, overgrazing, shortening and absence of fallow, poor use or absence of irrigation systems, poor access to a wider credit portfolio and a poor marketing infrastructure, all of which contribute to worsening food insecurity of the farming communities.

Owing to the settlement pattern and the terrain, agriculture in some areas seems unlikely to improve to the extent that it can provide an adequate livelihood for rural people under any amount of feasible intensification in the Ethiopian highlands in the foreseeable future. The main problems in this regard are small farm size and fragility. The latter is caused by the continuous cultivation of the same plots without fallowing.

Therefore, there is a dire need for policy-led intervention to diversify the livelihoods of rural people within and outside agriculture, including valley development schemes. These involve, in the short run, the provision of credit to initiate off-farm and non-farm employment, skills training for non-farm employment, development of infrastructure and support to farm production through diversification between and within crop, livestock and forest products. The state should create incentives and conditions that encourage decreasing the population of the rural people in the long run. These include: improving the quality of education, family planning and a broad-based economic development that can increase employment in non-agricultural sectors.

Intensification of crop and livestock production

Agricultural development in Ethiopia during the last three decades focused on external inputs mainly improved seed and fertilisers [71]. Apart from isolated efforts of ill-conceived SWC practices, conservation-based agriculture in the country is more colourful in the national study papers than in practice [72].

Thanks to the diversity in farming systems and variation in the level of prior intensification, some areas still have adequate room for further intensification. Feasible technological changes under the Ethiopian conditions are those that save land and use more labour. These include irrigation, high-yielding varieties, fertilisers, pesticides and soil and water conservation methods.

Since the mid-1990s, the government has been vigorously promoting an extension service to farmers. The shortcoming of this intervention is its focus on seed and fertiliser packages through credit schemes paying lip-service to conservation-based agriculture. What is more, the programme is implemented in the entire country without due consideration of agro-ecological, socio-economic and institutional variations.

Hence, reorienting the agricultural development approach towards intensification through conservation-based agriculture is highly desirable. More specifically, it is worthwhile to shift from the soil and water conservation perspective, to a land-husbandry approach that fits the farmers' understanding, such that conservation measures are seen as an input. In this shift, however, the integration of physical and biological conservation measures should be maintained for a higher success rate (see Section 8.8.1 on this discussion).

Improvements in training of extension agents

Curricula of the higher learning institutions in the country hardly include indigenous knowledge. Therefore, the extension agents have negative attitudes towards rural life and traditional farming methods. They are trained to promote what is seen as modern agriculture, which focuses on the use of external inputs and practices that are 'packaged' by the research/extension system. Due to this, they do not pay attention to rural knowledge, coping mechanisms of farmers, and to learn with them and adapt the outside technology. Extension agents should understand that farmers do what they do out of their own will and understanding. Moreover, the agents and their supervisors should understand the variability among farming communities that will lead to a differential response to intervention. Therefore, the

71 Note the Minimum Package approaches that started in 1971, the Peasant Agricultural Development Project that followed it in 1986 using the Training and Visit System and the New Extension Intervention that replaced the T&V in 1993/94, which is operational to date.

72 These include the Ethiopian Highland Reclamation Study (1985), the Ethiopian Forestry Action Plan (1994) and the National Conservation Strategy (1997).

training institutions should change their approach of training the extension agents so that they understand farmers' logic in land management.

Building on local institutions
Because of bias against indigenous knowledge and institutions, the extension system of the country has not involved local institutions in development initiatives. Instead, it has discredited them and then negated their role in the community by replacing them with formal institutions. In order to increase the chances of success, this trend should be changed to revitalise locally developed institutions. These should be involved in the overall community development programmes.

On incentives
Undertaking soil and water conservation practices entails foregoing some resources for the sake of future benefits. Owing to their poor socio-economic status, most Ethiopian farmers are not in a position to do so. Therefore, some form of incentive is required to support them to undertake relevant SWC practices on their farms and in watersheds until they begin to reap the benefits from the new practices.

This study argues that the past food-for-work programme was the right instrument but was wrongly deployed. However, incentives for rural people should not be limited to food. Alternatives include: cash, tools, seed, seedlings, infrastructure, and other materials and services that the community favours. It would be more effective if incentives targeted socio-economic variations observed in the community such as land and family size.

The most important instrument is, however, the dialogue and discussions with rural people on resource management, rather than the specific material or service offered *per se*, which is lacking. Therefore, there is an urgent need to integrate incentives and learning processes into introducing conservation initiatives.

On land tenure
It was observed that land tenure was not a strong determinant to soil and water conservation in the study areas, particularly on the arable lands. However, all farmers are aware of the government's power over land. It would therefore be worthwhile to provide further security of tenure to remove any doubt in the minds of the public, particularly regarding redistribution of cropland and on utilisation and management of non-arable land (forested and grazing). Generally, such a policy would be effective if accompanied by a sound land-use policy that takes into account the existing farmers' situations.

8.9 Issues for further research

8.9.1 Action research into a Maybar irrigation system

One of the intriguing encounters in this study was the resistance of the Maybar farmers to irrigation in spite of many good reasons to take advantage of the lake and the external facilities. This study and others (Ludi, 2002) have suggested plausible reasons as to why the farmers were not motivated to co-operate in an irrigation programme. The ideal test of these findings is to go back to the community and enter into a dialogue with it and facilitate a re-initiation of irrigated agriculture through action research.

8.9.2 Testing the status of soil fertility

Even though soil fertility is an important aspect of this study, testing the status of soil fertility under different SWC practices was beyond the scope of this research. In order to understand farmers better and also to clarify the technical matters with them, a participatory soil fertility study whereby farmers' knowledge and perceptions are integrated needs to be carried out to discuss suitable conservation measures with farmers. For instance, the plots in the homestead areas might have an excess stock of some nutrients while having very low levels in others. In such a case, assessing the SWC practices and examining soil fertility under different practices would make things very clear for all partners.

8.9.3 Replication of the Konso study in Ankober

Excluding the terraced fields of the Axumite Kingdom (100BC –1000AD) that have long disintegrated, Ankober, located in the Amhara Regional State is another important area next to Konso where an indigenous terrace-based farming system has developed in Ethiopia.

After undertaking the study in Konso, I intended to include Ankober for an indigenous system in the northern setting to compare to that of Wello which falls in the same geo-political and farming systems. Unfortunately, I could not extend my study to Ankober due to logistical problems.

In his seminal book, 'People of the Plow ... (1800-1990)', James McCann (1995) states that 'the presence of terracing as a dominant element of Ankober agriculture in 1840 indicates a highland population density sufficient to generate the needs for new arable land and sufficient labour to build and maintain the terraces.' On the other hand, he quotes a traveller who suggested low population pressure with vast area still remaining under pasture. The focus of the book is on the general agrarian history without specifically going into the historical reasons that led the 19th century Ankober people into terracing. The reasons behind the existence of terraces in Ankober is said to be the climatic restrictions, which stimulated the building of the terraces. The terraces facilitated the production of mid-altitude crops like teff, wheat and pulses that were restricted by climatic factors such as frost and flooding in the upper plateau.

Therefore, an understanding of the emergence of terrace-based agriculture in the 19th century ox-plough Ankober requires further study on the organisation of labour, local institutions, the impact of mixed land tenure that existed during that period, its influence on the neighbouring areas, its present status and prospects.

8.9.4 Farmers' motivation in mass mobilisation for SWC

After use of the food-for-work programme for SWC was abolished in the Tigray and Amhara Regions, the main source of labour has become community mobilisation organised at the village and sub-village levels. In this practice, every able community member has to provide 20 days of free labour for the community every year.

Farmers in my case study area in Wello have clearly indicated that they were not interested in mobilising labour for terrace construction and maintenance. However, this view was not tested in other Peasant Associations. Therefore, it is worthwhile to carry out a large-scale study in different regions to avoid the mistakes of the former food-for-work programme in which the government and technicians assumed that farmers would simply accept their 'orders'. The arguments of this study are to first understand farmers' rationales before pushing a practice on their farm.

8.9.5 Periodic production and consumption study

As highlighted in Chapter 3, there is a technical gap in measuring land degradation and the contribution of SWC to production. Due to this, the farmers' view on soil erosion, soil fertility and production is often doubted and associated with a dependency syndrome. While refinement in the techniques of land degradation measurement continues, it is worthwhile to carry out periodic studies on production and consumption, which is a less difficult factor for comparison than land degradation. Such studies would be useful for policy-makers, in providing a better picture of the farmers' views on land productivity than what the national statistical survey might provide.

8.9.6 Comparative study of gender factors in SWC

This study dealt with the farmers in general without targeting the impact of gender differences in soil and water conservation. The few female-headed households who turned up in the random samples were not sufficient to be treated as a stratum. Therefore, a study with a gender focus would help to understand the specific problems and perspectives of female-headed households regarding land management, and more specifically, soil and water conservation.

References[73]

Ajzen, I. (1988). Attitudes, Personality and Behaviour. Open University Press, Milton Keynes.

Ajzen, I. and Fishbein, M. (1980). Understanding Attitudes and Predicting Social Behaviour. Englewood-Cliffs, Prentice-Hall. New Jersey.

Alemayehu Konde, Data Dea, Ejigu Jonfa, Fannel Folla, Scoones, Ian, Kelsa Kena, Tesfaye Berhanu and Worku Tessema (2001). Creating Gardens: The Dynamics of Soil Fertility Management in Wolaita, Southern Ethiopia. In: Scoones, I. (ed). Dynamics and Diversity: Soil Fertility and Farming Livelihoods in Africa. Earthscan Publishing Ltd., London.

Alemneh Dejene (1990). Environment, Famine and Politics in Ethiopia: A view from the Village. Lynne Rienner Publishers, Colorado and London.

Amare Gebreegziabhher (1988). Socio-economic and Ecological Analysis of Soil Conservation in Ethiopia. Cases from Gunno Twin Catchments. A Thesis submitted in Partial Fulfilment of the Requirement for the Degree of Master of Science (Management of Natural Resources and Sustainable Agriculture). NORAGRIC: Norwegian Centre for International Agricultural Development, Agricultural University of Norway.

Amare Getahun (1977). Raising The Productivity of Peasant Agriculture in Ethiopia. AAASA Journal IV(1): 27-40.

Ambron, H. (1984). History of Events and Internal Development: The Example of the Burji-Konso Cluster. In: Taddesse Bayene (ed.), Proceedings of the Eighth International Conference of Ethiopian Studies in Addis Ababa. Institute of Ethiopian Studies. Addis Ababa.

ANRS (2000). Proclamation No.46/2000: Proclamation issued to determine the administration and use of the rural land in the Amhara Nation Region. Zikre Hig, ANRS Bahir Dar.

Aster Akalu (1982). The Process of Land Nationalization in Ethiopia: Land Nationalization and The Peasants. CWK, Gleerup.

Baidu-Forson, J. (1999). Factors Influencing Adoption of Land Enhancing Technology in the Sahel: Lessons from a case study in Niger. Agricultural Economics 20(3): 231-239.

Barels, Gerard (2002). Behavioural Modifications as a Transaction between Individual, Behaviour and the Environment. In: Bartels, Gerard and Wil Nelissen (eds), Marketing for Sustainability: Towards Transactional Policy-making. IOS Press, Amsterdam, The Netherlands.

Beedell, J. and Tahir Rehman (2000). Using Social-psychology Models to Understand Farmers' Conservation Behaviour. Journal of Rural Studies 16:117-127.

Bekele Shiferaw (1998). Peasant Agriculture and Sustainable Land Use in Ethiopia: Economic Analysis of Constraints and Incentives for Soil Conservation. Published PhD Thesis. Dissertation no. 1998:1. Agricultural University of Norway.

Bekele-Tesema, A. (1997). A Participatory Agroforestry Approach for Soil and Water Conservation in Ethiopia. PhD. Dissertation, Wageningen Agricultural University, Wageningen, The Netherlands.

Belay T. (1992). Farmers' Perception of Erosion Hazards and Attitudes towards Soil Conservation in Gunno, Wolaita, Southern Ethiopia. Ethiopian Journal of Development Research 14(2): 31-58.

Belay Tegene (1998). Potential and Limitations of an Indigenous Structural Soil Conservation Technology of Wello, Ethiopia. EASSRR XIV(1): 1-18.

Berhe Wolde-Aregay (1996). Twenty Years of Soil Conservation in Ethiopia: A Personal

73 Note that Ethiopian authors are referred to with their first names in the text and written without commas in this section.

Overview. Regional Soil Conservation Unit/SIDA. Nairobi, Kenya.

Biot, Y., Blaikie, P.M., Jackson, C. and Palmer-Jones (1995). Rethinking Research on Land Degradation in Developing Countries. World Bank Discussion Paper No. 289, World Bank, Washington, D.C.

Bojö, J. and Cassels, D. (1995). Land Degradation and Rehabilitation in Ethiopia: A reassessment. AFTES Working Paper No. 17. World Bank, Washington, D.C.

Boserup, Ester (1965). The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. George Allen & Unwin LTD, London.

Brouwers, J.H.A.M. (1993). Rural People's Response to Soil Fertility Decline: The Adja Case (Benin). Published PhD Dissertation, Wageningen Agricultural University.

Bureau of Agriculture (2000). Office Record. Southern Nations, Nationalities and People's Region (SNNAP) (unpublished).

Centre for Development and Environment (CDE) (1997). A Memo: Statement of WB Members Regarding Soil Degradation in Ethiopia. University of Berne.

Cerulli, E. (1956). Peoples of Southeast Ethiopia and Its Borderland. North-Eastern Africa, Part III. Ethnographic Survey of Africa. International African Institute, London.

Chambers, R. and Jiggins, J. (1987). Agricultural Research for Resource-Poor Farmers. Part I. Transfer of Technology and Farming Systems Research. Agricultural Administration and Extension 27:35-52.

Checkland, P. (1985). From Optimising to Learning: A development of systems thinking for the 1990's. Journal of Operational Research Society 36(9): 757-767.

Checkland, P. (1989). Soft Systems Methodology. Human Systems Management 8, 273-289. IOS B.V.

Checkland, P. And Scholes, J. (1990). Soft Systems Methodology in Action. John Wiley & Sons, Chichester, New York, Brisbane, Toronto and Singapore.

Cohen, J.C. and Weintraub, Dov (1975). Land and Peasants in Imperial Ethiopia: The Social Background to a Revolution. Van Gorcum & Comp. B.V., Assen, The Netherlands.

Collinson, M. and Lightfoot, C. (2000). The Future of Farming Systems Research. In: M. Collinson (ed.), A History of Farming Systems Research. FAO, and CABI Publishing, Biddles Ltd, Guildford, UK.

Constable, M. (1985). Ethiopian Highlands Reclamation Study (Summary). Land Use Planning and Regulatory Department, Ministry of Agriculture and FAO. UTF.ETH.037/ETH. Working Paper 24. Land Use Planning and Regulatory Department, Ministry of Agriculture, Addis Ababa.

Conway, D. (2000). Some Aspects of Climate Variability in the North East Ethiopian Highlands-Wello and Tigray. SINET: Ethiopian Journal of Science. 23(2):139-161.

Crabtree, B.F and Miller, W.L. (1992). Primary Care Research: A Multi-method Typology and Qualitative Road Map. In: Crabtree, B.F. and Miller, W.L (eds). Doing Qualitative Research: Research Methods for Primary Care. Volume 3. Sage Publications. Newbury Park, London and New Delhi.

Cramb, R.A., J.N.M. Garcia, R.V. Gerrits and G.C. Saguiguit (1999). Smallholder Adoption of Soil Conservation Technologies: Evidence from Upland Projects in The Philippines. Land Degradation & Development 10: 405-423.

Critchley, W.R.S. (2000). Groundtruthing: New perspectives on soil erosion and conservation in the tropics. Ph.D Thesis. Vrije University of Amesterdam, The Netherlands.

CSA (1996). The 1994 Population and Housing Census of Ethiopia. Vol. I: Part I. Statistical report on population size and characteristics. Federal Democratic Republic of Ethiopia. Office of Population and Housing Census Commission, Addis Ababa.

CSA (1998). The 1994 Population and Housing Census of Ethiopia: Results at Country Level. Vol. I. Central Statistical Authority (CSA), Addis Ababa.

Dagnew Eshete (1995). Seasonal and Exceptional Food Shortages, Their Causes and Socio-Economic Consequences: A Case Study of Wolaita District in Southern Ethiopia. A Paper Presented on Inaugural and First Annual Conference of the Agricultural Economics Society of Ethiopia; 8-9 June, 1995, Addis Ababa, Ethiopia.

Data Dea (1998). Soil Fertility Management in its Social Context: A study of local perception and practices in Wolaita Southern Ethiopia. Managing Africa's Soils No.1. Farm Africa. Russell Press, Nottingham.

De Graaf, Jan (1996). The Price of Soil Erosion: An economic evaluation of soil conservation and watershed development. Tropical Resource Management Papers No. 14. Wageningen Agricultural University, Department of Irrigation and Soil and Water Conservation, Wageningen, The Netherlands.

Dejene Aredo (1999). Property Rights: Theory and illustration with response to land tenure in Ethiopia. In: Taye Assefa (ed.), Food Security Through Sustainable Land Use: Policy on Institution, Land Tenure, and Extension Issues in Ethiopia. NOVIB Partners Forum. Addis Ababa.

Dessalegn Rahmato (1984). Agrarian Reform in Ethiopia. Scandinavian Institute of African Studies, Uppsala, Sweden.

Dessaglegn Rahmato (1990). Co-operatives, State Farms and Smallholder Production. In: Pausewang, S, Cheru Fantu, S. Brune, S. and Chole Eshetu (eds). Ethiopia: Rural Development Options. Zed Books Ltd, London and New Jersey.

Dessalegn Rahmato. (1994). Land Tenure and Land Policy in Ethiopia after the *Derg*: Proceedings of the Second Workshop of the Land Tenure Project. Representralen AVH. Trondheim, Norway.

Dessalegn Rahmato (1994). Policy Issues: Land Policy in Ethiopia at the Cross-roads. In: Dessalegn, Rahmato (ed). Land Tenure and Land Policy After the *Derg*: Proceedings of the Second Workshop of the Land Tenure Project. Representralen AVH, Trondheim, Norway,

Dessalgen Rahmato (1998). Littering the Landscape: Environment and Environmental Policy in Wollo (Northeast Ethiopia). Paper Prepared for the International Symposium on African Savannas: New Perspectives on Environmental and Social Change held at the University of Illinois, Urbana-Champaign.

EARO (2000a). Soils and Water Research Programme Strategic Plan. Ethiopia Agricultural Research Organisation (EARO), Soil and Water Research Directorate. Addis Ababa.

EARO (2000b). Research-Extension-Farmer Linkages Strategy. Ethiopian Agricultural Research Organisation, Research-Extension-Farmer Linkages Department. Addis Ababa.

EFAP (1994). Synopsis Report. Ethiopian Forestry Action Plan (EFAP) Secretariat, Addis Ababa.

EFAP (1994). The Challenge of Development. Vol. II. Ethiopian Forestry Action Plan Secretariat, Addis Ababa.

Eggertsson, T. (1990). Economic Behaviour and Institutions. Cambridge University Press, Cambridge.

Engel, Paul G.H. (1997). The Social Organization of Innovation: A focus on stakeholder interaction. KIT, Amsterdam.

Escobar, A. (1995). Encountering Development: The making and unmaking of the Third World. Princeton University Press, Princeton, New Jersey.

Eswaran, H., R. Lal and P.F. Reich (2001). Land Degradation: An overview. In. Bridges, E. Michael; Ian D. Hannam; L. Roel, Oldeman; Frits W.T. Penning, de Vries; Sara J., Scherr and Samran, Sombatpanit (eds) with assistance from Robin, N. Leslie, Tanadol, Compo and Apuntree, Prueksapog. Response to Land Degradation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi and Calcutta.

Ethiopia (1992). National Report on Environment and Development: A report prepared for the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. Transitional Government of Ethiopia Addis Ababa, Ethiopia.

Ethiopia (1995). Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia. Proclamation No.1/1995. Addis Ababa.

Ethiopian Evangelical Church Mekane Yesus Clinic (nd). Children's Nutritional Status in Konso (unpublished).

Eyasu, Elias (1997). Soil Fertility Declines and Coping Strategies: the case of Kindo Koisha, Southern Ethiopia. Ph.D Thesis University of East Anglia, Norwich, UK.

Eyasu Elias (1998). Is Soil Fertility Declining? Perspectives on Environmental Change in Southern Ethiopia. Managing Africa's Soils No.2. Farm Africa. IIED, London.

Eyasu Elias (2000). Soil Enrichment and Depletion in Southern Ethiopia. In: Hilhorst, T. and Muchena, F. (eds), Nutrients on the move: Soil fertility dynamics in African Farming Systems. International Institute for Environment and Development, London.

Eyob Belete (2002). Consultancy Report on Socio-economic Survey of Eleven Peasant Associations in Konso, Special *Wereda* (Draft Report). UMC-Baseline Survey, FARM Africa Konso Project (unpublished).

FARM Africa (2001). Capacity Building Project in Konso: Emergency Response Programme (Employment Generation). Terminal Report. Farm Africa, Konso

Farrington, J. (2000). The Development of Diagnostic Methods in FSR. In: M. Collinson (ed.), A History of Farming Systems Research. FAO, and CABI Publishing, Biddles Ltd, Guildford, UK.

FDRE (1997a). The Conservation Strategy of Ethiopia. The Resources Base, its Utilization and Planning for Sustainability. Volume I. Environmental Protection Authority in Collaboration with the Ministry of Economic Development and Co-operation, Addis Ababa.

FDRE (1997b). Ethiopian Agricultural Research Organisation Proclamation. Federal Negarit Gazeta. No.42. Addis Ababa.

Feder, G. and Feeny, D. (1991). Land Tenure and Property Rights: Theory and Implications for Development Policy. The World Bank Economic Review 5(1): 135-153.

Ferguson, J. (1990). The Anti-politics Machine: 'Development', Depoliticisation and Bureaucratic Power in Lesotho. Cambridge University Press, Cambridge.

Gebre-wold Ingida-worq (1962). Ethiopia's Traditional System of Land Tenure and Taxation. Translated by Mengesha Gessesse from the book 'Ya Ityopya Maretna Gibir Sim' Ethiopian Observer. V (4):302-339.

Giger, M. (1998). Using Incentives and Subsidies for Sustainable Management of Agricultural Soils: A challenge for projects and policy-makers. In: Blume, H., H. Eger, E. Fleischhauer, A. Hebel, C. Reij and K.G. Steiner (eds), Towards Sustainable Land Use: Furthering co-operation between people and institutions. Advances in Geoecology 31, Volume II. ISSS CATENA VERLAG GMBH, Reiskirchen, Germany.

Gold, John R. (1980). An introduction to Behavioural Geography. Oxford University Press, New York, London, Glasgow.

Goldstein, H. (1981). Social Learning and Change: A Cognitive Approach to Human Services. Tavistock Publications, New York and London.

Gonzalez, R.M. (2000). Platforms and Terraces: Bridging participation and GIS in Joint-learning for watershed management with the Ifugaos of the Philippines. Published PhD Thesis. Wageningen University and Research Centre, Wageningen, The Netherlands.

Grillo, R.D. and Stirrat, R.L. (eds) (1997). Discourses of Development: Anthropological perspec-

tives. BERG, Oxford and New York.
Guba, E.G. and Lincon, Y.S. (1989). Fourth Generation Evaluation. Sage Publications, Newbury, London and New Delhi.
Gunten, von Anna-Barbara (1993). Soil Erosion Processes in a Twin Catchment Set-up in Gunno Area, Ethiopia. Soil Conservation Research Project. Report 23. Ministry of Agriculture, Ethiopia; University of Berne, Switzerland in association with The United Nations University, Tokyo. Switzerland
Hallpike, C.R. (1972). The Konso of Ethiopia: A Study of the Values of a Cushitic People. Oxford University Press, London.
Hardin, G.(1968). The Tragedy of the Commons. Science 162:1243-48.
Hayami, Y. and Ruttan, V.W. (1985). Agricultural Development: An international perspective. Revised and Expanded Edition. Johns Hopkins University Press, Baltimore and London.
Herweg, K. (1993). Problems of Acceptance and Adaptation of Soil Conservation in Ethiopia. In: Baum, E., Peter Wolff and Micheal A. Zöbisch (eds), Acceptance of Soil and Water Conservation: Strategies and Technologies. Volume 3. Tropics in Applied Resources Management in the Tropics. The German Institute for Tropical and Subtropical Agriculture, Witzenhausen, Federal Republic of Germany.
Hoben, Allan (1996). The Cultural Construction of Environmental Policy: Paradigms & politics in Ethiopia. In: Leach, M. and Mearns, R. (eds), The Lie of the Land: Challenging received wisdom on the African environment. African Issues. The International African Institute, London.
Hounkonnou, D. (2001). Listen to the Cradle: Building from local dynamics for Africa renaissance. Case studies from rural areas of Benin, Burkina Faso and Ghana. PhD Thesis. Wageningen University and Research Centre, Wageningen, The Netherlands.
Hudson, N.W. (1993). Soil and Water Management for the Nineties: New pressure, new objectives. In: Hudson, Norman and Cheatle, Rodney (eds), Working with Farmers for Better Land Husbandry. Intermediate Technology Publications in association with World Association of Soil and Water Conservation, London.
Huntingford, G.W.B. (1955). The Galla (sic) of Ethiopia, The Kingdoms of Kafa and Janjero. Ethnographic Survey of Africa. International Africa Institute, London.
Hurni, H. (1988). Options for Conservation of Steep Lands in Subsistence Agriculture Systems. In: Moldenhauer, W.C. and Hudson, W. (eds), Conservation Farming on Steep Lands. Soil and Water Conservation Society, Ankeny.
Hurni, H. (1993). Land Degradation, Famine and Resource Scenarios in Ethiopia. In: Pimental, D. (ed.), World Soil Erosion and Conservation. Cambridge University Press, Cambridge.
Hurni, H. (1994). Methodological Evolution of Soil Conservation Research in Ethiopia. IDRC Currents 9 (June): 17-21. Swedish University of Agricultural Sciences, Uppsala.
Hurtubise, R. (1984). Managing Information Systems: Concepts and Tools. Kumarain Press,
Jabbar, Mohammad A., Mohammad Saleemand Hugo Li-Pun (2000). From Component Technology to Integrated Resources management: Evolution toward Transdisciplinarity Research in a Project in Ethiopia. In: The Proceedings of The International Transdisciplinarity 2000 Conference. Transdisciplinarity Joint Problem-Solving among Science, Technology and Society, Workshop I: Dialogue Sessions and Idea Market. Swiss Federal Institute of Technology, Zurich, Switzerland.
Janke, E. and Getachew Asamenew (1983). Ethiopian Highland Reclamation Study. An Assessment of the Recent Past and Present Livestock Situation in the Ethiopian Highlands. Land Use Planning and Regulatory Department, Ministry of Agriculture and FAO. UTF/ETH/037/ETH. Working Paper 7. Addis Ababa.

Jones, H. (1990). Population Geography. Paul Chapman Publishing Ltd, London. (2nd edition).

Kassaye Goshu (1997). Biological Soil Conservation Techniques for Maybar Area, Ethiopia. Research Report 36. University of Berne, Switzerland, in association with the Ministry of Agriculture, Ethiopia.

Kebede Tato and Hurni, H. (1992). Soil Conservation for Survival. In: Kebede, Tato and Hurni, H. (eds), Soil Conservation for Survival. Soil and Water Conservation Society in Co-operation with International Soil Conservation Organisation (ISCO) and World Association of Soil and Water Conservation (WASWC).

Keeley, J. and Scoones, I. (2000). Knowledge, Power and Politics: The environmental policy-making process in Ethiopia. Journal of Modern African Studies 38(I): 89-120. Cambridge University Press, United Kingdom.

Kelsa Kena (1996). Major Soil Groups of Southern Regions of Ethiopia and Their Land Use Practices. A Paper Presented at the Workshop on the Environmental Awareness Raising, Held at Awassa and Mizan-Teferi Towns, October 8-11 and 28-31 respectively. Southern Nations, Nationalities and People's Regions, Awassa.

Kerr, J.M. and Sanghi, N.K. (1993). Indigenous Soil and Water Conservation in India's Semi-Arid Tropics. In: Baum, E., Peter Wolff and Micheal A. Zöbisch (eds). Acceptance of Soil and Water Conservation: Strategies and Technologies. Volume 3. Tropics in Applied Resources Management in the Tropics. The German Institute for Tropical and Subtropical Agriculture, Witzenhausen, Federal Republic of Germany.

King, C. and Jiggins, J. (2002). A Systemic Model and Theory for Facilitating Social Learning. In: Leeuwis, C. and Pyburn, R. (eds). Wheelbarrows Full of Frogs: Social learning in rural resources management. Koninklijke Van Gorcum BV, Assen, The Netherlands.

Kolb, D. (1984). Experiential Learning: Experience as The Source of Learning and Development. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Kothari, B. (2002). Theoretical Streams in Marginalized People's Knowledge(s): Systems, Asystems, and Subaltern Knowledge(s). Agriculture and Human Values 19: 225-237.

Kruger, Hans-Joachim, Brehanu Fentaw, Yohannes G. Michael and Kefeni Kajela (1996). Creating an Inventory of Indigenous SWC Measures in Ethiopia. In: C. Reij, et al. (eds), Sustaining the Soil: Indigenous Soil and Water Conservation in Africa. Earthscan Publications Ltd., London.

Laing, D. and Ashby, J.A. (1993). Adoption of Improved Land Management Practices by Resource Poor Farmers. In: Baum, E., Peter Wolff and Micheal A. Zöbisch (eds). Acceptance of Soil and Water Conservation: Strategies and Technologies. Volume 3. Tropics in Applied Resources Management in the Tropics. The German Institute for Tropical and Subtropical Agriculture, Witzenhausen, Federal Republic of Germany.

Lapar, Ma. L.A. and Pandey, S. (1999). Adoption of Soil Conservation: The case of the Philippine uplands. Agricultural Economics 21(3): 241-256.

Leach, M. and Mearns, R. (eds) (1996). The Lie of the Land: Challenging Received Wisdom in African Environmental Change. International African Institute, London.

Lee, David R., Paul J. Ferraro and Christopher B. Barrett (2001). Introduction: Changing Perspectives on Agricultural Intensification, Economic Development and the Environment. In. Lee, D.R and Barrett, C.B. (eds), Tradeoffs or Synergies? Agricultural Intensification, Economic Development and Environment. CAB International.

Leeuwis, C. (1993). Of Computers Myths and Modelling: The social construction of diversity, knowledge, information and communication technology in Dutch horticulture and agricultural extension. Published PhD Thesis. Wageningen Agriculture University, The Netherlands.

Leeuwis, C. (2002). Making Explicit the Social Dimensions of Cognition. In: Leeuwis, C. and Pyburn, R. (eds), Wheelbarrows Full of Frogs: Social learning in rural resources management. Koninklijke Van Gorcum BV. Assen, The Netherlands.

Leeuwis, Cees with van den Ban A. (forthcoming). Communication for Innovation in Agriculture and Rural Resources Management: Building on the tradition of agricultural extension. Blackwell Science, Oxford.

Lele, Uma and Stone, Steven W. (1989). Population Pressure, the Environment and Agricultural Intensification. MADIA Discussion Paper 4. The World Bank, Washington, D.C.

Lomborg, B. (2001). Should we worry about erosion? In: The Skeptical Environmentalist: measuring the real state of the world. Cambridge.

Long, Norman (2001). Development Sociology: Actor perspectives. Routledge, London and New York.

Ludi, Eva (2002). Economic Analysis of Soil Conservation: Case Studies from Highlands of Amhara Region, Ethiopia. Published PhD Dissertation, Centre for Development and Environment (CDE), Institute of Geography, University of Bern, Switzerland.

Lynam, J. (2002). A Book Review: A History of Farming Systems Research, edited by M.Collinson. Agricultural Systems 73(2): 227-232.

Maarleveld, M. and Dangbégnon, C. (1999). Managing Natural Resources: A Social Learning Perspective. Agriculture and Human Values 16: 267-280.

Marglin, S.A. (1990). Towards the Decolonisation of the Mind. In: Marglin, F.A. and Marglin, S.A. (eds), Dominating Knowledge: Development, Culture, and Resistance. Clarendon Press, Oxford.

Markos Ezra (1997). Demographic Responses to Ecological Degradation and Food Insecurity: Drought Prone Areas in Northern Ethiopia. Published PhD Thesis. University of Groningen. The Netherlands. PDOD Publication, Prinseneiland, Amsterdam.

Marsden, D. (1994). Indigenous Management and the Management of Indigenous Knowledge. In: Scoones, I. and Thompson, John (eds), Beyond Farmer First: Rural people's knowledge, agricultural research and extension practice. Intermediate Technology Publications, International Institute for Environment and Development, London.

Maturana, H.R. and Varela, F.J. (1992). The Tree of Knowledge, the Biological Roots of Human Understanding. Shambala Publications, Boston.

Mazzucato, V. and Niemeijer, D. (2000). Rethinking Soil and Water Conservation in a Changing Society: A case study from eastern Burkina Faso. Published PhD Thesis, Wageningen University, The Netherlands.

McCann, James (1987). From Poverty to Famine in Northeast Ethiopia: A Rural History 1900-1935. The University of Pennsylvania Press, Philadelphia.

McCann, James (1995). People of the Plow: An agricultural history of Ethiopia, 1800-1900. University of Wisconsin Press, Madison, Wisconsin.

Mengistu Woube. (1986). Problems of Land Reform Implementation in Rural Ethiopia: A case study of Dejen and Wolmerea districts. University of Uppsala, Uppsala, Sweden.

Merid, W. Aregay (1986). Land Tenure and Agricultural Productivity, 1500-1850. Proceedings 3rd Annual Seminar, Department of History, Addis Ababa University. Addis Ababa. pp 115-125.

Meseret Lejebo (1990). A Study of Technological, Social, Socio-economic and Environmental Constraints Affecting the Performance of Ethiopian Agriculture: With Special Reference to Drought and Famine Crises in Konso. Giessener Schriften sur Wirtschafts-und Regionalsoziologie, Heft 18, Giessen.

Metasebia Bekele (1997). Notes on Megalithic Sites of Southern Ethiopia, with Highlights on

Late Paleolithic Occupation Sites. Ethiopia in Broader Perspective: Vol. 1: Papers of the XIII th International Conference of Ethiopian Studies, 12-17th December. In: Fukui, K., Kurimoto, E. and Shigeta, M. Shodao Book Sellers, Kyoto, Japan.

Millar, J. and Curtis, A. (1999). Challenging the Boundaries of Local and Scientific Knowledge in Australia: Opportunities for Social Learning in Managing Temperate Upland Pastures. Agriculture and Human Values 16: 389-399.

Ministry of Water Resources (1999). Koka Reservoir Bathymetry Survey Report. Department of Hydrology, Addis Ababa.

Moser, Christine M. and Barrett, Christopher B. (2002). The System of Rice Intensification in Practice: Explaining low farmer adoption and high disadoption in Madagascar. Department of Applied Economics and Management, Cornell University, Ithaca, NY, USA. (First Draft).

Mulat Demeke (1999). The Challenge of Increasing Food Production in Ethiopia. Proceedings of the Eighth Annual Conference on the Ethiopian Economy; Oct. 30-Nov.1, 1999, Nazareth, Ethiopia.

Mulugetta Tesfaye (1988). Soil Conservation Experiments on Cultivated Land in the Maybar Area, Wello Region, Ethiopia. Soil Conservation Research Project. Research Report 16. University of Berne, Switzerland in association with the United Nations University, Berne.

Napier, T.L. and Sommers, D.G. (1993). Soil Conservation in the Tropics: A prerequisite for social development. In: Baum, E., Peter Wolff and Micheal A. Zöbisch (eds), Acceptance of Soil and Water Conservation: Strategies and Technologies. Volume 3. Tropics in Applied Resources Management in the Tropics. The German Institute for Tropical and Subtropical Agriculture, Witzenhausen, Federal Republic of Germany.

Negarit Gazette (1975). Public Ownership of Rural Lands: Proclamation No. 31 of 1975. 34 (26). Addis Ababa, Ethiopia.

Netting, Robert McC. (1993). Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture. Stanford University Press, Stanford, California.

Nichola, T. (1985). Agricultural Research and Extension in Ethiopia. The State of Arts. IDR Research Report, No.22. A.A.U. Addis Ababa.

NMSA (2000). Data Base. National Meteorological Service Agency, Addis Ababa.

O'Keefe, D.J. (1993). Persuasion: Theory and Research. Sage Publications, Newbury Park, London and New Delhi.

Ogunfiditimi, T.O. (1993). Abandoned Adoption: Why adopters Discontinued use of previously adopted innovations. Journal of Extension Systems 9 (2): 86-91.

Östberg, W. and Reij, C. (1998). Culture and Local Knowledge: Their roles in soil and water conservation. In: Blume, H., H. Eger, E. Fleischhauer, A. Hebel, C. Reij and K.G. Steiner (eds), Towards Sustainable Land Use: Furthering co-operation between people and institutions. Advances in Geoecology 31, Volume II. ISSS CATENA VERLAG GMBH, Reiskirchen, Germany.

Otto Shako (1994). The nine clans of the Konso. Sociology Ethnology Bulletin 1(3): 80-92.

Ovuka, M. (2000). More People, More Erosion? Land Use, Soil Erosion and Soil Productivity in Murang'a District, Kenya. Land Degradation & Development 11:111-124.

Pankhurst, A. (1990). Resettlement: Policy and Practice. In: Pausewang, S, Cheru Fantu, S. Brune, Chole Eshetu (eds), Ethiopia: Rural Development Options. Zed Books Ltd., London and New Jersey.

Pankhurst, R. (1966). State and Land in Ethiopian History. Institute of Ethiopian Studies and The Faculty of Law, Haile Sellassie I University in association with Oxford University Press, Addis Ababa.

Pender, J.L. and Kerr, J.M. (1998). Determinants of Farmers' Indigenous Soil and Water Conservation Investment in Semi-arid India. Agricultural Economics 19(1-2): 113-125.

Pinstrup-Andersen, P. and Pandya-Lorch, Rajul (eds) (2001). The Unfinished Agenda: Perspectives on Overcoming Hunger, Poverty, and Environmental Degradation. International Food Policy Research Institute, Washington, D.C.

Rasmussen, K., Fog Bjarne and Jens E. Madsen (2001). Desertification in Reverse? Observations from northern Burkina Faso. Global Environmental Change 11: 271-282.

Reij, C. (1998). How to Increase the Adoption of Improved Land Management Practices by Farmers? In: Blume, H., H. Eger, E. Fleischhauer, A. Hebel, C. Reij and K.G. Steiner (eds), Towards Sustainable Land Use: Furthering co-operation between people and institutions. Advances in Geoecology 31, Volume II. ISSS CATENA VERLAG GMBH, Reiskirchen, Germany.

Renaud, F., H.D Bechstedt and Udomchai Na Nakorn (1998). Farming Systems and Soil Conservation Practices in a Study Area of Northern Thailand. Mountain Research and Development 18(4): 345-356.

Richards, P. (1985). Indigenous Agricultural Revolution: Ecology and Food Production in West Africa. Huchinson, London.

Ritler, Alfons (1997). Land Use, Forests and the Landscape of Ethiopia 1699-1865. An Enquiry into the Historical Geography of Central-Northern Ethiopia. Soil Conservation Research Programme, Ethiopia. University of Berne, Switzerland, in association with the Ministry of Agriculture, Berne.

Robert, C., A. Pacey, and Lori Ann Thrupp (eds) (1989). Farmer First: Farmer innovation and agricultural research. Intermediate Technology Publications, Short Run Press, Great Britain.

Rogers, E.M. (1983). Diffusion of Innovations. Third Edition. The Free University Press, New York.

Rogers, E.M. (1995). Diffusion of Innovations. Fourth Edition. The Free University Press, New York.

Röling, N. (1981). The Rural Poor and Development Intervention: Final report of the working party on 'The small farmer and development co-operation.' IAC, Wageningen, The Netherlands.

Röling, N. (1988). Extension Science: Information systems in agricultural development. Cambridge University Press, Cambridge.

Röling, N. (1992). The Emergence of Knowledge Systems Thinking: A changing perception of relationships among innovation, knowledge process and configuration. Knowledge and Policy: International Journal of Transfer and Utilisation 5(1): 42-64.

Röling, N. (1994). Platforms for Decision-making about Ecosystem. In: Fresco, L.O, L.Stroosnijder, J. Bouma and H. van Keulen (eds), The Future of the Land: Mobilizing and Integrating Knowledge for Land Use Options. John Willey & Sons Ltd, New York.

Röling, N. (1997). The Soft-side of Land. ITC Journal, Special Issue on Geo Information for Sustainable Land Management. Vol, 1997, No. 3/ 4 PP:248-263.

Röling, N. and J. Jiggins (1998). The Ecological Knowledge System. In: N. Röling and M.A.E Wagemakers (eds). Facilitating Sustainable Agriculture. Participatory and Adaptive Management in Time of Environmental Uncertainty. Cambridge University Press, Cambridge.

Röling, N. and Jiggins, J. (2001). Agents in Adaptive Collaborative Management: The Logic of Collective Cognition. In: Buck, L.E, Charles C. Geisler, John Schelhas and Eva Wollenberg (eds), Biological Diversity: Balancing interests through adaptive collaborative management. CRC Press, Florida, USA.

Ruthenberg, Hans (1980). Farming Systems in the Tropics. Third Edition. Clarendon Press, Oxford.

Ruthenberg, Hans (1985). Innovation Policy for Small Farmers in the Tropics: The Economics of Technical Innovations for Agricultural Development. Edited by Jahnke, H.E. Clarendon Press, Oxford.

Sain, G.E. and Barreto, H.J. (1996). The Adoption of Soil Conservation Technology in El Salvador: Lining productivity and conservation. Journal of Soil and Water Conservation 51 (4): 313-321.

Sandford, J. and Sandford, S. (1994). Land Tenure in an Enset Growing Region. In: Dessalegn, Rahmato (ed.), Land Tenure and Land Policy After the Derg: Proceedings of the Second Workshop of the Land Tenure Project. Representralen AVH, Trondheim, Norway.

Scherr, S. and Hazell, P. (1994). Sustainable Agricultural Development Strategies in Fragile Lands. IFRPI-EPTD Discussion Papers No. 1.

Scoones, I. and Thompson, John (1994). Knowledge, power and agriculture: towards a theoretical understanding. In: Scoones, I. And John Thompson (eds). Beyond Farmer First: Rural people's Knowledge, agricultural research and extension practice. Intermediate Technology Publications, International Institute for Environment and Development. London.

Scoones, I., Chris Reij and Camilla Toulmin (1996). Sustaining the Soil: Indigenous soil and water conservation in Africa. In: Reij, C., Ian Scoones and Camilla Touliman (eds), Sustaining the Soil: Indigenous Soil and Water Conservation in Africa. International Institute for Environment and Development. Earthscan Publications Ltd., London.

Scoones, I. and Toulmin, Camilla (1999). Policies for Soil Fertility Management in Africa. IIED, London.

Scott, J.C. (1998). Seeing Like a State: How certain schemes to improve the human condition have failed. Yale University Press, New Haven and London.

SCRP (1996a). Soil Conservation Research Project. Data Base Report (1982-1993). Series II. Gunno Research Unit. University of Berne, Switzerland, in Association with The Ministry of Agriculture, Ethiopia.

SCRP (1996b). Soil Conservation Research Project. Supplementary Notes on Soil Erosion Assessment and Recommendations on Soil and Water Conservation. University of Berne, Switzerland, in Association with the Ministry of Agriculture, Ethiopia.

SCRP (1996c). Soil Conservation Research Project. Data Base Report (1981-1993). Series I. Maybar Research Unit. University of Berne, Switzerland, in Association with The Ministry of Agriculture, Ethiopia.

SCRP (2000a). Area of Gunno, Sidamo, Ethiopia: Long-term Monitoring of the Agricultural Environment 1981-94. Soil Erosion and Conservation Database. Centre for Development and Environment, University of Berne, Switzerland, in Association with The Ministry of Agriculture, Ethiopia.

SCRP (2000b). Area of Maybar, Wello, Ethiopia: Long-term Monitoring of the Agricultural Environment 1981-1994. Soil Erosion and Conservation Database. Centre for Development and Environment, University of Berne, Switzerland, in Association with the Ministry of Agriculture, Ethiopia.

Semgalawe, Z.M. (1998). Household Adoption Behaviour and Agricultural Sustainability in the Northern Mountains of Tanzania: The case of soil conservation in the North Pare and West Usambara Mountains. Published PhD Thesis, Wageningen University, Wageningen, The Netherlands.

Setotaw Ferede, Hugo Verkuijl, Douglas G. Tanner and Takele Gebre (2000). Optimising Fertiliser Use in Ethiopia: Results of a Baseline Survey of Fertiliser Adoption in Arsi Zone. Sasakawa-Global 2000, Addis Ababa.

Sfeir-Younis, A. and Dragun, A.K. (1993). Land and Soil Management: Technology, Economics

and Institutions. Westview Press, Oxford.
Sheleme Beyene (forthcoming). Soil Characteristics at Gunno/Areka CND-Research Site, Ethiopia.
Smaling, Eric, M.A. Stephen, M. Nandwa and Bert H. Janssen (1997). Soil Fertility in Africa is at Stake. In: American Society of Agronomy and Soil Science Society. Replenishing Soil Fertility in Africa. SSSA Special Publication No. 51. Madison, USA.
Song, Y. (1998). 'New' Seed in 'Old' China: Impact of CIMMYT Collaborative Programme on Maize Breeding in South-western China. Published PhD Thesis, Wageningen Agricultural University, Wageningen, The Netherlands.
Sonneveld, B.G.J.S. (2002). Land Under Pressure: The impact of water erosion on food production in Ethiopia. Published PhD Dissertation, Vrije Universiteit. Shaker Publishing BV, Maastricht, The Netherlands.
Stahl, M. (1990). Constraints to Environmental Rehabilitation through People's Participation in the Northern Ethiopian Highlands. United Nations Research Institute for Social Development, Geneva.
Stocking, M. and Abel, N. (1992). Labour Costs: a critical element in soil conservation. In: Kebede, Tato and Hurni, H. (eds), Soil Conservation for Survival, Soil and Water Conservation Society in Co-operation with International Soil Conservation Organisation (ISCO) and World Association of Soil and Water Conservation (WASWC).
Strauss, A. And Corbin, J. (1990). Basics of Qualitative Research: Grounded Theory Procedures and Techniques. Sage Publications. Newbury Park, London and New Delhi.
Stuiver, M., C. Leeuwis and J.D. van der Ploeg (forthcoming). The Force of Experience: Farmers' Knowledge and Sustainable Innovations in Agriculture. In: J.S.C. Wiskerke & J.D. van der Ploeg (eds). Seeds of Transitions: essays on novelty production, niches and regimes in agriculture. Van Gorcum, Assen.
Tagoe, C. and Dejene Alemayehu (1983). Ethiopian Highlands Reclamation Study: A Tentative Review of Agriculture in the Highlands. Land Use Planning and Regulatory Department, Ministry of Agriculture and FAO. UTF/ETH/037/ETH. Working Paper 1. Addis Ababa.
Takele Tilahun, Bashir Hadj and Bashir Barre (1994). From Communal Grazing to Privatised Enclosure: a case study of changing land tenure in Region 5. In: Dessalegn Rahmato (ed.), Land Tenure and Land Policy After the Derg: Proceedings of the Second Workshop of the Land Tenure Project. Representralen AVH, Trondheim, Norway.
Tefera Mekuria (1996). Environment, Resources and Population in SNNPR. A Paper Presented at the Workshop on the Environmental Awareness Raising, Held at Awassa and Mizan-Teferi Towns, October 8-11 and 28-31 respectively. Southern Nations, Nationalities and People's Regions, Awassa.
Teferi Abate (1992). Resource use in Konso. Sociology Ethnology Bulletin 1(2): 22-25
Terefe Degefa (2001). Death of the Mother Tree: Land Tenure and Environmental Degradation in the Oromian Highlands, Ethiopia, 1900-1997. Published PhD Thesis. Institute of Social Studies, The Netherlands. Shaker Publishing, Maastricht.
Tesfaye Beshah (1997). The Role of Extension in Agricultural and Rural Development in Ethiopia: With a Particular Reference to Extension Approaches and Strategies. African Regional Conference Proceedings. Addis Ababa.
Tesfaye Beshah (1999). Orienting Agricultural Extension towards Sustainable Land Use and Food Security. In: Taye Assefa (ed.), Food Security Through Sustainable Land Use: Policy on Institutional, Land Tenure, and Extension Issues in Ethiopia. Proceedings of the First National Workshop of NOVIB Partners Forum on Sustainable Land Use. NOVIB Partners Forum. Addis Ababa.

Tesfaye Beshah (2002). Lessons from Soil Conservation Intervention in the Highlands of Wolaita, Ethiopia. Paper Presented at the International Conference on Sustainable Agriculture and Rural Development in Mountain Regions, June 16-20, Adelboden, Switzerland.

Tewelde Brehan Gebre Egziabher (1989). Historical and Socio-Economic Basis of the Ethiopian Ecological Crisis. Asmara University, Asmara.

Tiffen, M., M. Mortimore and F. Gichuki (1994). Population Growth and Environmental Recovery: Policy Lessons from Kenya. Gatekeepers Series No. 45. IIED, London.

Tilahun Amede, Takele Belachew and Endrias Geta (2001). Reversing the Degradation of Arable Land in the Ethiopian Highlands. Managing Africa's Soils No. 23. IIED, London.

Tolcha Thomas (1991). Aspects of Soil Degradation and Conservation Measures in Agucho Catchment, Western Harerge. Soil Conservation Research Project. Research Report 19. University of Berne, Switzerland in association with MoAEP, Ethiopia and The United Nations University, Berne.

Tsehai Berhane-Selassie (1994). Social Survey of the Soil Conservation Areas, Dizi, Anjeni and Gunno (Ethiopia). Soil Conservation Research Programme. Centre for Development and Environment, University of Berne, Switzerland, in association with the Ministry of Agriculture, Ethiopia and The United Nations University. Research Report 24. Berne.

Van den Ban, A. W. and Hawkins, H.S. (1996). Agricultural Extension. Longman, Burnt Mill, Harlow.

Van Eijk, Toon (1998). Farming Systems Research and Spirituality: An analysis of the foundations of professionalism in developing sustainable farming systems. Published PhD Thesis, Wageningen Agricultural University, Wageningen, The Netherlands.

WADU (1981). Wolaita Agricultural Development Unit. Phase II Evaluation Report. WADU, Addis Ababa.

Wana Wagesho (1998). The History of the Wolaita People (written in Amharic). Brehan Printing House, Addis Ababa.

Warren, D.M and Cashman, Krishtin (1988). Indigenous Knowledge for Sustainable Agricultural and Rural Development. Gatekeepers Series No SA10. IIED, London.

Warren, D.M. (1991). Indigenous Agricultural Knowledge and Development. Agriculture, Food and Human Values Society, Gainesville.

Waters-Bayer, Ann; Alemneh Dejene, Diribu Jemal and Mitiku Haile (1998). Report on the Final External Review of the Soil Conservation Research Project (SCRP). (unpublished).

Watson, E.E. (1998). Ground Truth: Land and Power in Konso, Ethiopia. PhD Dissertation, University of Cambridge, UK.

WCMC (1991). Bio-diversity Guide to Ethiopia. World Conservation Monitoring Centre, Cambridge.

Weigal, G. (1986a). The Soils of the Gunno Area, Sidamo Research Unit, Ethiopia. Soil Conservation Research Project. Report 8. Ministry of Agriculture, Ethiopia, University of Berne, Switzerland in association with the United Nations University, Tokyo, Berne.

Weigel, G. (1986b). An Agro-ecological Development Plan for the Maybar Area, Wello Research Unit, Ethiopia. Soil Conservation Research Project. Report 8. Ministry of Agriculture, Ethiopia; University of Berne, Switzerland in association with The United Nations University, Tokyo. Berne.

Weigel, G. (1986c). The Soils of the Maybar Area, Wello Research Unit, Ethiopia. Soil Conservation Research Project. Report 8. Ministry of Agriculture, Ethiopia; University of Berne, Switzerland in association with The United Nations University, Tokyo. Berne.

Westphal, E. (1974). Pulses in Ethiopia: Their taxonomy and agricultural significance. Centre

for Agricultural Publishing and Documentation, Wageningen, The Netherlands.
Westphal, E. (1975). Agricultural Systems in Ethiopia. Wageningen University, The Netherlands and the College of Agriculture, Ethiopia. PUDOC, Wageningen.
Wilson, K. and Morren, G.E.B. (1990). Systems Approaches for Improvement in Agriculture and Resources Management. Macmillan Publishing Company, New York.
Woodhill, J. and Röling, N. (1998). The Second Wing of the Eagle: the human dimension in learning our way to more sustainable futures. In Röling, N. and M.A.E. Wagemakers (eds), Facilitating Sustainable Agriculture: Participatory learning and adaptive management in times of environmental uncertainty. Cambridge University Press, United Kingdom.
World Bank (1991). World Development Report: The challenge of development. World Bank, Washington D.C.
World Bank (1992). World Development Report: Development and the environment. World Bank, Washington D.C.
World Bank (1996). Natural Resources Degradation in Sub-Saharan Africa (SSA) Restoration of Soil Fertility: A Concept Paper and Action Plan. Africa Region. World Bank, Washington, D.C.
World Bank Group (2002). World Development Indicators. The World Bank, Washington D.C.
Yeraswork Admassie (2000). Twenty Years to Nowhere: Property Rights, Land Management and Conservation in Ethiopia. The Red Sea Press, Inc., Lawrenceville and Asmara.
Yigremew Adal (1999). Ethiopian Rural Land Tenure System: Its Impact on Sustainable Land Use and Food Production. In: Taye, Assefa (ed.), Food Security Through Sustainable Land Use: Policy on Institution, Land Tenure, and Extension Issues in Ethiopia. NOVIM Partners Forum, Addis Ababa.
Yin, R.K. (1984). Case Study Research: Design and Methods. Sage Publications. Beverly Hills, London, and New Delhi.
Yohannes Gebre Micheal (1998). Indigenous Soil and Water Conservation Practices in Ethiopia. In: Blume, H., H. Eger, E. Fleischhauer, A. Hebel, C. Reij and K.G. Steiner (eds), Towards Sustainable Land Use: Furthering co-operation between people and institutions. Advances in Geoecology 31, Volume II. ISSS CATENA VERLAG GMBH, Reiskirchen, Germany.
Yohannes Gebre Micheal (1999). The Use, Maintenance and Development of Soil and Water Conservation Measures by Small-scale Farming Households in Different Agro-climatic Zones of Northern and Southern Wello, Ethiopia. Soil Conservation Research Programme. Centre for Development and Environment, University of Berne, Switzerland, in association with the Ministry of Agriculture, Ethiopia. Research Report 44.
Young, A. (1997). Agroforestry for Soil Management. Second Edition. CAB International in association with the International Centre for Research in Agroforestry, New York.
Zealbowessen Asfaw (1998). Analysis of Farmers' Perception and Adoption of Traditional and Introduced Soil Conservation Measures: A case of Maybar and Atarymestk, South Wello, Ethiopia. MSc Thesis in Management of Natural Resources and Sustainable Agriculture. Agricultural University of Norway.
Zemenfes Tsighe (1995). The Political Economy of Land Degradation in Ethiopia. Journal of Northeast Africa Studies 2(2): 71-98.

Summary

Soil erosion by water is an old problem in Ethiopia. The prevalence of mountainous and undulating landscapes, coupled with the expansion of arable farming on steep areas due to population pressure have aggravated the soil erosion problem in the country.

Prompted by one of the great famines in the country in 1973, the international community and the Ethiopian government began to carry out massive conservation measures that covered extensive areas. Since then, the conservation movement has continued. Ethiopia's major research partner in soil and water conservation was the Swiss-financed Soil Conservation Research Project that operated from 1981 to 1998. In spite of this project, farmers' practices have not changed markedly nor have they adopted the introduced conservation practices.

This study was initiated to understand farmers' soil and water conservation behaviour in order to improve insights into the land-management problems of the country. For this, farmers' knowledge and attitudes on soil erosion and soil and water conservation were assessed to find out what influenced their soil and water conservation practices. Where applicable, farmers' responses to interventions in soil and water conservation were examined. Finally, the determinants of soil and water conservation behaviours among farmers were identified. Both qualitative and quantitative research methods were used to gather and analyse data.

The conceptual framework that guided this study was drawn from perspectives on land degradation and intensification, theories on planned change and development intervention, farming systems, indigenous knowledge, social learning, and from an attitude-behaviour model. Efforts were made to review empirical studies on determinants of soil and water conservation practices.

This study was carried out in three areas, namely, Konso, Wolaita and Wello. The first site provided the case of an indigenous soil and water conservation system, whereas the other two sites were intervention cases in which an intensive soil and water conservation research and extension programme was carried out for nearly two decades.

The indigenous system in Konso, into which soil and water conservation methods were integrated is exceptional in Ethiopia and has existed for at least four centuries. It was developed out of societal needs for survival in a rather fragile environment. This community developed institutions that provide labour, control population numbers and protect the stone terrace-based farming system. The strong soil and water conservation elements in this system emerged because of the harsh physical environment and were sustained by the institutions developed in the society. As evidence of the importance of local institutions for developing and maintaining soil and water conservation practices, this system has recently undergone some deterioration due to the abandonment of its population-control system and its local labour organisations, as well as due to climatic factors.

The two intervention case studies, though they vary from one another, are markedly different from that of the indigenous system. Their physical resources were much more secure than those of the indigenous system. Therefore, physical conservation practices did not develop in these two sites on their own, but needed to be prompted from outside. One of these systems is characterised by the use of organic sources of fertiliser, whereas the other system mainly depends on long fallow periods and the establishment of staggered structures in the steeper fields.

This study found that farmers in these two areas responded differently to the introduced interventions. In Wolaita, farmers refrained from maintaining the introduced bunds, and removed a considerable number that had been installed through a food-for-work programme; whereas in Wello, farmers first removed the stone bunds and later on replaced them with

their own modification of the design, introducing innovative bund-management methods. These differences resulted because of variations in the existing physical factors and in the soil fertility management practices. In the former case, the soil is deep and yet organic fertiliser was used together with a supplement of inorganic fertilisers. In the latter case, in which shallow soils dominate, making the situation even worse when the conservation structures were removed, the use of organic fertiliser is limited to garden plots and inorganic fertiliser is not widely used. 'Dis-adoption' in Wolaita took place because of negative side effects of the soil bunds, such as mole-rat and weed infestations, and hindrance to ox-ploughing. The underlying problem of the side effects is the fact that there is a shortage of land, which was exacerbated by the introduction of bunds. At the Wolaita site, the technology failed to outweigh the negative side effects perceived by the farmers. In addition, the research and extension systems also failed to be proactive to demonstrate the pros and cons of the alternate practices, other than to collect physical data.

The case studies show that there is no lack of knowledge about soil erosion and soil and water conservation among farmers, nor do they have a problematic attitude to these issues. They are very much aware of the problems and solutions. However, farmers and outsiders differ in terms of their perceptions of soil erosion. Unlike outsiders, farmers look at the problem of erosion through its impact on soil fertility rather than through the actual physical process involved, which takes the soil away. This contrast was reflected in farmers' prioritisation of crop production problems in which they ranked soil erosion far lower than other physical problems.

There was no strong evidence found, of negative effects of state ownership of land in the case study areas with the exception of the non-arable communal lands (grazing, hillsides).

The past food-for-work incentive, which allowed for the establishment of conservation structures in the intervention areas, was not found to be a shortcoming in itself. The provision of food was an appropriate method of payment for people who could not produce their own. It can be noted that food produced by these people supports them for only 5-7 months. However, a problem emerged because of a lack of understanding of farmers' behaviour regarding soil and water conservation that was aggravated by the absence of a learning process that should complement a technical intervention. In view of this, it is suggested to improve extension agents' training to help them understand farmers' practices.

The study found out that farmers' behaviour regarding soil and water conservation is a result of the interplay among social, economic, institutional and technical factors. More specifically, the determinants of soil and water conservation in this study are: physical factors (topography, soils and rainfall), local institutions, labour organisation, land size, family size, livestock ownership, risk perception, food availability, land tenure on non-arable lands and characteristics of technology (e.g., relative advantages, compatibility, etc.).

The improvement of Ethiopia's land-management practices requires the promotion of farmer participation, diversification production and income, intensification of production systems, improvement in the training of extension agents, integration of learning processes into conservation incentives and the implementation of a land-tenure system that reflects diversity in the country and that links management and utilisation of natural resources in communal holdings.

Finally, the study underlines the need to carry out location-specific research studies on land management using a holistic approach.

Samenvatting

Watererosie is sinds lange tijd een serieus probleem in Ethiopië, met name in de bergen en op heuvelachtig terrein. Het probleem is de laatste decennia groter geworden door de sterke bevolkingsgroei en de daarmee samenhangende uitbreiding van het areaal aan akkerland.

Na de ernstige hongersnood van 1973 werden grootschalige bodemconserverings-projecten door de Ethiopische regering en de internationale gemeenschap uitgevoerd. Deze conserveringsactiviteiten zijn sindsdien doorgegaan. Voor Ethiopië was Zwitserland de belangrijkste buitenlandse partner voor onderzoek naar erosie en bodemconservering. De Zwitsers financierden het 'Soil Conservation Project' van 1981 tot 1998. Ondanks dit langdurige en grootschalige project hebben Ethiopische boeren hun bodemmanagement nauwelijks veranderd en bleef de adoptie van erosiebeperkende maatregelen laag.

Deze studie werd uitgevoerd om te begrijpen hoe Ethiopische boeren omgaan met erosie en bodemconservering, zodat een beter inzicht in het bodembeheer verkregen kan worden. Hiervoor werd onderzocht wat de kennis en de gebruiken van boeren met betrekking tot erosie en bodemconservering zijn en wat hun keuzes voor erosiebeperkende maatregelen beïnvloedt. Zowel kwalitatieve als kwantitatieve onderzoeksmethoden werden toegepast. De basis voor het onderzoek waren theorieën en inzichten over bedrijfssystemen, intensivering van bodemgebruik, bodemdegradatie, veranderend landgebruik, traditionele kennis en kennisoverdracht.

De studie werd uitgevoerd in drie gebieden, namelijk Konso, Wolaita en Wello. In Konso werd een traditioneel bodemconserverings-systeem bestudeerd, terwijl in de andere twee gebieden gedurende de afgelopen 20 jaar intensieve bodemconserverings-programma's werden uitgevoerd.

Het traditionele systeem in Konso is uniek voor Ethiopië en bestaat minstens vier eeuwen. Het werd uit nood geboren om te kunnen overleven in een fragiele omgeving. De lokale gemeenschap ontwikkelde instituties die arbeid leverden, de groei van de bevolking binnen toelaatbare marges hield en de terraslandbouw beschermde. Beperking van erosie was een belangrijk element in het landbouwsysteem vanwege de moeilijke fysieke omstandigheden. De bodemconserverings-structuren werden onderhouden door de verschillende instituties in de gemeenschap. Het belang van deze lokale instituties voor ontwikkeling en onderhoud van de structuren wordt benadrukt door het recente verval van deze maatregelen. Dit is voornamelijk het gevolg van de ongecontroleerde bevolkingstoename en het teloorgaan van de arbeidsorganisaties. Ook de veranderde klimatologische omstandigheden spelen een rol.

Hoewel de situaties in Wello en Wolaita niet exact gelijk zijn, verschillen ze beide in grote mate van Konso. De beschikbaarheid en zekerheid van natuurlijke bestaansbronnen is vele malen grotere dan in Konso. Hierdoor werden lokaal geen bodemconserverings-maatregelen ontwikkeld, maar werden geïnitieerd door buitenstaanders. Het systeem in Wolaita wordt gekarakteriseerd door het gebruik van organische mest, terwijl het systeem in Wello is gebaseerd op lange braakperioden en het gebruik van erosiebeperkende maatregelen op steile hellingen.

De boeren in Wello en Wolaita reageerden verschillend op geïntroduceerde maatregelen. In Wolaita wezen de boeren de geadviseerde terrassen af en ze verwijderden een aanzienlijk aantal terrassen die middels een voedsel-voor-arbeid (food-for-work) project waren aangelegd op hun velden. In Wello daarentegen werden de terrassen eerst verwijderd, maar later werden ze weer aangebracht in een door de boeren aangepaste vorm. Dit kan worden beschouwd als een innovatieve vorm van bodemconservering. De oorzaken van deze verschillen in reacties tussen Wello en Wolaita lagen in andere omgevingsfactoren en het management van de

bodemvruchtbaarheid. In Wolaita zijn de bodems diep en maken de boeren gebruik van organische mest, aangevuld met kunstmest. In Wello zijn de bodems minder diep en is derhalve de noodzaak voor bodemconservering groter. Organische mest wordt alleen gebruikt in groentetuinen, terwijl kunstmest slechts sporadisch wordt gebruikt. Het niet adopteren van terrassen in Wolaita is voornamelijk het gevolg van ongewenste neveneffecten, zoals belemmering van grondbewerking en de verspreiding van ratten en onkruiden. Deze neveneffecten zijn belangrijk voor boeren omdat er relatief weinig land beschikbaar is. De aanleg van terrassen verergert dit probleem. Het bleek dat de landbouwvoorlichting had nagelaten aan de boeren de voor- en nadelen van terrassen te demonstreren.

In de drie studiegebieden beschikten de boeren over voldoende kennis van erosie. Over het algemeen werd erosie niet als een groot probleem beschouwd in tegenstelling tot andere problemen die de gewasproductie beïnvloeden (o.a. droogte, ziekten). Boeren zijn voldoende op de hoogte van de erosieproblemen en de mogelijke maatregelen. Uit deze studie bleek tevens dat boeren anders over erosie denken dan buitenstaanders, zoals landbouwvoorlichters en onderzoekers. Boeren beschouwen erosie als een probleem dat de bodemvruchtbaarheid beïnvloedt. Ze hebben niet of nauwelijks aandacht voor de processen die tot bodemverlies leiden, terwijl buitenstaanders hier met name in geïnteresseerd zijn.

De stimulans voedsel-voor-arbeid (food-for-work) uit het recente verleden maakte het mogelijk dat bodemconserverings-maatregelen werden aangelegd in twee van de drie studiegebieden. Deze stimulans was op zich niet slecht. De verschaffing van voedsel aan mensen die zelf niet voldoende konden produceren was een goede methode van betaling. Maar er ontstond een probleem doordat de projectuitvoerders geen inzicht hadden in de meningen van boeren met betrekking tot bodemconservering. Dit probleem werd verergerd door het ontbreken van een leerproces dat zou moeten samengaan met het plannen en ontwerpen van maatregelen. Het wordt aanbevolen de training van voorlichters en projectuitvoerders op dit punt te verbeteren, zodat ze in de toekomst beter in staat zijn de boerengebruiken te begrijpen.

De houding van boeren ten opzichte van erosie en bodemconservering in de drie studiegebieden is het resultaat van de interactie tussen sociale, economische, institutionele en technische factoren. De belangrijkste factoren die bodemconservering beïnvloeden zijn: fysieke omgeving (bodem, topografie en klimaat), lokale instituties, gezinsgrootte, landbezit, veebezit, voedselzekerheid en de beschikbare technische hulpmiddelen. Voor de verbetering van het bodemmanagement in Ethiopië zijn nodig: participatie van boeren in projecten, diversificatie van landbouwproductie en -inkomen, intensivering van landbouwsystemen, verbeterde training van landbouwvoorlichters, integratie van leerprocessen in bodemconserverings-projecten, invoering van een systeem voor landbezit dat een afspiegeling van de diversiteit in Ethiopië is en dat management en gebruik van natuurlijke bestaansbronnen combineert.

Tenslotte blijkt uit deze studie het belang van lokatie-specifiek onderzoek naar bodemmanagement waarbij gebruik gemaakt wordt van een holistische benadering.

Appendix 1

Methods of soil loss and runoff data collection[74]

Soil loss and runoff assessment within plots

Individual storm or storm-period data on runoff and soil loss from different land uses, soil types, slope lengths and gradients were assessed in each research station using test plots (TP) and micro-plots (MP) from an area of 30 m^2 (2x15m) and 3 m^2 (1x3m) respectively. Corrugated iron borders were installed. They were inserted 10 cm in the ground and erected 20 cm above the ground to enable the runoff to be collected in the tank through an inlet tube. Runoff and sediments are collected in two tanks each with a 250 litre capacity; the first tank (A) takes most of the soil from the plot, with the second tank (B) taking 1/10th only of the eventual overflow from the first tank (A), through a slot divisor. Activities relating to the monitoring of test and micro-plots were operated by the research assistants. In order to keep a very close approximation to natural conditions in the catchment, instead of simulating the traditional cultivation practices, the test-plot borders were removed whenever the farmers were working on the field (ploughing), and were set up again afterwards. Both test plots and micro-plots were arranged side by side.

Plots were established near the rainfall meter to link the results of the rainfall and runoff period. Measurements of erosion losses were made after each rainy day.

The volume of runoff water was measured directly from the sedimentation tanks. Representative runoff and soil samples were taken for laboratory analysis. For soil losses, 500 grams of soil and 1 litre of suspended sediment were sampled from the sedimentation tank (A) and the overflow tank (B), if necessary.

After each sampling, the collection system was emptied and cleaned for subsequent storms. In the station, the 1 litre sample, taken for sediment assessment was filtered and dried. The 500 g sample taken from each plot was also dried in the oven and weighed. Soil loss was calculated on a per hectare basis.

Soil loss and runoff assessment under experimental plots - Soil conservation impact assessment

Different soil conservation measures were applied on different sites with varying soil types and slope gradients. This was meant for collecting information about the performance of different soil conservation measures, tested on parallel plots of 180 m^2 (6x30 m) each. In all stations except Anjeni and Afdeyu, level bunds, level Fanya juu, graded bunds, graded *Fanya juu* and grass strips were installed to monitor the soil/runoff losses versus a control or traditional plot. Methods used for runoff and soil loss data collection from each experimental plot were similar to those described in section 1.1 above.

74 Source: SCRP (1996c). Data Base Report (1981-1993). Series I Maybar Research Unit. Note that these procedures were uniformly applied in other research stations too.

Appendix 2

Correlation results of Wolaita and Wello

	Percentage of bunds removed	
	Wolaita (n=82 farmers)	*Wello (n=399 plots)*
Age	- 0.145	-.112*
	0.193	0.026
Livestock (in number)	0.074	0.009
	0.510	.861
Labour (active labour force)	- 0.010	- 0.068
	0.931	0.175
Family size	0.046	0.056
	0.685	0.266
Cropland area (ha)	- 0.260*	- 0.011
	0.018	0.827

** Correlation is significant at the 0.05 level (2-tailed)*

Acronyms

ANRS	Amhara National Regional State
AP	Agro-Pastoral
AUA	Alemaya University of Agriculture
CGIAR	Consultative Group for International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CSA	Central Statistical Authority
CSE	Conservation Strategy of Ethiopia
DAP	Di-Ammonium Phosphate
EARO	Ethiopian Agricultural Research Organisation
EECMY	Ethiopian Evangelical Church Mekane Yesus
EFAP	Ethiopian Forestry Action Plan
EHRS	Ethiopian Highlands Reclamation Study
EPID	Extension Projects Implementation Department
EPRDF	Ethiopian People's Revolutionary Democratic Front
FAO	Food and Agriculture Organisation
FDRE	Federal Democratic Republic of Ethiopia
FFW	Food For Work
GDP	Gross Domestic Product
HPC	High Potential Cereal
HPP	High Potential Perennial
IAR	Institute of Agricultural Research
ILRI	International Livestock Research Institute
LPC	Low Potential Cereal
LSD	Least Significant Difference
Masl	Meters above sea level
MoA	Ministry of Agriculture
NGO	Non-Governmental Organisation
PA	Peasant Association
PADEP	Peasant Agricultural Development Project
PADETES	Participatory Demonstration and Training Extension System
PC	Producers Co-operatives
PLAR	Participatory Learning and Action Reserach
PRA	Participatory Rural Appraisal
RAAKS	Rapid Appraisal of Agricultural Knowledge Systems
RD	Research and Development
RELC	Research and Extension Liaison Committee
RRC	Relief and Rehabilitation Commission
SC	Service Co-operatives
SCRP	Soil Conservation Research Project
SNNPR	Southern Nations, Nationalities and Peoples Region
SWC	Soil and Water Conservation
ToT	Transfer of Technology
WADU	Wolaita Agricultural Development Unit
WCMC	World Conservation Monitoring Centre
WFP	World Food Programme

List of Local Terms

Bega:	The dry season of Ethiopia covering October to February
Darkua:	The fertile zone of farm plots in Wolaita
Derg:	The Military Government that ruled Ethiopia from 1974-1991
Dib:	A physical structure constructed in the hill-side to protect soil from eroding
Fereyuma:	A custom local to Konso, which forbade marriage until about the age of 30 or more
Kiremt:	The main rainy season of Ethiopia covering June-August/September
Shoka:	The low fertility zone of farm farm plots in Wolaita
Teff:	A small cereal grown and used as human food in Ethiopia
Wereda:	An administrative body above the Peasant Association that is equivalent to a district
Xela:	The indigenous administative assembly in Konso
Waaqa:	God

About the Author

Tesfaye Beshah Asfaw was born at Jarso, Hararghie, eastern Ethiopia on January 18 1962. He completed primary and secondary schools under the aegis of the then Alemaya College of Agriculture, in Alemaya, Ethiopia. He obtained a BSc degree in Agricultural Economics in July 1986 from the Alemaya University of Agriculture (AUA). Following that, he was employed by AUA in September 1986. After two years of service as a graduate assistant at Alemaya, he won a scholarship at the Wageningen Agricultural University, The Netherlands where he obtained a MSc degree in the Management of Agricultural Knowledge Systems (MAKS) in July 1990. Returning to AUA, he served the university in different capacities until October 1997, with the exception of a semester in 1996 when he was granted an in-country study leave. During his study leave he was associated with the United Nations Economic Commission for Africa (UNECA) where he participated in the Sustainable Agriculture and Environmental Rehabilitation Programme (SAERP) in Ethiopia. During his service years at the AUA, he served as Research Coordinator and head of the Department of Agricultural Extension besides teaching and research responsibilities.

In addition to his duties and responsibilities at the Alemaya University, the author participates in professional activities in the country through contributions in workshops and seminars in his main area of interest, i.e., agricultural extension and rural development. Furthermore, he has worked with some local and international NGOs in Ethiopia, in various consultancy capacities. These opportunities together with the study leave at UNECA have immensely contributed to the professional development of the author.

In October 1997, he was granted a scholarship to pursue a PhD study at Wageningen University and Research Centre, with the Communication and Innovation Studies Group, which is concluding with this volume.

All photos and illustrations not acknowledged were made by the author.
Cover and interior design: Luc Dinnissen (studio DS, Nijmegen)