Irrigation Practices, State Intervention and Farmers' Life-Worlds in Drought-Prone Tigray, Ethiopia

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To Nishan, Eyobed and Belen

Table of Contents

List of Figures

List of Tables

List of Boxes

List of Photos

Acronyms

ADLI	Agricultural Development-Led Industrialization
AEMFI	Association of Ethiopian Micro Finance Institutions
AMC	Agricultural Marketing Corporation
BoANR	Bureau of Agriculture and Natural Resources
CADU	Chilao Agricultural Development Unit
Co-SAERT	Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray
CSA	Central Statistics Authority
DA	Development Agent
DAP	Di-ammonium Phosphate
DECSI	Dedebit Credit and Savings Institution
DPA	Drought-Prone Area
DPPC	Disaster Prevention and Preparedness Commission
EEU	European Economic Commission
EPLF	Eritrean People's Liberation Front
EPRDF	Ethiopian Peoples' Revolutionary Democratic Front
FAO	Food and Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
GNP	Gross Domestic Product
IEG	Imperial Ethiopian Government
MoWR	Ministry of Water Resources
NGOs	Non-Governmental Organizations
ONCCP	Office of the National Committee for Central Planning
PADETES	Participatory Demonstration and Training Extension System
PMAC	Provisional Military Administrative Council
REST	Relief Society of Tigray
RRC	Relief and Rehabilitation Commission
SAERRD	Sustainable Agriculture and Environmental Rehabilitation Reconstruction Development
SSIS	Small-Scale Irrigation System
SWC	Soil and Water Conservation
TDA	Tigray Development Association
TPLF	Tigray People's Liberation Front
UNDP	United Nations Development Program
UNECA	United Nations Economic Commission for Africa
WADU	Welamo Agricultural Development Unit
WFP	World Food Program
WIC	Walta Information Center
WRDBT	Water Resources Development Bureau of Tigray

Glossary of Local Terms

Abo mai	Father of water
Abo wonber	Chairman
Afercheka	Local chief during the Imperial Regime
Awraja	Province
Baito	Local Council
Bega	Dry season
Belg	Minor season (rainfall usually begins in January-February and ends in April-May)
Birr	Ethiopian currency
Chikashum	Local chief during the Imperial Regime
Derg	Council (The Provisional Military Administrative Council)
Gujele	Group
Hayfo	Plot which obtains water until end of December in Hewane
Keremt or Meher	The main rainy season (rainfall starts in June-July and ends in September)
Kuna	A local basket containing 5 to 10 kilos depending on the size
Kushet	Village
Mahberawe firdebet	Social court
Mesno	Irrigation
Tabia	Sub-district
Tela	Local beer
Tela bet	Local beer house
Timad	Local unit of measurement equivalent to 0.25 hectare
Woferit	Sharecropping
Woreda	District

Preface and Acknowledgments

This study discusses irrigation practices, state intervention and the responses of farmers in the drought-prone Tigray region of Ethiopia. Limited and erratic rainfall, and the recurrent drought and famine characterize the region.

Although governments have been involved in the construction of irrigation infrastructures since the mid-1980s to mitigate drought and famine in many parts of Ethiopia, the responses of irrigators to such interventions have never been studied. In the official view, the provision of land, irrigation water and agricultural extension services would enable household to achieve food security. The main concern of this study therefore is to document how irrigation intervention interfaces with the livelihood of small-scale irrigators.

The point of departure is based on the argument that the need for irrigation systems on the part of farmers is there, but that the provision of irrigation and agricultural services does not dovetail effectively with the life-worlds of farmers.

Numerous people have directly or indirectly assisted me in finalizing this doctoral thesis. Unfortunately, they cannot all be mentioned in these few pages. Even so, I would like to take this opportunity to mention some people who have been particularly important for my work.

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Woldeab Teshome
Wageningen, The Netherlands, October 2003

1
Introduction

Irrigation is a very old practice in the world. In Africa, furrow irrigation has been practised throughout the continent (Wyss, 1990). However, irrigation development has been promoted as a means to bring about socio-economic transformation in particular since the Second World War (Vincent, 1994).

The role of irrigated agriculture in achieving food security at global level is well established (Burke, 2002; FAO 2001; FAO/World Bank, 2001). There are regions that suffer from hunger in many parts of the world, however. The current estimate of undernourished people by FAO indicates that there are 840 million people in the world, of which 799 million live in developing countries. In sub-Saharan Africa 196 million people are undernourished (FAO, 2002).

Moris (1987:99) notes that 'in Africa, irrigation projects have often enjoyed a privileged status among some policy-makers. They seem the obvious solution for modernising production, minimising food imports, removing food deficits, and ameliorating the impact of drought'. Yet, although irrigated agriculture is a promising option for tackling food shortage, the effort in sub-Saharan Africa is gloomy. Burke (2002:1) points out that 'between 1961/63 and 1995/97, the irrigated area in developing countries increased at an annual rate of 1.9 percent to 197 million hectare. (…) while the increase in sub-Saharan Africa was only 2 million hectares'.

African countries facing drought and famine have also been considering irrigation as a drought proofing strategy without paying much attention to sustainability issues. Moris (1987:100) confirms that 'in Africa irrigation is often seen as the universal answer to drought, and thereby escapes detailed justification and local adaptation'.

Irrigation intervention in Africa has been an issue of debate because of its limited success. Commenting on the disappointing performance of irrigation in developing countries, Diemer and Huibers (1996:2) state that 'it is now generally acknowledged that the 15 billion dollars that used to be poured into the irrigation subsector in less-developed countries annually have not produced more that 50 per cent of the anticipated output'. Many argue that irrigation development is 'a risky investment' (Moigne and Barghouti, 1990; Adams and Anderson, 1988). Guijt and Thompson (1994:297) argue that 'ironically (…) irrigation development has not always worked well in environments with

highly variable rainfall, such as semi-arid parts of Africa'. Others argue that unfavourable policy environments have contributed to the unsatisfactory construction and maintenance of irrigation infrastructures which have had a negative impact on production and income of farmers (Barghouti and Subramanian, 1990).

Moris and Thom (1990:33) quoting Steinberg (1983:37-38), give arguments against the uncritical promotion of irrigation development in Africa. According to Steinberg's world-wide overview of irrigation, there are certain circumstances where irrigation investment represents an "inappropriate" policy response**.** The specific constraints warned against include:

- when there is an unresolved presence of irrigation failure in the past;
- if irrigation intrudes into a fragile environment (ecological or social);
- when economic policies or institutions are weak;
- where there are poor agricultural pricing policies, ineffective marketing facilities, high transport costs, or the unavailability or required agricultural materials;
- if irrigation involves massive dislocation of peoples;
- if it will exacerbate social tensions;
- if the institutional capacity to manage irrigation has not been demonstrated or if overall management is weak;
- if a long-term donor commitment is unlikely or if the donor lacks the required disciplinary skills and monitoring capability;
- if required socio-cultural knowledge is lacking;
- if the legal basis is clouded or if dispute resolution is likely to be faulty.

Some argue that African countries should give priority to the improvement of water management and strengthening of existing irrigation institutions instead of focusing on new irrigation systems (Moris, 1987; Moris and Thom, 1990). Conversely, others emphasise that the physical, social and economic environment of irrigation should be given attention because the sources of a problem are not only the irrigation schemes (Seckler, 1990). Irrigation design is also one area with problems. Diemer (1992:108) argues that 'the lack of 'fit' between the supply of engineering expertise and the farmers' demand for technical assistance is the reason why the irrigation scene in Africa is split into two sectors. There is an official and an 'informal' one'.

In Ethiopia, irrigated production is far from satisfactory. Food insecurity has been a chronic problem in the country since the 1970s. Estimated food aid requirement, for instance, rose from 492, 000 metric tonnes in 1995 to 896, 936 in 2000 (Devereux, 2000:3). The economic policy of Ethiopia, which is based on an Agricultural-Development-Led Industrialisation (ADLI), indicates that

agricultural productivity in Drought-Prone Areas (DPAs)[1] among others, should be increased through small-scale irrigated agriculture with the provision of agricultural inputs, credit and extension services. However, while the country's irrigation potential is about 2.5 million ha, the total irrigated area is 197,000 ha. The share of the irrigated farms out of the total cultivated land in 1998 was only 2 percent (MoWR, 2001:11).

1.1 The Problem

In Ethiopia, government has been the main actor in initiating, planning and implementing development interventions since the mid 1950s. Modernization has been the driving ideology behind the various development plans that aimed at transforming the backward economy. Government is considered as 'the main provider of all benefits (Dessalegn, 1994) or as a Tigrian farmer conceived it '*Mengist Lehezbu Egiziabher Lefteretu*' meaning 'government is for its people, and God is for his creature'. The top-down nature of major development programs including the 1975 land reform, resettlement, villagisation, cooperativization and agricultural extension programs, indicate the history of forced change in the country. Local people were either forced or mobilized to 'participate' in the implementation of such projects, which were supposed to be 'beneficial' to local people.

Since the mid-1980s government has responded to drought and famine through the construction of irrigation infrastructure aim at increasing agriculture production in drought-prone regions of Ethiopia. Planning of irrigation projects has been done at the centre. However, not enough is known about farmers' reactions and responses to these government initiatives.

This study concerns state irrigation interventions in a drought-prone area designed to increase crop production to achieve food security at household level, and explores the planned interfaces with irrigators' life worlds in two small-scale irrigation systems located in Tigray region, northern Ethiopia.

1.2 Conceptual and Theoretical Approaches

Erratic rainfall and frequent droughts characterize Tigray region. Between 1961 and 1987, for instance, the mean rainfall of Tigray was 578 mm with a coefficient variation of 28 while the national average rainfall was 921 mm with a coefficient variation of 8 (Webb et al., 1992:24). Subsistence agricultural production is almost entirely dependent on *keremt* (wet season) rainfall (between June and September), although in some parts of the region irrigated agriculture is practiced. In Tigray, 90 percent of employment is in the agricultural sector, which is traditional based on animal traction.

Tigray farmers need drought-proofing strategies to manage water better but also to spread risks. Farmers still have rainfed and/or irrigated plots and many are involved in multiple livelihood strategies. Local people employ numerous coping strategies with respect to drought and famine. Resource-poor farmers, for instance, have adopted fitting access strategies to resources such as land and oxen through sharecropping arrangements.

The two irrigation systems selected for study are the Gum Selassa and Hewane irrigation systems located in the southern Tigray region. A micro-dam is the source of water for the Gum Selassa irrigation system, which was constructed in 1996 by the regional government. Hewane irrigation is a longstanding 'system' reconstructed under land reform where 15 offtakes take turns to use the river water.

The conceptual and theoretical framework of this study highlights the interfaces and social discontinuities between the life-worlds of irrigators and government bureaucrats embedded in irrigation management. An irrigation intervention constitutes an arena of struggle in which access to resources such as land and water provides the central point of dynamic interactions, encounters, confrontations and negotiations between different social actors. As Long and Ploeg (1989:226-227) explain, 'focusing upon intervention practices allows one to take into account the emergent forms of interaction, procedures, practical strategies, types of discourse, cultural categories and the particular 'stakeholders' (Palumbo 1987:32) present in specific contexts and to reformulate questions of state intervention and agrarian development from a more thoroughgoing actor perspective'.

In the livelihood domain, interlocking relationships among the different social actors including landlords (during the imperial regime), farmers, local government administrators, development agents, and *Abo mai* ('father of water') are central. The concept of 'domain' best expresses the nature of these interlocking relationships. As Long (2001: 241-242) notes:

> *Domains represent the loci of rules, norms and values that become central to this process of social ordering and to the establishment of certain pragmatic rules of governance. The idea of domain is also important for understanding how social and symbolic boundaries are defined and upheld, though precisely which normative or strategic principles will prevail situationally or over the longer term remains an open question. Domains should not be conceptualised as 'cultural givens' but as being produced and transformed through actors' shared experience and struggles'.*

Irrigation and irrigation management

Management tasks

In irrigated crop production a number of interrelated activities ranging from designing and constructing of the irrigation infrastructure to water acquisition

and watering crops are carried out. Uphoff (1986:42) identifies three categories of irrigation management activities, namely water use activities, control structure activities and organizational activities. The first involves water acquisition, allocation, distribution and drainage. The second focuses on design, construction, operation and maintenance. The third focuses on conflict management, communication, resource mobilization and decision making.

The management aspect of irrigation is often neglected while priorities are given to the construction of irrigation infrastructure, although both the human and physical aspects interact in an irrigation domain. Uphoff (1986:4) also notes that 'the social dimensions of irrigation management have been too often neglected, handled badly, assumed not to require any special knowledge or expertise'.

While Uphoff's work addresses irrigation management tasks, the crucial issue, water control and power relations in irrigation management does not get much attention. Vincent (1995:94), criticizing Uphoff's model of irrigation management tasks, argues that 'de-politicizing and de-culturalizing irrigation activities to create this model has improved understanding of management activities. However, this approach can reduce understanding of the way governments and farmers may be using irrigation organization for multiple reasons, and not only for irrigation activities'. In Ethiopia, for instance, during the *Derg* regime farmers were not willing to become involved in irrigated farming by taking land from the government because they were required to form producer cooperatives (FAO, 1994; Dessalegn, 1999).

Property rights and hydraulic tenure

In terms of intervention, Coward (1984) distinguishes between direct and indirect investment approaches. Under direct investment, the agency takes full control of implementation activities including design and construction. In these cases, the agency often takes over the management of the system, though it may aim to turn it back to the farmers for operation and maintenance after construction is complete. Under the indirect investment approach, the agency provides resources (financial, technical assistance, materials) to an existing irrigation organisation in the form of grants, subsidised loans, and technical assistance, which support that organisation in improving its irrigation system. Management control of the system remains with the farmers.

Underlining the importance of the indirect investment strategy, Coward (1986:502) argues that 'it provides a means for the state to invest in irrigation development and simultaneously reinforce or create property-based local irrigation groups'. Yoder (1994) argues that any assistance to irrigation systems should contribute to the irrigators' capacity building in terms of operation and maintenance of systems. Farmers should be encouraged to mobilise their

material, labour and financial resources to sustain their irrigation systems. The danger of dependency on external assistance is well-documented (Merrey, 1997; Yoder, 1994; Underhill, 1984). Vincent (1994:310) notes that 'as the state withdraws and specific public assistance programmes for SSIS decrease, there may be a special need to ensure that an enabling environment does remain for SSIS'.

Governance in irrigation systems

Ostrom (1992:45) identifies three layers of rules that cumulatively affect irrigation systems. *Operational rules* refer to the day-to-day decisions concerning when, where, and how to withdraw water, monitoring of actons, and rewards and sanctions assigned to actions. *Collective-choice rules* are used by irrigators, their officials, or external authorities in making managment policies. A change in policy implies a change in oeprational rules. *Consitutional-choice rules* determine who is eligible to participate in the system and what specific rules will be used to craft the set of collective-choice rules. In the crafting of irrigation institutions, suppliers and users should be encouraged to design their institutions (ibid.).

Commenting on the governance model developed by Tang and Ostrom, Vincent (1995:94) points out that ' they distinguished governance from management activities, in order to study how governance functions are increasingly controlled by external agencies. However, governance and management activities may well be coordinated within the same organizational framework'.

Irrigation system as a sociotechnical system

Different approaches have been employed in the analysis of irrigation. Eggink and Ubels (1984:121-122) identify three approaches: the technocratic approach, the organisational approach and the social force approach. The technical infrastructure of the irrigation system is the main focus of the 'technocratic approach'. Importance is given to large-scale construction and rehabilitation works. Irrigation management is confined to the operation and maintenance of the irrigation infrastructure. The 'organisational approach' mainly focuses on the management of irrigation systems. Organisational problems with respect to water distribution in large-scale irrigation systems are studied. The 'social force approach' considers irrigation as 'a way of producing, a social activity, shaped by the dialectical interaction of social forces and, in that process, becoming a social force in itself and influencing further development in society' (ibid.). Problems in irrigation systems are examined as an ongoing struggle between different interest groups over water. These approaches have attempted to

examine irrigation in a non-comprehensive way using individual disciplines such as engineering, management, anthropology and economics.

Mollinga (1998:11-12) criticises the professional irrigation literature by pointing out three limitations: the treatment of technology as a black box; a limited concept of human agency and the absence of the study of the social relations of power. He argues that an interdisciplinary investigation of irrigation requires insight into its technical, organisational or institutional, and socio-economic and political aspects.

In the present study, an irrigation system is considered as a 'sociotechnical system' (Mollinga, 1998; Vincent, 1997, 2001). Such an approach 'gives explicit attention to the multiple ways in which technology shapes social action, and is also shaped by it' (Vincent, 1997: 45). Mollinga (1998:14) outlines the social dimensions of an irrigation system in terms of three basic concepts: social construction, social requirements for use and social effects.

Social Construction

Mollinga (1998:14-15) explains what is meant by the idea that 'irrigation technologies are socially constructed':

- technology development and design are social processes in which different stakeholders interact (communicate, negotiate, take decisions, etcetera), and
- the nature of that process and the different perceptions and interests of the stakeholders shape the technical characteristics of the technologies (together with the properties of the materials used and the nature of the (bio) physical mechanisms involved).

Irrigation, then, is an arena of struggle where social actors negotiate and decide on the technology choice and management of the water. After the construction of the irrigation infrastructure, some form of irrigation management-- farmer-managed, agency-managed or a combination of the two--should be in place to run the irrigation system. In many irrigation projects the issue of water management should be considered at the same time as the physical works. However, as Ostrom (1992:5) notes 'the initial plans for many of the major irrigation projects in developing countries have focused almost exclusively on engineering designs for the physical systems. Distribution of water to farmers and subsequent maintenance were frequently not addressed'. The project managers ---invariably engineers who are more interested in the physical construction—leave the 'soft' activity to the end, and then find it to be the hardest part of the project. In Tigray, the regional government has attempted to hand over micro-dams to irrigation systems that had unclear management

status for over five years by demanding irrigators to establish water users associations in order to receive the irrigation infrastructures.

Social requirements for use

Horst (1998:16) defines an 'irrigation system' as 'the physical infrastructure needed to capture, transport, and distribute water to (group of) farms'. To a considerable degree then the source of water (river, dam or groundwater) and the canal system in use determines the type of organization needed in an irrigation system.

Differences in sources of water may require different forms of management. In river diversions, gravity irrigation is carried out using earth canals bifurcating from the main stream in which water distribution is carried out day and night. This may need the assignment of many *abo mais* (fathers of water). A dozen *abo mais* are in charge of water distribution in Hewane river diversion since irrigators take water from 15 offtakes in 36 hectares of farmland. Whereas, in Gum Selassa irrigation system (110 hectares), a micro-dam is the source of water, distribution of water is mainly carried out during daytime, which requires the opening and closing of the gate on a fixed time table. Four *abo mias* are assigned in Gum Selassa. Since seepage water is available because of a faulty reservoir, two types of water distribution programs are implemented. The first is for the plots that receive water from the canals during daytime. The second is for the plots that use seepage water day and night. Maintenance tasks also vary depending on the sources of water. Soil salinity, for instance, is a major problem for a micro dam, while flooding damages the canal structure of a river diversion during the rainy season. In the case of siltation, the maintenance task is often beyond the farmers' ability, requiring the involvement of an irrigation agency.

In an irrigation system where dam technology is used as the water harvesting technique, the water allocation (scheduling) practice is dependent on the volume of water stored in the dam. Accurate measurement of the available water on a regular basis is important to determine the irrigable land size in the irrigation system. Technical skill is needed in the estimation of the irrigable land taking into consideration such factors as evaporation loss, dead storage, human consumption and animal consumption. Having determined the irrigable area, irrigators can then be informed in time as to whether they will receive water or not. They could also decide the type of crop to plant. Guesswork with respect to the allocation of water in Gum Selassa irrigation system had a detrimental effect on irrigators' water rights.

Horst (1998:36) writes 'irrigation projects are based on an assumed cropping pattern'. In Gum Selassa, where the assumed cropping pattern is not observed

either by the irrigators or the Agriculture Department, the available water could be either over or under utilized in the irrigation system.

The transport of water from a dam to the farms needs an efficient canal network to tackle problems such as water logging and soil salinity. The type of canal (cemented or earthen) contributes or minimizes, conveyance water loss. Soil salinity, for instance, has become a creeping problem in Gum Selassa because of water logging, mainly caused by seepage and/or over-irrigation of plots. Hence, farmers may need training in techniques of water management, irrigated agriculture, and conservation of resources.

Social effects

The third way in which irrigation technologies are socially relevant is in their social effects. Through such effects, for example, on crop production and people's health, irrigation affects people's livelihoods (Mollinga, 1998: 14-15). It is very important in irrigation that farmers get water on time with required quantity. The canal structure conveys the water to the fields. An ill-designed canal or dam limits farmers access to water. In Gum Selassa irrigation system, for instance, not all irrigators received water due to the fact that the canal slops up after irrigating certain farmlands. Thus, farmers who depended on irrigated farming faced difficulty in cultivating their plots, which threatened their livelihood. As Vincent (1997: 6) states, 'the technologies installed that mediate between natural supply and demand also have a major effect on supply, demand, negotiating power and relative scarcity'. Furthermore, unreliable water supply may have a negative effect on the management of an irrigation system. If farmers consider that the arrival of water in the canal is unreliable and quite unpredictable, or if they have not had any for a long time, their participation in water management could be curtailed.

It is important to view the development of small-scale irrigation from a livelihood perspective since as Guijt and Thompson (1994: 299) note, 'the degree of people's interest in, commitment to and willingness to invest in irrigation will depend on how it is perceived to enhance or diminish their lives'. Furthermore, Uphoff (1991:90) argues that 'where irrigated agriculture is profitable for water users, they have more stake in the activity and are likely to be more willing to co-operate in intensified management that 'pays'. (…) When, on the other hand, irrigation is a 'marginal' enterprise economically, there will be resistance on various fronts to allocating it more resources'.

Farmer's willingness to contribute to construction or to pay some of the costs is seen as a token of their commitment to irrigation; they will not, supposedly, contribute unless they see that they will benefit. Participation has frequently been deceiving; farmers contribute their time and material but do not maintain the irrigation works adequately or maximize the irrigation potential. In some cases

unwilling farmers were pressured by authorities to participate in the construction of micro-dams in Tigray, which was another form of corvee labor demanded by the authorities. Coerced farmers do not participate because they are not committed to irrigation, and so commitment is not sustained.

The dynamics of State intervention: some central concepts

Development intervention is an arena in which infusion of resources takes place in order to 'improve' or 'prevent' difficult situations (e.g. drought, famine, disease, alcoholism, soil erosion). As Long (2001:242) describes, 'arenas are spaces in which contests over issues, claims, resources, values, meanings and representations take place; that is, they are sites of struggle within and across domains'. In Ethiopia, for instance, a state sponsored resettlement program was carried out following the 1984/85 drought and famine that claimed thousands of lives. In the implementation of the settlement program, coercion, cooperation, resistance and rejection were all manifest.

Long and Ploeg (1989:230) argue that 'Intervention (…) implies the confrontation or interpenetration of different life-worlds and socio-political experiences, which may be significant for generating new forms of social practice and ideology'. An actor- oriented approach is useful then in understanding and analysing the process of change initiated by the government such as irrigation intervention and farmers' response. Farmers are not passive recipients of an intervention. Planners with linear thinking may assume that planned projects could get full acceptance on the part of 'beneficiaries'. But, as Long and Ploeg (1994:69) note farmers '…try to create space for their own interests so that they might benefit from, or, if need be, neutralize, intervention by outside groups or agencies'.

Long (1992:9) argues:

> *Applied to the field of development research, an actor-oriented approach requires a full analysis of the ways in which different social actors manage and interpret new elements in their life-worlds, and understanding of the organising strategic and interpretive elements involved, and deconstruction of conventional notions of planned intervention. Rather than viewing intervention as the implementation of a plan for action, it should be visualized as an ongoing transformation process in which different actor interests and struggles are located. Integral to this type of approach are two other crucial aspects: an understanding of the processes by which knowledge is negotiated and jointly created through various types of social encounter, and understanding of the power dynamics involved.*

Thus the interaction among social actors is dynamic and entails the shaping and reshaping of planned intervention. On the part of the 'target population' adoption, transformation or rejection of the intervention can take place. Such results are an outcome of power and negotiation among the social actors. The

concept of 'social interface' is important to explore planned intervention and irrigators' life-worlds. Long (2001: 177) defines '…social interfaces as critical points of intersection between different social fields, domains or lifeworlds, where social discontinuities based upon differences in values, social interests and power are found'. And Vincent (2001:67) affirms that 'the concept of 'social interface' has been used to explore the role and significance of irrigation infrastructure and institutions in social action, and the social interface of knowledge between irrigators and engineers'.

Agency and social actors

In understanding the life-worlds of social actors we must give weight to the meanings and motives attributed to events and relationships by the actors themselves. Furthermore, as Long (2001: 241) explains, 'social actors are all those social entities that can be said to have agency in that they possess the knowledgeability and capability to assess problematic situations and organise 'appropriate' responses. Social actors appear in a variety of forms: individual persons, informal groups or interpersonal networks, organisations, collective groupings, and what are sometimes called 'macro' actors (e.g., a particular national government, church or international organisation)'. In the context of irrigation intervention, the social actors include farmers, government and non-government bureaucrats involved in administration, agricultural workers, and agencies involved in dam construction and credit services.

Human agents are knowledgeable and capable of taking actions meaningful to their life. Agency commonly refers to the ability of actors to operate independently of the determining constraints of social structure. The concept of 'agency refers to the knowledgeability, capability and social embeddedness associated with acts of doing (and reflecting) that impact upon or shape one's own and others' actions and interpretations. Agency is usually recognized *ex post facto* through its acknowledged or presumed effects. Persons or networks of persons have agency. In addition, they may attribute agency to various objects and ideas, which, in turn, can shape actors' perceptions of what is possible. Agency is composed, therefore, of a complex mix of social, cultural and material elements' Long (2001: 240-241). Agency suggests not merely the ability to act, but to act in ways that demand the recognition and/or response of others.

Life-Worlds

Long and Ploeg (1994:64) argue that 'all forms of external intervention necessarily enter the existing life-worlds of the individuals and social groups affected, and in this way are mediated and transformed by these same actors and local structures. Also to the extent that large-scale and remote social forces

do alter the life-chances and behavior of individuals, they can do so only through shaping, directly or indirectly, the everyday life experiences and perceptions of the individuals concerned'.

As developed in the phenomenological sociology of Alfred Schutz (Schutz and Luckmann, 1974), the life-world is the taken-for-granted stream of everyday routines, interactions, and events that make up individual and social experience. 'Lifeworlds are 'lived-in' and largely 'taken-for-granted' social worlds centring on particular individuals. Such worlds should not be viewed as 'cultural backcloths' that frame how individuals act, but instead as the product of an individual's own constant self-assembling and re-evaluating of relationships and experiences. Lifeworlds embrace actions, interactions and meanings, and are identified with specific socio-geographical spaces and life histories' (Long, 2001: 241).

Livelihood and practices

The concept of livelihood has been defined in different ways. The dictionary meaning is 'the way by which one earns enough to pay for what is necessary' (Longman Contemporary English). Rennie and Singh (1996) explain that a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. These definitions mainly focus on the material resources and labour that are the basic components for the maintenance of livelihoods. Others view livelihoods as something more than the means of earning incomes. De Haan (2000:343) notes that 'livelihood is not necessarily the same as having a job and does not necessarily even have anything to do with working. Moreover, although obtaining a monetary income is an important part of livelihood, it is not the only aspect that matters'. Furthermore, Ellis (1998) states that 'a livelihood encompasses income, both cash and in kind, as well as the social institutions (kin, family compound, village and so on), gender relations, and property rights required to support and sustain a given standard of living'. Long goes on to stress that one should not focus only on material and labour resources but also on adaptive and coping strategies that individuals and groups employ to sustain livelihoods. Hence, he argues that 'livelihoods are made up of practices by which individuals and groups strive to make a living, meet their consumption necessities, cope with adversities and uncertainties, engage with new opportunities, protect existing or pursue new lifestyles and cultural identifications, and fulfil their social obligations' (Long, 2001:241).

According to Giddens (1976:75) the concept of practice involves 'regularised activities that take the form of habits, traditions or customs', and as Arce (1994:156) underlines, this entails 'analyzing the ways in which people operate in their everyday life'. Hence, the usefulness of concept of practice as applied to

irrigation that it 'enables us to assess how a particular type of irrigation infrastructure is related to particular actions of people' (van der Zaag, 1992:4).

Irrigated agriculture is one set of livelihood practices designed either by local people or government/NGO to enable crop production by removing 'the uncertainties inherent in reliance on natural rainfall' (Carter 1989:5). Guijt and Thompson (1994:294) argue that 'an environmental and socio-economic analysis of irrigated agriculture challenges us to come to terms with the complexity of local livelihood strategies in diverse and risk-prone environments. This, in turn, demands a redefinition of irrigation as a means to an end and not an end in itself'.

Understanding how irrigation fits into farmers' livelihoods is one of the important lacunae in irrigation studies. Many studies on irrigation development focus on the productivity of irrigation systems, but Chambers (1994:55) writes 'to my knowledge, livelihood thinking has been little applied to irrigation. Arguments for improving the performance of canal irrigation systems are usually couched in production terms'. Furthermore, feasibility studies of irrigation often exclusively consider the economic internal rate of return. Tiffen (1987:5) argues that: It is necessary not only to look at benefits to the national economy as a whole, but also to the costs and benefits created for the project beneficiaries and for the project administration'. Furthermore, Chambers (ibid.:50) believes that 'benefits from irrigation can be assessed in terms of its livelihood-intensity—the number of households enabled by irrigation to gain adequate and secure livelihoods'. The Kenyan experience of the Mwea irrigation settlement project, for instance, reveals that farmers were not able to generate sufficient income to sustain their families due to the high cost of farm inputs, particularly fertilizers and other agro-chemicals (Aluknoya, 1993). In irrigation intervention, due consideration should therefore be given to the various livelihood practices pursued by farmers before considering irrigated agriculture as a viable solution.

Power and authority

There have been many debates concerning the meaning of power, yet, as Waters (1994:218) notes, 'there is widespread disagreement about the meaning of power and its sources'.

Power is a crucial instrument of social and economic change and we need first to identify it as a relation rather than a possession that one might enjoy independently of others. Moreover, power implies much more than how hierarchies and hegemonic control demarcate social positions and opportunities, and restrict access to resources. Power, as Scott (1985) points out, inevitably generates resistance, accommodation and strategic compliance as regular components of the politics of everyday life.

Barnes sees power residing in the routines of social life and in the capacity for action which those routines represent. Barnes (1986:180) regards 'authorities as the passive agent of powers'. He goes on saying 'a power directs a routine, and directs it with discretion. This is the basis of power, the nature of the capacity to enforce something upon others' (…) whereas a power directs a routine with discretion, authority directs it without discretion. All those who direct routines routinely and automatically are thus to be thought of as authorities. Like powers they switch routines on and off, point them this way and that, combine them together or separate them off. But they do so in response to external indications; the basic pattern of their action is entirely the product of external constraint**.** Authority, then, is power minus discretion' (ibid.182). According to Barnes (1988:64) discretion 'is nothing more than the ability of an agent to act or to give a sign, which act or sign is followed by an appropriate change in the routine in question'.

In irrigation intervention water control is the central activity which determines irrigators' access to water. Mollinga (1998:28-29) identifies three dimensions of water control—*technical*: guiding-manipulating-mastering of physical process; *organizational*: regulation and control of human behavior, particularly with regard to the forms of cooperation necessary to make irrigation systems function; and *socioeconomic and political*: the conditions of possibility of technical and managerial water control. Mollinga argues that it is 'the concept of power that binds the three dimensions of water control together'.

Water rights are defined as 'authorized demands to use (part of) a flow of water, including certain privileges, restrictions, obligations and sanctions accompanying this authorisation, among which a key element is the power to take part in collective decision-making about system management and direction' (Beccar, et al 2002: 3). Water rights recognized in any form can be reconstructed due to state interventions including rehabilitation of irrigation infrastructure, land reform, resettlement and large-scale commercial farming (Bruns, 2000). In Hewane irrigation system, reconstruction of water rights took place due to the TPLF sponsored land redistribution in 1990.

In this thesis, the power of bureaucratic actors involved in the fields of hydraulic organization and political control is examined. As de Vries (1995:42) argues such 'intervention includes institutional models about how to deal with farmers, tactics for dealing with 'recalcitrant' and 'uncooperative' farmers, and strategies by which farmers cope with the state bureaucracy'.

In order to get to grips with such complexities, we need to indicate how issues of power, authority and intervention are to be approached in respect to irrigation and livelihoods. Long (2001: 242-243) provides a useful set of suggestions:

> *Power configurations are depicted in terms of the idea of interlocking actors' projects made up of heterogeneous sets of social relations imbued with values, meanings and notions of authority and control, domination and subordination, and sustained by specific patterns of resource distribution and competition (i.e., power construction). Power cannot simply be possessed or accumulated. Nor can it be precisely measured in terms of quantity or quality. It emerges out of social processes and is better considered a 'product' rather than a 'given'. Having power does not entail that others are without it: there is no zero-sum game. However, power may become reified in social life; that is, people often think of it as a unitary coercive force wielded by 'the ruling class', 'agents of the state' or 'establishment'.*

On the basis of this approach one can explore how various forms of state and non-state power are constituted and reconstituted in the settings and practices of everyday life. The approach also highlights the processes by which the relatively 'powerless' appropriate, manipulate and subvert outside authority in their struggles to defend and promote their own interests and 'projects'.

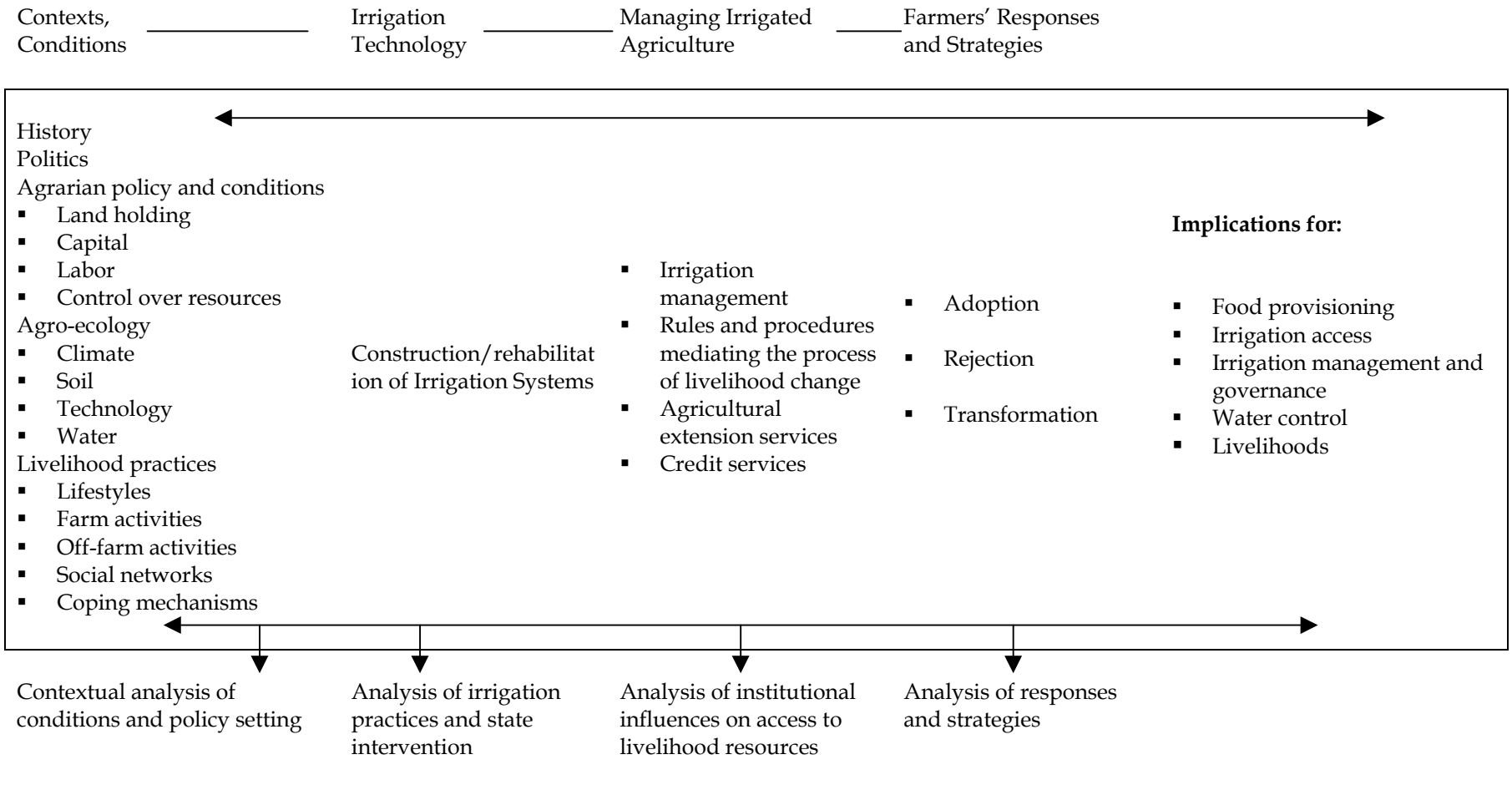
National institutions and objectives exert a pervasive influence on farmers' life-worlds. For instance, government social and economic policies and institutional arrangements, legislation, market, etc. may influence household livelihood strategies and can have durable effects on livelihood practices. I agree with Chambers (1983) that for adequate and decent livelihoods to be sustainable much depends on the policies that affect agriculture. Yet as Long and Ploeg (1989:234) point out: 'since it is seldom the case that evaluations question the whole idea of planned intervention and the rationality of planning, it is usually the farmer, environmental factors or the mysteries of distant commodity markets that are blamed for failure, not the package or the activities of the agency itself'.

As discussed in this thesis, concept of power and authority are used in the context of:

- irrigation practices;
- the enforcement of standardised agricultural extension packages and credit services; and
- the implementation of 'development projects' (e.g. irrigation, soil and water conservation).

Paraphrasing Latour (1986:264), Long (2001:17) emphasises 'the ability to influence others or to pass on a command (e.g. to get them to accept a particular message) rests fundamentally on 'the actions of a chain of agents each of whom "translates" it in accordance with his/her own projects' – and 'power' is composed here and now by enrolling many actors in a given political and social scheme'.

Figure 1.1 Interlocking Relationships and Actors' Strategic Actions in State Irrigation Intervention: A Framework for Analysis



1.3 The Research Questions

Based on the above theoretical discussions, the following central research question has guided this study.

How do state irrigation interventions interface with irrigators' life-worlds in a drought-prone region of northern Ethiopia?

The sub-questions are:

1. *What state interventions have taken place and how have they affected agrarian relations and irrigation technology choices in Ethiopia?*
2. *How is irrigated agriculture practiced, and what is the value of irrigated agriculture in the life-worlds of irrigators?*
3. *How do local government bureaucracies intervene in everyday irrigation management and irrigated agriculture and what are the key interfaces and arenas shaping interactions and outcomes between agencies and farmers?*
4. *What are the coping strategies in respect to drought and famine employed by local people, and what other food provisioning/livelihood strategies exist apart from farming?*

1.4 Methodological Considerations

In the implementation of irrigation intervention interaction takes place between the intervening actors, the government and non-governmental agencies involved in the irrigation development on the one hand, and the farmers (often called 'beneficiaries') on the other. Of particular concern is the issue of the institutional control, at farm, *tabia* (sub-district), district and regional levels of state officers of government bureaucracies and NGOs. In view of this, I was interested to investigate how actors adopted, transformed or rejected the irrigation intervention by adopting 'pragmatic moves' (Schutz and Luckmann, 1974). Such an approach enabled me to take into account social actors' reasons and the social context of action.

A case study method was employed to conduct the research. One of the characteristics of qualitative research is the use of case studies (Stake, 1995; Neuman, 1997). Yen (1989:13) states that 'in general, case studies are a preferred strategy when "how" or why" questions are being posed, when the investigator has little control over events, and when the focus is on contemporary phenomenon within some real-life context'. Thus, it was appropriate to undertake case studies that allowed me to investigate the life-worlds of farmers within the context of two irrigation systems. The approach taken was largely ethnographic, that is, it has been concerned with understanding social life and discovering how people construct meaning in

natural settings. I wanted to learn what is meaningful or relevant to the people being studied, and how individuals experience daily life. The methodology was designed to employ a variety of methods to capture different aspects of complex relationships.

Selection of the case study areas

Before I started my fieldwork, some friends and relatives asked me why I chose Tigray region as a research site. Even a close friend of mine suggested my birthplace, Wollo region, for carrying out the research. I could understand why they raised such questions. A good reason on their part was that since I do not speak Tigrigna, the local language, field interviews and discussions with local people might not be easily conducted. Coming from another ethnic group, I had to ask myself what would be the response of the farmers and government officials and employees working at all levels to my presence. Would I encounter bureaucratic red tape in the government organisations? Fortunately, I did not encounter either bureaucratic red tape or a cold reception from farmers in the field. The Tigrian farmers were willing to share their ideas and feelings. The local people showed me hospitality by inviting me for coffee during my long interviews with them at home. Through out my fieldwork I had three research assistants from the two *tabias* who speak Tigrigna.

The methodology designed for the study established a number of requirements for the selection of the case study area. Tigray region was preferred on a number of criteria: First, in order to understand the coping strategies of local people since the region is affected by recurrent drought and famine; and second, the presence of both longstanding river diversions and government-initiated irrigation systems. The locations, then, were suitable for exploring the role of irrigated agriculture in curbing drought-induced food insecurity at household level.

The fieldwork was carried out in two phases. The first phase was between January 2000 and September 2001. During this period visits were made to ten irrigation systems to gain first hand information about the implementation of irrigation development and management of the small-scale irrigation systems in Tigray. This was followed by the selection of two irrigation systems for further in-depth study. This second phase of the fieldwork was carried out between August to October 2002.

After staying in Addis Ababa for one month searching for literature on Tigray, I went to the regional capital, Mekelle, in January 2000. I stayed there for two weeks discussing with experts and officials in the Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray (Co-SAERT), Bureau of Agriculture and Natural Resources, and Mekelle University

College irrigation development in Tigray and the problems encountered. In the course of the discussions, I made a short list of micro dams and river diversions and conducted a preliminary visit to ten irrigation systems that helped me in the final selection of the two research sites. Finally, Hewane irrigation system (river diversion) and Gum Selassa irrigation system (micro dam) constructed by the regional government were chosen for detailed research. The selection was made on the basis of three criteria: age of the irrigation system, medium scarcity of water, and accessibility and proximity of the micro dam and river diversion. Hewane and Gum Selassa irrigation systems are located at a distance of 20 kms in Hintalo Wajirat Woreda (district), southern zone of Tigray, which is frequently affected by drought and famine. Research on two irrigation systems was considered necessary in order to understand whether there existed significant differences in the irrigation management or not.

Methods

Ethnographic interviewing

Interviews were carried out with various community members including women, priests, irrigators, *Abo mais* ('fathers of water'), engineers, executive committee members of the water users association and leaders of the women's association. Furthermore, development agents, supervisors, government and NGO officials were also interviewed in order to understand the policies and programs designed to increase agricultural productivity in the region. Interviews with informants also generated historical information concerning land distribution, landlords and peasants' relations and coping strategies with respect to drought and famine. All the interviews were undertaken with the consent of the informants and partly tape recorded and transcribed.

Participant observation

Participant observation was employed to observe relationships among people and events and the organization of people and events. I chose participant observation in order to gain an inside look at the life-worlds of farmers and operators and government agents. Extended observations were made by staying in the fields and villages with a view to understanding the day-to-day interaction of local people and their livelihood practices. I made observations and had discussions with farmers in various settings including residential quarters, farming places, water sources, *tela bet* (the local beer house) and markets to learn the day-to-day activities of individuals. I also attended irrigators' meetings to learn the problems encountered in irrigation management and implementation of the agricultural extension program.

Household interviews

The household interviews were carried out in Gum Selassa and Hewane irrigation systems to complement the information collected using the above mentioned methods. The purpose of the interviews was to collect data on individual experience on a range of issues including irrigation practice, agricultural production, off-farm activities, land issues, and organisation of labour, famine coping strategies and participation of women in agriculture. In addition, I collected detailed life histories with an interest in capturing how particular individuals understood and framed their own pasts.

The kinds of information gathered at household level included household composition, which consisted of an inventory of household members in terms of demography, occupations and migration. Regarding agriculture, household members were asked about access to land, either as plot owner or lessee, including both irrigated and non-irrigated lands and the reasons for leasing-out or leasing-in lands, farming practices, livestock holdings and labor organization. An attempt was made to collect the average yield in a year and access to markets for sale of agricultural produce.

A total of 60 people were randomly selected and regularly interviewed in order to build specific household case studies and life histories. Informants were broadly classified into two groups—cultivating plot holders and plot holders involved in *woferit* (sharecropping) arrangements.

Table 1. 1 Type of Informants in Hewane and Gum Selassa Irrigation Systems

Type of Informants	Number of Informants	
	Hewane	Gum Selassa
Cultivating plot holders:		
Irrigated and rainfed plots	8	10
Cultivating irrigated plots (women)	2	2
Rainfed plots	3	3
Hayfo plots	2	-
Involved in Woferit (sharecropping):		
Leased in irrigated plots	5	5
Leased out irrigated plots	5	5
Leased out plots (women)	5	5
Total	30	30

The first group included those who till their own land themselves and/or hire laborers. The second group were plot holders who do not cultivate their own plots but lease out to get a share of the harvest, and farmers who leased in plots.

Unless otherwise specified, all tabulated data presented in this thesis were collected thorough household interviews.

Secondary data collection
To understand the context of irrigation development and agrarian relations in the Tigray region, background data on land tenure systems, drought and famine situations, war and economic situation under different governments were obtained from various sources such as books, articles, records and reports of different government departments and NGOs.

1.5 Organisation and Contents of Chapters

The thesis consists of eight chapters. Chapter two presents a brief overview of agrarian policies, interventions, drought and famine conditions and irrigation development and technology choices under the present and former governments of the country.

Chapter three discusses the Hewane irrigation system highlighting how irrigation management is embedded in local government bureaucracies and the water management practices under past and current governments. This is followed by how water rights were reconstructed due to land redistribution in Hewane *tabia*. The negative impact of riverbank erosion on farmers' livelihoods cultivating both irrigable and rainfed plots and consequently emerging bee-keeping practices are also presented.

Chapter four is about the first irrigation system constructed by the current government, i.e., the Gum Selassa irrigation system. The chapter describes how Gum Selassa was established by pooling and redistributing farmers' land despite farmer opposition to the land redistribution. This chapter also discuses how irrigation management is embedded in local government bureaucracies, and how the socio-technically-mediated water scarcity threatened farmers' livelihoods.

Chapter five presents the practices of irrigated agriculture and its value in the life-worlds of irrigators; and how the government planned cultivation arrangements in Gum Selassa irrigation system have undergone a transformation from owner cultivated to leased out cultivation (sharecropping) and the implications of this for plot holders' food security.

Chapter six discusses coping strategies in respect to drought and famine employed by local people. In addition, local people's food self-provisioning strategies are examined to understand the relative importance of irrigated agriculture in the making of their livelihoods.

Chapter seven deals with farmers' 'participation' in development projects in general and in particular, in fertilizer intake. It examines how the diffusion of

fertilizer technology that was carried out by means coercive persuasion under the aims of Participatory Demonstration and Training Extension System (PADETES) contributed to farmers' distancing from irrigated agriculture through the decision of many not to purchase chemical fertilizer. The provision of credit services and the debt trap that farmers have encountered are also presented.

Chapter eight presents the main empirical findings and final conclusions of the study.

Notes

1 Drought-prone areas are those vulnerable to uncertainty in agrarian conditions due to the vagaries of the rainfall (Vincent, 1997:29).

2

An Overview of Agrarian Policies, Agricultural Planning and Irrigation Development in Ethiopia

2.1 Introduction

This chapter gives a brief overview of Ethiopia's agrarian policies and conditions, interventions and irrigation technology choices of differing regimes. The country has been under three distinct political regimes: the monarchy until the overthrow of Emperor Haileselasse in 1974, the *Derg* (military council) embracing Marxist-Leninist ideology (between 1974 and 1991) and the current government led by the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) since 1991.

The three regimes are generally characterized by 'feudalism', 'socialism' and 'market-oriented' modes of development. Each has had a direct impact on agrarian relations and brought changes to rural Ethiopia. But whatever policy adopted, Ethiopia has remained unable to feed adequately its people. The country has experienced drought and famine under all three regimes. The *Derg* government considered irrigation intervention as a 'drought proofing' strategy when the country was badly hit by the 1984/85 drought and famine, although the outcomes were not satisfactory (Dessalegn, 1999; MoWR, 2001).

The second section of this chapter introduces the country. This is followed by the presentation of agrarian policies, interventions, drought and famine conditions and irrigation technology choices during the three regimes in sections three, four and five. Section six, focuses on the promotion of small-scale irrigation in Tigray region, and outlines the key institutional actors involved.

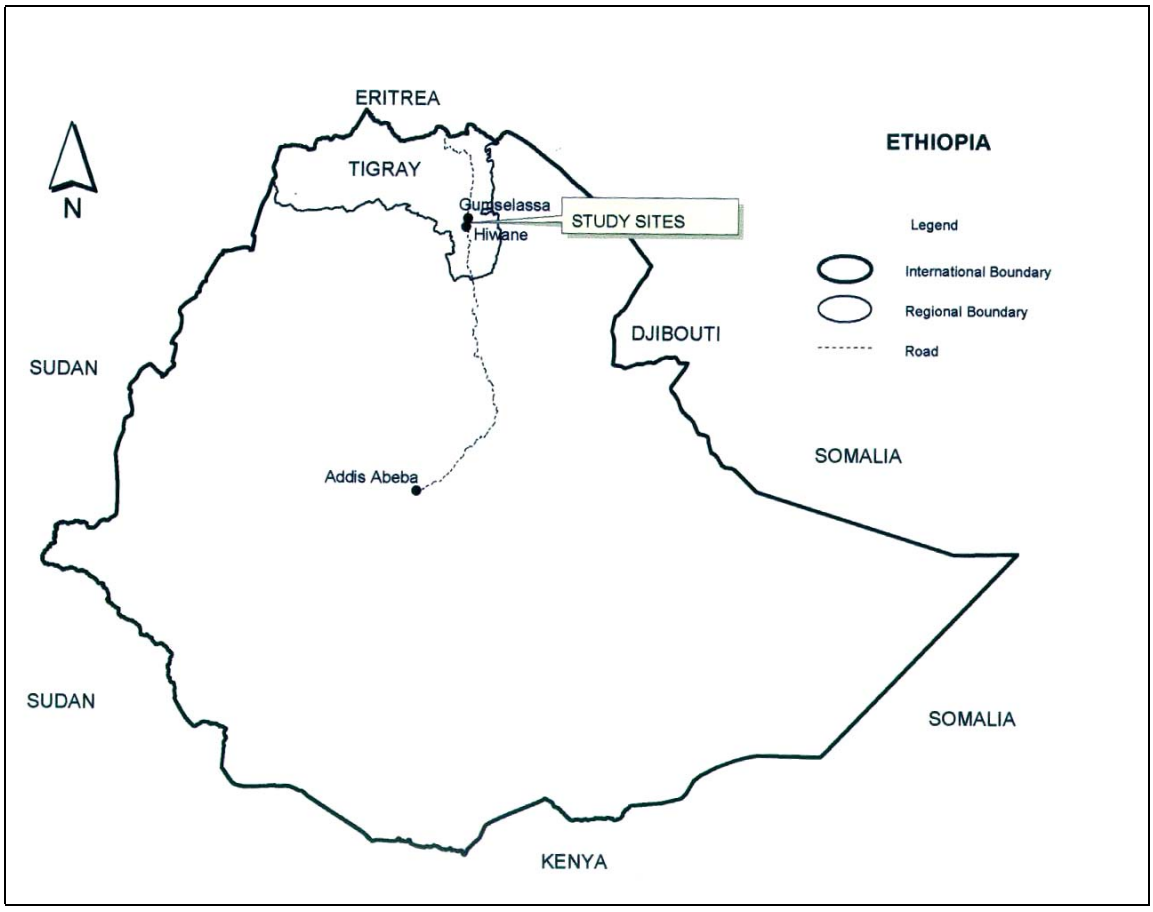
2.2 The Country

With an area of 1,127,127 square km, Ethiopia had an estimated population in 2001 of 65.8 million (World Bank, 2003:234). This population lives in three agro-ecological zones (Caldwell, 1992): the *dega* (highlands) area located at an altitude of 2300 meters and more, with cool temperatures; the *weyna dega* (mid-highlands) characterized by moderate temperature and altitude ranges from 1500 to 2300 meters, and the *kolla* (lowlands) area located between 500 and 1500

meters. The people do not only live in different agro-ecological zones, but also differ in ethnic composition, religion, language, customs and traditions.

The country is predominately agrarian with about 85 percent of the population living in rural areas, and depends on subsistence agriculture. The share of agriculture of the Gross Domestic Product (GNP) was 52 percent in 2001. The country is characterised by extensive poverty. On the basis of the international poverty line, 31.3 percent of the population live on below US $ 1 a day (World Bank, 2003:236-238)

Figure 2. 1 Map of Ethiopia Showing Study Sites



Ethiopia has two main seasons, *keremt* (wet) and *bega* (dry). The *keremt* season is the long rain period, which mainly lasts from June to September. The *keremt* rainfall is important to agricultural production. The *bega* season is dry, and extends from September to April. Although the two seasons are the main ones, a third period, which is referred to as *belg* (minor season) takes place from

February to June. *Belg* rainfall usually begins in January-February and ends in April-May.

The annual rainfall distribution varies from less that 100 mm along the border of Somalia and Djibouti to 2400 mm in the southwest highlands. Zewdie (1994:41) notes that 'the country's annual renewable fresh-water resources amount to some 110 billion m^3/year in the fourteen river basins. However, only 3 percent remains in the country. The remaining 97 percent is lost in run-off to the lowlands of neighboring countries'.

The country's irrigation potential[1] is estimated at 2.5 million hectares. The total area under irrigation is 197,100 hectares (MoWR, 2001). The size of area cultivated under small-scale irrigation systems is about 70, 000 hectares. Crops grown include cereals, vegetables and fruit, mainly for domestic consumption but with some surplus for cash. The small-scale systems are of significant benefit to the communities they serve.

Informal irrigation has a history of several centuries in some parts of Ethiopia. Individual and/or groups of farmers have attempted to harness the available water from small rivers, springs and large rivers in the flood plains. These systems cover relatively small and scattered areas and employ rather simple methods. The intake structures are often temporary, having to be replaced from time to time. Much of the diverted water is lost through canal seepage before reaching the fields and the field irrigation efficiency is quite low. The Ministry of Water Resources (1999) notes the disproportionate settlement of people as a main factor that places demands on the water resources of Ethiopia. About 80 to 90 percent of the water resources of the country are situated in the four basins located in western and south-western parts of Ethiopia with 30 to 40 percent of the country's population. On the other hand, over 60 percent of the population live in central and eastern parts of the country where 10 to 20 percent of the water resources are located. In addition, availability of water with the required amount and time remains low due to the erratic rainfall.

In the following sections I focus on the agrarian policies, irrigation development and agricultural planning under the Imperial, *Derg* and EPRDF-led regimes in order to understand the historical conditions that shaped agrarian relations in general and irrigation development in particular.

2.3 The Imperial Regime

Agrarian policy and conditions

Ethiopia is an ancient country with a long history and culture. Cohen and Weintraub (1975:ix) write that:

> *the long historical traditions of Abyssinia[2], the lack of sustained colonial experience, the patrimonial aspects of the polity and the effects of feudalism on the social and economic*

institutions make this country very different from those nations covered in most broad studies of rural development, such as Tanzania, Indonesia or Chile.

Although the imperial government attempted to modernise the country, feudalism was prevalent in many parts of Ethiopia until 1974. Land tenure issues were not dealt with at all during the period. This was an agrarian economy in which a vast peasant population surrendered its surplus to the maintenance of the ruling class and a large economically inactive priesthood. Different types of tenancy were practiced in Ethiopia before 1974. In the northern regions such as Tigray, Gojam and Begemeder the percentage of tenant farmers was not more than one third of the farming population where kinship and village land tenures prevailed. In the southern regions the concentration of absentee landlords was high, and the majority of the farmers who did not own land worked as tenants. The expansion of Emperor Menilik II into the south of Ethiopia at the end of the 19th century enabled him to control large tracts of land and to distribute some to his soldiers and loyal followers.

Table 2.1 Percentage of Tenants in Total Farm Population and Percentage of Total Area Cultivated by Tenants, 1963-67

Administrative region	Tenancy wholly rented		Tenancy partly rented		Total tenants	
	Farm Population	Area	Farm population	Area	Farm population	Area
Arssi	45	51	7	11	52	62
Begemeder	9	1	6	1	15	2
Gamogofa	43	46	4	6	47	52
Gojam	13	-	7	-	20	-
Hararghe	49	46	5	15	54	61
Illubabor	73	62	2	4	75	66
Keffa	59	67	3	4	62	71
Shewa	51	55	16	17	67	72
Sidamo	37	35	2	1	39	36
Tigrei	7	7	18	6	25	13
Wollega	54	49	5	5	59	54
Wollo	16	14	16	25	32	39

Source: Ministry of Land Reform and Administration, The Major Features of Prevailing Land Tenure System in Ethiopia, Addis Ababa, 1971.

The land tenure systems in Ethiopia were some of the most intricate, and most difficult to understand. This is mainly because of the ecological, cultural and ethnic diversity found in Ethiopia, all of which produced differing tenure relations and land holding patterns even between neighbouring small regions (Cohen and Weintraub, 1975; Gilkes, 1975; Markakis and Nega, 1978; Pausewang, 1990). A full discussion of land tenure systems in Ethiopia is

beyond the scope of this chapter. Thus, a brief description of the five principal and tenure systems (Cohen and Weintraub, 1975) - kinship, village, private, church and government - is presented in Box 2.1.

Box 2.1 Brief Description of Land Tenure Systems (pre-1974)

Kinship tenures: Rist and gult were the two types of kinship tenures in the northern Ethiopia. They were found mainly in Tigray, Gondar and Gojjam. Rist was the right to claim a share of land based on kinship with an historical ancestor held in common with other rist holders. The rist holder had the right to lease all or part of his land. In gult, one was entitled to all or part of the wealth, which the occupant within the area of his gult normally transfers to the state. Rist gult grants in the north tended to go to important members of the royal family, court favourites, or influential provincial nobles. And, they tended to cover large areas of land inhabited by many farming peasants.

Village tenures: Under this system particular tenures, known as sehena were held to be the common property of a local area, either through the village, the parish, or both. Unlike rist or risti tenures, family relationship played no official part in the allocation of land to individuals. Rather claims were based on residence, with each member of the community entitled to an equal share of the land. The plot holder cannot sell or give it away.

Private tenures: Areas of land essentially held in freehold by individual owners were known to exist in the north, but it is in the south that private tenures predominate. Roughly estimated, 35 percent of the Ethiopian population lived in kinship or village areas, and 65 percent in private tenure areas. The private tenures in the south were created when the crown confiscated land conquered by its armies and granted vast blocks to a wide range of people and institutions.

Church tenures: The Ethiopian Orthodox Church and leading clergy held a great deal of land under a variety of tenure arrangements. The holding of church land extended from major religious institutions and officials down to the smallest rural churches or monasteries and the local clergy serving them. However, aristocrats and provincial gentry have also transferred land to local institutions and officials. The church holdings were no more than five percent of the total land, but 20 percent of the cultivated land of Ethiopia.

Government tenure: The imperial government held about 46.6 percent of the total land of Ethiopia. Much of this land was located in remote regions difficult to exploit. A large percentage of the total holdings have been the historical pasturage of nomadic people. However, the government had continually assumed that all nomadic lands belong to the government. The 1955 constitution rendered all land not held or possessed in the name of any person, natural or juridical, to be in the state domain.

Source: Cohen and Weintraub (1975:28-47)

In general the peasant class worked on the feudal lands of absentee landlords and paid taxes and tithes on their own land to maintain the church

and state above them. Peasants had a weak bargaining position since landlords dictated the tenancy terms (Makonnen, 1987).

Box 2.2 Land Tenure Constraints (pre-1974)

- *The struggle for land units in the tenure of kinship and village systems led to extensive litigation. In addition, occupants were reluctant to improve their fields because kin would claim one's share of the family lands at any time.*
- *Diminution and fragmentation of plots took place. The average cultivated area by household, for instance, in Tigray and Gojjam was 1.02 ha and 0.93 ha respectively. Fragmentation of land had high costs as time was wasted travelling from plot to plot.*
- *Tenancy was not a major problem in the north compared to the south. Most of the tenants in Ethiopia were sharecroppers. In the south since most farmers were tenants, tenancy was a major constraint to increased peasant production. There were many forms of rent arrangements, depending on the share of the crop demanded by the landowner and the inputs contributed by him towards production. The major rental forms ranged from one-third to half of the harvest after the tenant has paid asrat, one-tenth of the total production to the landowner. The tenant supplied his own seeds, oxen, and farming implements and the landowner supplied land.*
- *Lack of security: There was seldom a written lease, and in almost all cases the tenant had no protection from arbitrary or sudden eviction.*
- *Government land grants: In most cases gentry, civil servants, and military or police officers rather than landless peasants received land from the government as a reward for service and loyalty without any conditions being placed on its use. About 95 percent of the registered land grants and 75 percent of the unregistered land grants went to members of civil servants, military and police officials and other elites, whereas 5 percent of the registered land grants and 25 percent of the unregistered land grants have gone to the landless or unemployed citizens.*

Cohen and Weintraub (1975:47-61)

The conditions were made worse by the fact that landlords usually made verbal agreements with tenants and reserved for themselves the right to end such agreements at any time. There were an increasing number of landless peasants willing to replace any dissatisfied tenant. Eviction was a common practice. Peasants were persistently at or below subsistence level because their meager production was constantly flowing out in the form of tax, rents, debt payments, and forms of bribery and extortion. In these circumstances of marginal living there was little surplus for sale and peasants therefore had no potential for raising the productivity of their lands through some form of investment. There was little alternative to remaining dependent on traditional methods of

production. Most peasants remained outside the market economy partaking in few cash transactions and incapable of commercialising their farms.
A landless agricultural labouring class was beginning to emerge, especially in the southern provinces working on larger mechanised modern farms, which were often foreign owned.

In the 1950s, the imperial government introduced a centrally administered development plan in Ethiopia for the first time. The twenty-year development program envisaged changing the Ethiopian economy from a backward and predominantly agricultural one to a modern and efficient agro-industrial one.

The first Five-year Development Plan (1957-61) sought to develop infrastructure, particularly transportation, construction, and communications to link isolated regions, which constituted the main physical obstacle to the intended economic development.

The evaluation of the First Five-Year Plan indicates how agricultural production lagged behind because the imperial government gave priority to non-agricultural activities in the plan period.

> *It should be noted that the total anticipated plan investment was surpassed by 24 percent. However, housing and transport and communications, which actually do not contribute directly to the growth of the economy, received the largest share close to 60 percent of total investment. On the other hand, the directly productive sectors, such as agriculture, mining, and manufacturing received lowest priority and this was in fact the main reason why the national target, foreseen by the plan, was not reached during the extended plan period. (…) the greatest attention was devoted to the improvement of coffee cultivation (…). Cereal production could not meet the growing demand of the population, so that Ethiopia became an importer of wheat (…), instead of being an exporter, as she was 5 or 6 years ago (IEG, 1962:43-45).*

The Second Five-year Development Plan (1963-67) emphasized the significance of general consumption. The plan document states that:

> *in the prevailing Ethiopian circumstances where there is no shortage of food and climatic conditions are favorable, but educational, health and other social services are lacking, general consumption must be given priority. Such a policy is not only justified from the point of view of the overall national progress; it is also being supported by the desires of the population, particularly the rural people, who consider education and medical care as a sign of progress and better future (ibid: 89).*

Although education, health and other social services were important, what was the pressing need of rural people? The government notes the importance of a land reform program in the Second Five year Development Plan.

> *The execution of Land Reform with the final aim of realising the proclaimed principle that "the fruits of the farmer's labour must be enjoyed by him whose toil has produced the crop", should be considered as a composite part of the measures for the development of peasant*

> *agriculture. The execution of the first phase of Land Reform during the Second Plan is, in fact, a sine qua non for the successful application of other measures' (ibid: 119).*

Furthermore, the Third Five-Year Development Plan states that:

> *The need for vigorous policies of land reform is, as has already been stressed, evident. Very little progress in agrarian reconstruction and development, particularly in peasant agriculture, can be made under the existing condition of tenure and farm size. The immediate concern of land reform is to overcome the apathy of the agricultural population, caused by traditional inequitable land tenure patterns, concentration of land ownership in a small group, insecurity of tenure, and exorbitant rent or share cropping arrangements (IEG, 1968: 195).*

However, for the imperial government, while stating the importance of land reform in the country in the two plan periods, the development priority was rapid expansion, particularly in the modern commercial sectors of farming and livestock. This was essential in order to secure the maximum short-run impact on production and supply for the cities, as well as for export markets.

In the Third Five-Year Development Plan, policies for peasant agriculture were designed in 'package programs'. The government adopted a policy that focused on strategically selected areas in which 'good results' could soon be seen. Thus, three regional projects were launched: Chilalo Agricultural Development Unit (CADU) in Arussi province, Welamo Agricultural Development Unit (WADU) in Sidamo province, and the southern livestock region. CADU and WADU were established in 1967 and 1970 respectively. The program was known as a 'package programme' which meant a policy of concentrating development efforts, in given areas of not too great a size, utilising all the material and human resources required to change traditional and inefficient methods.

The above schemes intended to support smaller farmers were initiated in the southern provinces, designed and implemented by foreign aid agencies, and run by the Extension and Project Implementation Department (EPID). These programmes provided planning, credit, storage and marketing facilities, price stabilisation, extension services and some mechanisation. The progress in production was impressive but, as other results of the program became clearer, the funding and implementing agency involved, the Swedish International Development Agency, threatened to withdraw its assistance because of the unintended outcomes. Schulz (1976: 8) points out the limitations of CADU:

- difficulty of duplication because of high costs and needs in trained manpower;
- increase in regional inequalities;
- low attainment of farmers in the lowest income quartile;

- unintended negative social consequences such as growing rates of tenant eviction.

Although agriculture is the main stay of the Ethiopian economy, the imperial government did not give due attention to transforming it on a large scale. Bequle and Eshetu (1969:48) note that 'a review of the Ethiopian budget expenditure over the past two decades indicates that the budget expenditures of the Ministry of Agriculture have never exceeded 5% of the total budget, and that often it varied between 1 and 2%'.

In short, Cohen and Weintraub (1975:2) conclude that 'the reason Ethiopian development strategies have not focused on peasant production rests on complex interrelationships between land tenure, economic interest and political power. In particular, …land tenure patterns are constraints to peasant production, … agrarian strategies cannot be widely pursued without reforming these patterns, and that such reforms constitute a substantial threat to those central and provincial elites who dominate all sectors of Ethiopian society'.

Drought and famine

In all the above mentioned development plans of the imperial government, the problem of drought and famine in rural Ethiopia was never mentioned. In addition to the failure of development strategy, natural calamities have constantly compounded the problems of rural people.

Famine and food shortages have a long history in Ethiopia, although the attributed causes and severity are not well recorded. The drought and famine affected zones concentrate in the north-eastern regions of Ethiopia, namely Wollo, Shewa and Tigray. During the imperial regime, between 1953 and 1974 there were famine and food shortages in Tigray, Wollo, western Ethiopia and Eritrea several times. The historical records at national level show 39 periods of food shortage and excess mortality or both, and in Tigray alone these occurred ten times. The 1971-1975 drought, for instance, caused 250 thousand people to die and fifty percent of the livestock was lost in Tigray and Wollo. (Webb et al., 1992).

It is well documented how the imperial regime neglected the drought-affected people in the northern part of Ethiopia (Shepherd, 1976; Mesfin, 1986; Kissi, 2000). The Governor-General of Tigray, for instance, reported a two-year old crisis to the Ministry of Interior by arguing 'how can we passively watch when human beings, created in the image of God, are thrashed to death by starvation'. However, the Prime Minster disclosed to the concerned government bodies that relief grain was obtained from the United States but only thirty-two months after thousands of people had died because of famine (Mesfin, 1986).

So why did the imperial government ignore this glaring problem of drought and famine in the country? Kissi (2000:113-114) reveals that,

> *the imperial Ethiopian government (the IEG) was well aware of the outbreaks of famine in the Ethiopian empire and the precarious conditions in which the peasants lived. But the government pretended to be unaware of these problems. Instead, it chose to present Ethiopia as a bountiful nation capable of feeding itself and its neighbors. It did so for political and diplomatic reasons. In the 1950s atmosphere of decolonization in Africa, Ethiopia served as a major symbol of independence and pride for Africans on the continent and in the Diaspora. Consequently, the IEG viewed famine in Ethiopia as an embarrassment and a blemish on national dignity. The negative meanings IEG attached to famine led it to deny that famine was a serious problem in Ethiopian society.*

Irrigation development and technology choice

Rainfed agriculture is the dominant form of farming in Ethiopia. Government intervention in irrigation development is a recent phenomenon, though the first government advice given to farmers to construct canals and sow seeds and plant vegetables to mitigate the looming drought effects was in 1928 through the issuing of the following proclamation.

> *Gizew dirk hono lesebel yemiasega bemhonu awaj. Megabit 8 ken 1920 (E.C)*
>
> *Bealfew zemen sebel metatat senazen yehw zendrom gizew endamenaw lemhon yemiasega honalena ahun sele dirkum wode egziabher ezen. Mesnom eyawetah ehel zera atakelt tikel. (Mahetemselasse 1942: 532)*

A proclamation for the current drought that would threaten crop production. 1st of March 1928

> *While we were sad at losing crops last year, this year also has become fearsome like the previous. Now pray to God. Construct irrigation canals; sow seeds and plant vegetables.*

Although traditional irrigation was practised in the highlands for centuries, it was only in the early 1950s that modern irrigation technologies were adopted in large private and government-owned schemes, primarily in the Awash River Basin. Surface irrigation with mainly furrow irrigation had been in practice for cotton and fruit production. Most of the early schemes were pump-irrigation projects, but later gravity irrigation schemes were introduced (FAO, 1997).

The imperial government was much interested in modernising the agricultural sector by inviting foreign investors to develop large-scale irrigation projects particularly in the Awash valley. The early planned small-scale irrigation intervention made by the Ethiopian government was an attempt to settle the Afar pastoralists living along the Awash Valley in the 1960s when the government decided to give the grazing land to local and foreign investors to promote commercial irrigated farming (van Lier, 1970). The Afar settlement

schemes were not successful for various reasons including the poor participation of the Afar settlers in agricultural activities, and the fact that a large proportion of the irrigated land remained uncultivated, and the settlers were unable to feed themselves, and as a result, they became dependant on food relief (Tadesse, 1988).

2.4 The Derg Regime

Agrarian policy and conditions

The 1974 Revolution was a turning point in Ethiopian history. This was the time when a few army officers toppled Emperor Haileselassie who had ruled the country for nearly half a century.

The *Derg* regime (Provisional Military Administrative Council) was established in 1974. The first immediate task of *Derg* was the preparation of land reform legislation to satisfy the land hunger of the peasantry by making land the collective property of the Ethiopian people. And above all, it was reasoned, the programme should be one that would enhance further the full participation of the Ethiopian peasants and accelerate the efforts of rural construction.

The proclamation for the nationalisation of rural lands made land the collective property of the Ethiopian people. Tenancy relationships were abolished. The government cancelled debts to landlords and allowed tenants to use oxen and farm implements previously owned by their landlords (PMAC, 1975). Land reform led to structural changes within the agricultural sector. The post-reform structure depended on the ideology of the government. In the Ethiopian case, attention was paid especially to the politicisation of the peasantry, the establishment of peasant and other associations, and the distribution of land on the basis of the proclamation. Peasants clearly accepted voluntarily the structure of the rural transformation as outlined in the 1975 proclamation. Thousands of peasant associations were formed embracing millions of peasants. Besides, over 80 percent of the peasant associations and their members joined service co-operatives.

In line with the radical land reform, the *Derg* embraced a Marxist-Leninist ideology. It was engaged in the promotion of collectivization, villagization, forced resettlement, compulsory grain procurement, and control of grain marketing and pricing. The government, in other words, tried to transform agrarian relations through state intervention, collectives, and communal living.

Central planning was adopted as the main instrument in the management and guidance of the socio-economic transformation of the country. Up to 1984, six annual plans, popularly referred as "*Zemechas*" (campaigns), were prepared and executed. The need for the Ten-Year Perspective Plan (1984/85–1993/94)

was crucial since the limited time frame and concern for current problems of annual plans could not bring about a structural transformation of the economy (ONCCP, 1984). The Ten-year Perspective Plan was ambitious and pervasive penetrating all regions and all sectors of the Ethiopian society. The plan identified the following priorities for agriculture:

- the cooperativiztion of peasants and expansion of agricultural extension services;
- the expansion of irrigated farming which would permit the realization of dependable and adequate domestic food supplies and enhance the country's export capabilities;
- raising the quality of livestock through breeding and the provision of veterinary services and improved pastures. (ibid.:40-41)

The government encouraged farmers to establish service and producers' cooperatives by issuing a series of proclamations and directives. During the Ten-year plan period most of the private farmers were expected to join the growing number of producers' cooperatives. By the end of the ten-year plan (1993/94) 15.3 thousand producers' cooperatives with 4.1 million members was the target. These members would amount to 53% of the total farming population (ibid.: 82).

The promotion of cooperatives on the part of the government was underpinned by the belief that small farmers were inefficient and were unable to take advantage of economies of scale. A three-stage development of cooperatives was set out. The first stage was the *melba*, an elementary type of cooperative which required members to pool land, with the exception of plots of 2,000 square meters which could be used for private use, and to share oxen and farm implements. The second stage was *welba* where members should transfer their resources to the cooperative and reduce the private plot to 1,000 square meters. The third stage, *weland*, required the abolishment of private land use and the practice of mechanized farming. Members obtained income on the basis of their labor contribution. The government provided a number of inducements to cooperatives such as credit priority, improved agricultural inputs (e.g. fertilizer, improved seeds) and a low rate of land use fees. Peasants who were not members of cooperatives were required to pay 10 *birr* annual land use fee, while members of cooperatives paid 5 *birr* without considering the location of farm and level of soil fertility (Eshetu, 1990).

By the end of the ten-year plan period the share of private farmers in overall crop production and area under cultivation would be greatly diminished. The area under private holdings would decrease from 6.6 million hectares in 1983/84 to 3.5 million hectares in 1993/94. The main reason for this expected

drastic decline was that most of the individual holdings would be changed to collective ownership (ibid.:83).

However, the progress in collectivisation was quite disappointing. Farmers were resistant to the idea of collectivisation since they saw the move to co-operatives as a prelude to the destruction of their 'family farms'. Data compiled in 1987/88 reveal that the share of producer's co-operatives was only 5.3 percent of total cultivated land; 6.3 percent of overall agricultural production, and that peasants organised into producers' co-operatives constituted 3.3 percent of the farming population (Mengistu, 1986). In short, the basic shortcoming of the government's programme of cooperativisation was that it was premised on the assumption of the superiority of large-scale over small-scale farming, a supposition whose validity was by no means established.

Table 2. 2 Wholesale Prices of Grain, Addis Ababa Grain Market*
(*birr* per quintal 13.3.89 – 13.3.89)

Grain type	AMC farm-gate price	AMC selling price	Free market average price
Teff			
White	48.00	69.55	124.83
Mixed	41.00	61.90	112.00
Red	37.00	57.55	93.67
Wheat			
White	36.00	57.55	110.67
Mixed	32.00	53.15	74.00
Black	31.00	52.10	67.83
Barley			
White	30.00	49.90	115.00
Mixed	28.00	47.70	63.50
Maize	22.00	44.45	52.00
Chick peas	30.00	49.90	135.67
lentils	45.00	66.30	186.50

*called "*ehel berenda*"in Amahric
Source: Eshetu, (1990:95)

Table 2.2 shows the price differential and disadvantages faced by farmers when selling their agricultural produce. Farmers were under the obligation to sell their agricultural products to the Agricultural Marketing Corporation (AMC) established by the government to influence the supply and price of crops. Eshetu (1990:94) notes 'quotas allocated per farmer per year range from a low of 0.02 quintals in Gofa and Wolaita *awrajas* (again not grain-growing areas) to a high of 3.13 quintals in Chilalo'.

The government also engaged in the expansion of state farms. It was planned to increase these from 221 thousand hectares to half a million hectares by the end of the plan period (ONCCP, 1984:81). State farms were given priority in the provision agricultural inputs over smallholder farms. Keller (1992:618) notes that 'state farms consumed about 82 per cent of all imported fertilizers, almost 75 per cent of the hybrid seeds that were distributed annually, and more than 80 per cent of the subsidized credit. In addition, they were paid about 20 to 50 percent more than peasants for their produce'.

Furthermore, the *Derg* regime was committed to building socialism by resettling the scattered rural people in villages. President Mengistu declared the role of villagisation in building socialism by criticising the existing settlement pattern. He said:

> *The scattered and haphazard habitation and livelihood of Ethiopian peasants cannot build socialism…. Insofar as efforts are dispersed and livelihood is individual, the results are only hand-to-mouth existence amounting to fruitless struggle and drudgery, which cannot build a prosperous society' (quoted in Scott, 1998:247).*

The goal of the government was to move about 33 million rural residents into villagized settlements by the end of the Ten-year Perspective Plan. The government managed to move 12 million Ethiopians to the newly built villages by mid-1988 (Alemayehu, 1990:136). Residents in the various areas challenged villagisation by avoiding it if possible and drifting back to their lands clandestinely. The creation of communal villages and the efforts to foster collective production further disrupted the rural areas but without substantially changing relations of production.

The *Derg* reforms failed then to elicit the anticipated broadly based liberation of rural productive forces and a corresponding increase in the rate of the country's economic development. As available data indicate, the growth in agricultural production consistently declined from 1984/85 to 1988 at an annual average rate of 0.4 per cent while the annual rate of population growth reached three percent (Mengistu, 1988).

As the economy collapsed and discontent increased in the 1980s, the government began to change course. On March 5, 1990, President Mengistu announced the adoption of a mixed economy in which private and public sectors would play complementary roles, and the failure of the Marxist economic system. However, the introduction of the new policy was too late to curb the problems of the country.

Dessalegn (1994) describes *Derg's* policy management as 'interventionism' and 'statism'. By adopting central planning as an instrument to guide the economy, the government was designing projects and programs at the centre.

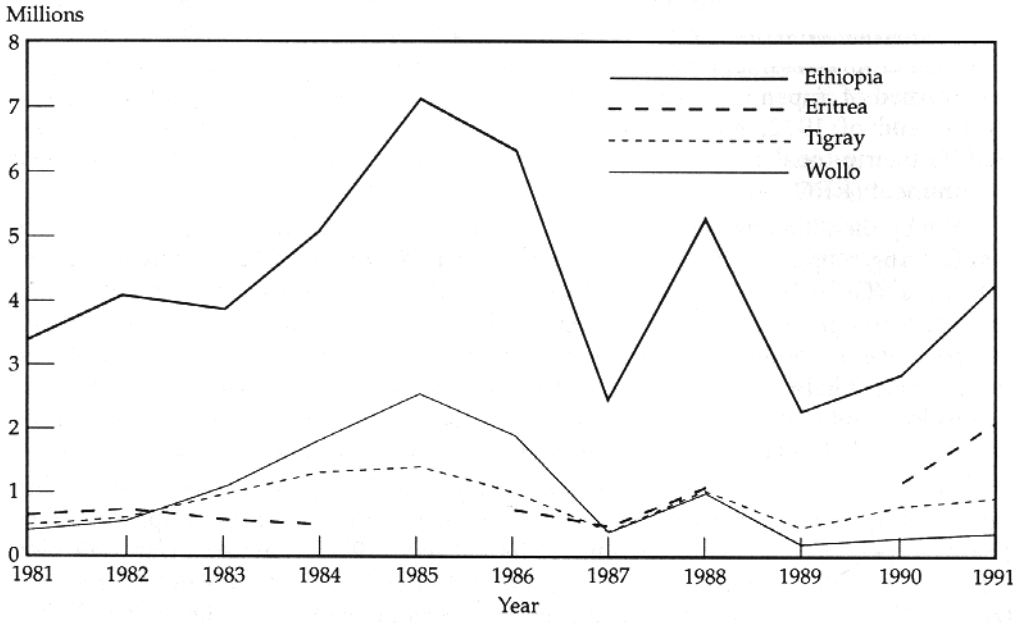
In a top-down approach, 'beneficiaries' were expected to accept the projects simply because the government had initiated them.

Although failure of the rural development strategy could be considered the main cause of the widespread poverty of the country, the civil war waged for decades in Tigray and Eritrea and famine and food shortages also aggravated the condition of the rural people under the Military government.

Drought and famine

The *Derg* government assumed power while drought and famine claimed thousands of lives in northern Ethiopia. The downfall of the imperial regime was, in part, due to the 'hidden famine' of Wollo. The first urgent task for the newly established military government was to strengthen the Relief and Rehabilitation Commission that was established in March 1974.

Figure 2.2 Estimated Drought-Affected Population for Selected Provinces, 1981-91



Note: Line breaks indicate that no data are available for that period.
Source: Webb, et al.(1992: 28)

The commission was responsible for coordinating both domestic and international aid for the relief of famine victims. The international community started to respond to this human tragedy. Aid began to pour into Ethiopia and funds and materials were collected and distributed, and the disaster was gradually brought under control.

Although the country had faced food deficits over many years, the major drought and famine that took place in 1984/85 all over Ethiopia affected close to 20 percent of the population. The most affected provinces were Wollo (71.6%), Tigray (59.3%) and Eritrea (30.6%) (Cladwell, 1992:147). The government, together with the international community, attempted to respond to the problem. A major response in addition to food relief was the resettlement of affected people in the more fertile parts of the country.

One of the objectives of the agricultural sector was to intensify the resettlement of persons displaced by disasters. Settlement farms were planned 'to generate employment for those persons affected by natural and man-made disasters including persons who cannot make a living from an ecologically disrupted locality and persons displaced by government initiated projects' (ONCCP, 1984:84).

The government managed to resettle 600,000 people, mainly from Wollo, Tigray, Shewa and Gondar in west and southwest Ethiopia (Pankhurst, 1990). The implementation of the resettlement plan was criticised by local and international communities. The criticisms focused on the element of coercion, forced separation of families, and lack of social services in resettlement centres that forced many settlers to go back home before and after the fall of the *Derg* regime.

Irrigation development and technology choice

In many countries the failure and inefficiencies of large-scale irrigation systems have resulted in the shift of attention to small-scale irrigation systems assuming their cost effectiveness and manageability by local people. However, in the Ethiopian context small-scale irrigation intervention on the part of the Ethiopian government took place mainly because of the 1984/85 drought and famine that affected millions of Ethiopians (Dessalegn, 1999).

In the Ethiopian context, irrigation systems are classified on the basis of size. Small-scale systems cover an irrigated area of less than 200 hectares, growing primarily subsistence crops. Irrigation systems between 200 and 3000 hectares are medium and large systems cover an area of 3000 hectares or more. The small-scale irrigation schemes fall under the general authority of the appropriate peasant association, whose members are expected to contribute to construction and maintenance efforts (Zewdie, 1994).

In the Ten-year perspective plan, an irrigation development program was included as one of the major agricultural projects, although it was planned to cultivate some 13 thousand hectares with medium and 113 thousand hectares with large-scale irrigation systems (ONCCP, 1984). In addition, the Ministry of Agriculture was made responsible for the development of small-scale irrigation.

In 1983 the Irrigation Development Department of the Ministry of Agriculture was put in charge of the initiation, study, design and construction of small-scale irrigation systems. Between the mid 1980s and 1991 the department constructed and rehabilitated 35 small-scale schemes, of which nearly one-third were formerly traditional schemes used by peasants. Later in 1994 the department was dissolved (Dessalegn, 1999).

In Ethiopia, small-scale irrigation systems have encountered numerous problems. Anderson and Flynn (1989:198-199) report the following:

- poor canal alignment, longitudinal slopes, and cross section;
- complete blocking of the river by weirs constructed from stones, earth and timber;
- lack of intake structures to control both the amount of water taken out and also to prevent floods entering the system;
- water abstractions were not related to the water needs of the crops, thus the [sic] water diverted in almost all cases exceeded need;
- land levelling and cultivation practises under rainfed and irrigated conditions have remained the same. Farmers do not understand the differences between flood irrigation and rainfall and consequently erosion, water logging, and moisture stress can sometimes be seen within the same irrigation plot; and
- no control structures were provided to reduce erosion in field channels and to measure and control water use and no surface drainage or gully crossing were provided.

In a government-sponsored national irrigation policy and strategy workshop in 1990 it was reported that almost all the irrigation schemes initiated in the past were functioning below anticipated targets. The core cause of this problem was that farmers were reluctant to participate in irrigation development activities (ONNCP, 1990). So what was the cause of this reluctance on the part of farmers? Most smallholder farmers were not willing to become involved in irrigated farming by taking land from the *Derg* government because they were required to form producer co-operatives, which the government considered the most important rural institution for bringing about socialism in Ethiopia. Producer co-operatives were unwanted organisations among farmers in Ethiopia (FAO, 1994).

Dessalegn (1999:12) also notes that '*Derg* almost destroyed traditional irrigation schemes by confiscating them and handing them over to producer co-operatives'. Furthermore, he (1999:14) argues that, 'the management of the projects themselves were in the hands of party or government functionaries, and not in the hands of beneficiaries. The irrigation schemes lacked operational autonomy, and there was no sense of ownership on the part of the beneficiaries. Because of the association of irrigation with collectivisation, many peasants

shunned irrigation and remained suspicious and reluctant to return to it even after the fall of *Derg'*.

Box 2.3 Irrigation project that did not materialise over 14 years

On 13th March 2001, I watched 'aynachen' (our eyes), the weekly Ethiopian television program, about the Agereb irrigation system under construction located in the Afar region, in the eastern part of Ethiopia. It was planned to settle 1200 pastoralists by introducing pump irrigation technology to cultivate 3000 hectares of land in two phases using the Awash River. The construction work was started in 1987 by the Ethiopian Water Construction Works under the supervision of the Ministry of Water Resources Development. The estimated project cost was 10 million Eth. Birr.

The sad story is that the construction of the irrigation project has not been completed over the past 14 years. The project cost has passed 20 million Eth. Birr. The pastoralists did not receive either land or irrigation infrastructure. The constructed canals are damaged since they have not been in use for the last 14 years. The three government organisations responsible for the completion of the project are the Agriculture Bureau of Afar Region (the one which should receive the project after completion), the Ministry of Water Resources Development and The Ethiopian Water Construction Enterprise. The journalist who prepared the program interviewed the officials responsible in the three government agencies to ask them why the project was not completed. Each agency accused one another by defending itself. The incomplete project needs additional money to make it operational.

The war with TPLF and EPLF, and land redistribution in Tigray

At the time when the imperial regime was overthrown, the Eritrean struggle for national liberation had been going on for over a decade. The two major wings involved in the armed struggle were the Eritrian Liberation Front (ELF) and the Eritrean People's Liberation Front (EPLF). The war with the liberation fronts continued during the *Derg* regime, and finally EPLF managed to liberate Eritrea in 1991.

In Tigray, the *Derg* regime and the Tigray People's Liberation Front (TPLF), were at war for some 17 years. Although *Derg* had introduced a nation-wide land reform in Ethiopia, as Young (1997:181) notes 'the extent to which the *Derg* land reform was carried out in Tigray is difficult to ascertain' due to the war between TPLF and the central government. TPLF, however, had implemented land redistribution in the areas that were under its control based on criteria such as the duration of a person's residence in a specific *tabia*, their age and family size. In addition, hundreds of drought-affected people, who abandoned the settlements in the south and southwestern Ethiopia, did not receive land after they returned home after the land redistribution was completed.

Later TPLF created a united front with the Ethiopian People's Democratic Movement (EPDM) in 1989 and established the Ethiopian People's Revolutionary Democratic Front (EPRDF) which continued the war against the *Derg* until it took power in 1991.

2.5 The EPRDF-Led Government

Agrarian policy and conditions

After the collapse of the highly centralised *Derg* regime in 1991, a federal government with nine regional states and two regional administrations was established. The economic policy of this Federal Government of Ethiopia is based on an Agricultural-Development-Led Industrialisation (ADLI) program with a 20-year perspective. Elements of the agricultural policy include improvements in smallholder agricultural productivity; expansion of large-scale privately-owned farms and industrialisation based on domestic raw materials and labour-intensive technology. The policy recognised that the first item on the development agenda had to be the improvement of traditional agricultural practices through the provision of credit and agricultural inputs. This was to be followed by the development of agricultural infrastructure such as rural roads, research and agricultural extension services, small-scale irrigation, and increased use of agro-chemicals.

The present-day regional state government's policies and guidelines closely resemble those enunciated in the Five Year Development Program of the EPRDF (the ruling party). Each regional state government has adopted "Implementation Guidelines of Five Year Strategy for Development Peace and Democracy". The main components of the development guidelines include:

- Agricultural production in the high potential areas will be increased through the expanded provision of agricultural inputs, credit and extension services.
- Agricultural productivity in drought prone areas will be increased through: a) small scale irrigation and the provision of agricultural inputs, credit and extension services, and b) the appropriate protection and development of the natural resources and the creation of off-farm income generating activities.
- The participation of the population, particularly the rural population, in the entire development process.

Land, the most important economic resource, has continued to be public property under the current government. The country's constitution has endorsed the vested right of land ownership in the State and in the people of Ethiopia.

> *the right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the state and in the people's of Ethiopia. Land is a common property of the Nations, Nationalities, and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange (FDRE: Proclamation No. 1/1995).*

Plot holders have the right to use or to lease out the farmland for a limited period. The government, on the other hand, has the power to expropriate land that belongs to farmers for public purposes such as schools, roads and agricultural projects.

There is an ongoing debate with respect to transferability of land rights. The first group including the government argues in favor of state ownership and right of usufruct. The main thrust of their argument is that plot holders will sell their land, and become landless if they are not able to cultivate themselves. Conversely, the second group argues on economic grounds that 'transfer rights are unambiguously investment-enhancing' (Deininger, et al. 2003: 1). Dessalegn (1994:280) argues that 'land belongs to the community and the individual land users (…); it does not belong to the state or some distant authority. Rights of use and transfer therefore reside in the individual user and of management and regulation in the community'.

Drought and famine

The incidence of drought and famine has not decreased much during the current government. The population requiring food assistance has varied between 2.7 and 11.3 million over the last nine years.

Table 2.3 Ethiopia: Cereal Relief Food Aid Estimates and Distribution 1995-2002

Year	January estimate (tonnes)	July estimate (tonnes)	Delivered /Distributed* (tonnes)	Distributed as percent of estimated needs	Population requiring food assistance (in millions)
1995	427000	492848	347379	70	4.0
1996	291000	262060	219000	84	2.7
1997	186000	329450	306000	93	3.4
1998	420000	602134	294932	49	5.3
1999	181871	460609	391558	85	6.6
2000	764044	1337695	999135	75	10.2
2001	54394	630610	540000	86	6.2
2002	557204	897299	580000	65	6.3
Average	421564	626588	459751	76	5.6

*2002 distribution data are provisional. Includes WFP emergency assistance, bilateral contributions to DPPC and contributions through NGOs.
Source: FAO (2002:32-33)

At present, there is a looming drought and famine that concerns the government greatly. The Ministry of Agriculture estimates that cereal and pulse production in 2003 is about 25 percent below last year's and 21 percent below the average for the previous five years. Production decline is attributed to the late start, poorly distributed and early cessation of seasonal rains, and severely depressed grain prices over the last two years. Current price increases have sharply reduced the ability of farmers to purchase both consumer goods and agricultural inputs. The FAO/WFP crop and food supply assessment mission to Ethiopia estimated that some 11.3 million people will need about 1.44 million tonnes of food including 1.3 million tonnes of cereals in 2003 (FAO, 2002:3).

Irrigation development and technology choice

No new irrigation policy was introduced until 1999. At this time, the government introduced an irrigation development policy under a general water resources management policy. The policy document describes general water resources and sectoral policies including irrigation, hydropower, and water supply and sanitation. The policy also includes crosscutting topics such as trans-boundary issues, groundwater resources, watershed management, water allocation, water quality, technology and engineering, and disasters and emergencies. The Ethiopian water resources management policy includes the following objectives:

- The development and optimum allocation of the country's water resources for the benefit of the people on an equitable, efficient and sustainable basis;
- Managing the effects of drought and other associated disasters through efficient allocation, redistribution, transfer, storage and efficient use of water resources;
- Controlling and regulating floods through sustainable mitigation, prevention, and other practical means; and
- Conserving, protecting and enhancing water resources and the overall aquatic environment on a sustainable basis.

The policy objectives of the irrigation sub-sector include:

- To achieve food production at household level by developing and promoting small-scale irrigated agriculture operated at farmer level;
- Promotion of small, medium and large scale irrigated agriculture to supply raw materials for industry; and at a national level, to achieve food security and earn foreign currency;
- To promote manageable, sustainable, equitable, reliable as well as environment-friendly irrigation systems; and

- To develop techniques of water use efficiency, water wastage control, maintenance of irrigation infrastructures and drainage (MoWR, 1999 (1991E.C): 21).

The current government appears to be committed to the promotion of irrigation. Parliament has endorsed the establishment of the Water Resources Development Fund, an institution that is in charge of the mobilisation of resources for the development of Ethiopia's water sector. The fund, which was established by proclamation No. 268/1994, has been described as expediting the efforts for the tapping of the vast water resource potential for sanitation, drinking and irrigation purposes (WIC, 2002). Furthermore, regional governments including Amhara, Tigray, Southern Peoples, and Oromia, have established Commissions for Sustainable Agriculture and Rehabilitation which are involved in the construction and rehabilitation of irrigation systems in their respective regions. The Agriculture and Natural Resource Bureaux provide technical support with respect to crop production to irrigation systems.

In the following section, by introducing the drought-prone Tigray region where my case study areas are located, I outline the irrigation development, technology choices and the key institutional actors involved in the support of agricultural development in the region.

2.6 Irrigation Development and Institutional Arrangements in Tigray

Tigray region is situated in the northern tip of Ethiopia. The topography of the region is predominantly mountainous and the elevation ranges from 500 meters above sea level in the eastern part of the region (Erob) to 3900 meters in the southern zone near Kisad Kudo (Tassew, 2000). The climate includes all the three categories: *kolla* (lowlands), *weyna dega* (midlands) and *Dega* (highlands). The average minimum temperature is 5^0c and the maximum 40^0c.

The estimated population of Tigray is 3,494,000 of which 565,000 are urban and 2,929,000 are rural inhabitants. Over 90 percent of the population are followers of Orthodox Christian Church. The total area is about 80,000 square km of which the arable land is estimated to be 15,000 square km. The average holding is about one hectare. This varies from 0.5 hectare to 0.9 hectare in the densely populated highlands and nearly 2 hectares in the lowlands. (CSA, 1997).

The region is primarily agricultural and the majority of the population is employed in this sector. Agriculture is dependent on unreliable rainfall. For many years rainfall has been very low and erratic. As a result, repeated crop failure and scarcity of food have forced inhabitants to depend on famine relief in the form of food for work.

The Tigray farmers have a long history of practising irrigation to supplement rainfed agriculture. Local people's initiative has been in practice

using the available water supply for irrigation purpose. As Pankhurst (1986: 137) writes, quoting Plowden and Salt:

> *Irrigation, though far from universal, was practised, Plowden notes, "whenever necessary" – or possible, and in view of the "numerous rivulets" was "an easy task." Small channels, as Salt noted in Tigré, would be dug from the higher parts of a stream to conduct water across a nearby plain, which would be criss-crossed with small ditches to form "small compartments." Irrigation of this kind on ditches about two feet wide was also used in some areas for the cultivation of cotton.*

Surface irrigation including river diversion, spring development and pond systems, is widely used in the region to irrigate plots. In the highlands of Tigray, farmers construct *dorra* (ponds) for the storage of spring water to irrigate their farms (Mitiku, et al.2001). In Tigray 15,495 ha is irrigated using traditional methods and make up 5 percent of the estimated irrigable land of 324, 286 ha (ibid: 9). Diversions structures are made simply of stones and wood. They are frequently washed away by the floods. The canals are not lined and water loss through seepage is significant.

The current government believes irrigation intervention to be a drought-proofing strategy in Tigray. To this end, international organisations such as UNDP, UNECA and FAO have participated in designing of a project on 'Sustainable Agriculture and Environmental Rehabilitation in Tigray'. Nana-Sinkam (1995: 87) reports:

> *With the framework of its 'Agenda on Emergency, Humanitarian, Rehabilitation and Reconstruction Affairs' and more specifically in consonance with 'its objective in Poverty Alleviation through Sustainable Development', UNECA, at the request of the Transitional Government of Ethiopia (TOE), has launched a major undertaking called 'Sustainable Agriculture and Environmental Rehabilitation in Tigray (SAERT), which is only the first of 8 Programmes being elaborated in co-operation with UNDP and FAO within the framework of what is known as 'Sustainable Agriculture and Environmental Rehabilitation, Reconstruction and Development (SAERRD) for Ethiopia'.*

This program has been developed to address not only the issue of food security in Ethiopia but also the whole area of sustainable development in agriculture and natural resources. One of its objectives is 'to increase production as quickly as possible using extensive water harvesting systems for irrigation' (ibid: 88). Furthermore, as Nana-Sinkam explains:

> *The design process for the Tigray region anticipates the building of 500 irrigation schemes, principally using micro-dams within a period of ten years. This undertaking, ambitious as it may appear, has been carefully targeted taking into consideration the experiences of the region in irrigation as well as in participatory labour processes. The undertaking of the proposed schemes will involve extensive watershed management as well as adequate preparatory measures in organizing the agronomy components of irrigation schemes to an*

> *extent that the region can be self-sufficient in food resources and export to other Ethiopian regions and to other countries in the Horn of Africa (such as the neighbouring Eritrea) within a matter of ten years (ibid.).*

Upon the recommendation of the above mentioned international organisations, the regional government established the Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray (Co-SAERT) making it responsible for the construction of micro-dams in the region.

In Tigray, the main institutional actors involved directly or indirectly in the irrigation intervention include the Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray, the Bureau of Natural Resources and Agriculture through the woreda department of agriculture, local government administrations, and non-governmental organisations such as the Relief Society of Tigray (REST) and the Dedebit Credit and Savings Institution (DECSI).

Hintalo Wajirat Woreda Agriculture Department

The *Woreda* Agriculture Department co-ordinates overall agricultural development in the Woreda. The department has over 60 agricultural workers engaged in the implementation of various activities including the agricultural extension program, soil and water conservation, forestry, irrigation, home economics, and animal and plant disease control. The workers have received training in general agriculture and plant science, forestry, and veterinary science and agricultural extension science. None of the workers of the department have training in irrigation engineering. The two workers responsible for irrigation development are trained in general agriculture. Among the workers, 70 percent are development agents (DA) who received six-month training after they completed their high school education. The development agents have day-to-day contact with farmers and are responsible for the implementation of agricultural extension at farm level. The department has a shortage of skilled manpower and addresses this problem by providing short-term training to workers. Due to the volume of work in the *woreda*, the department is compelled to employ farmers who have completed sixth or seventh grade as development agents.

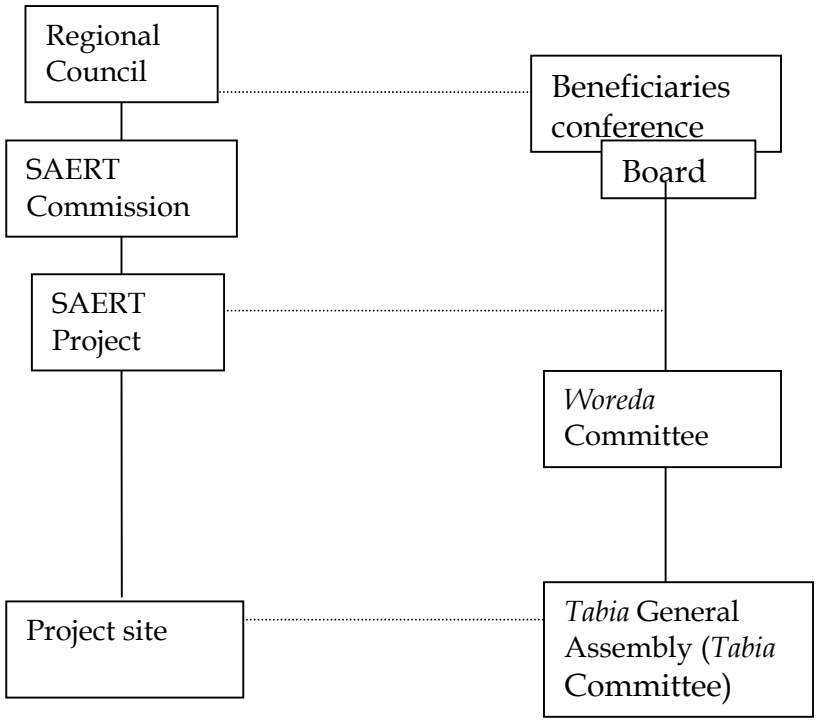
Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray (Co-SAERT)[3]

The Commission was established in 1995 whose objectives include policymaking, design and construction of dams and canals, and the maintenance of dams and water distribution systems. Co-SAERT is also expected to work in close collaboration with farmers to ensure the participation

of irrigators in planning, programming, and managing irrigation systems and conservation of catchments.

The structure of Co-SAERT reaches down to the level of the locality where a dam is constructed. At Woreda level, a Committee for Sustainable Agriculture and Environmental Rehabilitation is established. At dam level, there is a general assembly of dam water users with a Committee for Sustainable Agriculture and Environmental Rehabilitation.

Figure 2.3 Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray (Co-SAERT) Organisation Chart



Source: UNDP, ECA (FAO-ECA), TDA and the Regional Government of Tigray (1994)

Alongside the organisational structure of Co-SAERT, the 'Beneficiaries Conference', *woreda* and *tabia* committees for Sustainable Agriculture and Environmental Rehabilitation have been set up. The Beneficiaries Conference is an advisory body on the policy, strategy and objectives of Co-SAERT. It is composed of representatives of irrigators drawn from *woreda*.

Co-SAERT planned to construct 500 micro-dams over ten years. However, so far the Commission has constructed only 44 micro-dams up until 2002. The reservoir capacity of earth dams is a maximum of 3 million cubic meters. The

dams supply water as a supplement to rainfed land and irrigable land to produce a second crop. Co-SAERT has now discontinued the construction of micro-dams as many problems arose with their construction. The regional government is now encouraging the construction of small ponds by farmers to harvest rainwater within their villages.

Co-SAERT organised a workshop in 1999 to discuss the common problems encountered in the implementation of micro-dam construction in the region. The workshop identified numerous problems including lack of skilled manpower, negligence or lack of awareness on the part of experts and technical problems in the fields of irrigation engineering and geology (Table 2.4).

Table 2.4 Common Technical Problems of Micro-dams in Tigray

Major Problem	Possible cause	Associated problems
Water level in field canals much below adjacent fields	Faulty design	Farmers breach main canal Wastage of water Water logging, salinisation, soil erosion
Canal structures and transition tracks	Faulty design Poor construction quality	Unable to irrigate Heavy water leakage
Insufficient and/or reverse canal bed gradient	Poor design Poor construction	Reduced or no flow Standing water at depressions breeches canal embankment
Absence of cut-off drains	Faulty design	Destruction of canals and irrigated land by storm run off
Absence of internal drainage system	Faulty design	Heavy and frequent canal maintenance Water logging, salinization
Failures of earth-fill cross drainage structure	Faulty design Poor construction	Unable to irrigate Frequent maintenance
Inappropriate positioning of outlet and spillway	Faulty design	Unable to irrigate
Absence of flow measurement structures	Lack of attention/awareness	Difficult to control irrigation water management
Absence of foot path across canals	Lack of awareness	People and animals breach the embankment while crossing
No cross-drainage designs or out of standard designs	Faulty design	Heavy seepage losses through overtopping at the test path points Channels washed away by storm run-off during the rainy season
Too many drops in field canals	Faulty design	Unnecessary construction cost incurred
Insufficient geological investigation	Lack of experience	

Source: Compiled from the report 'Common Problems, Causes and Recommended Solutions' prepared by Study and Design Department of Co-SAERT, 1999.

With regard to silitation, so far there is no plan to tackle the problem. Experts have reported that many of the dams will not serve the estimated life span of 20 to 25 years for the community. The responsibility for carrying out the catchment conservation work was left to the Bureau of Agriculture and Natural Resources and the local community. However, in many catchment areas either the work is not carried out or it is insufficient. In 2002, for instance, construction of two dams was planned. However, the catchment conservation work has not yet been carries out.

In sum, Eyasu, et al. (2002: I) note the following major problems of Co-SAERT that they encountered:

- Ambitious planning as a result of which most of the basic assumptions such as manpower, external assistance, equipment, labour, and abutments were not adequately available;
- Lack of adequate and reliable information, especially with respect to climatic, runoff and sedimentation data;
- Lack of clear water and irrigation policy and co-operation among partner institutes;
- Lack of research input;
- Site specific problems, particularly the complex geology in some areas.

Handing over of micro-dams to water users

Since March 2000, the regional government has been engaged in handing over micro dams through the establishment of water users associations, but without giving due attention to the creeping water management crisis. Experts in Co-SEART and the Bureau of Agriculture and Natural Resources (BoANR) had assumed that after the construction of the micro dams the management of irrigation systems would be transferred to the BoANR. Then in 1999, the feasibility of such an idea was questioned and discussed by BoANR and Co-SAERT. Finally the officials and experts of the two organisations agreed that BoANR should not take over the management of the irrigation systems because it is a government organisation. Consequently, it was decided that irrigation users themselves should take the responsibility for managing the irrigation systems through water users associations. At *Woreda* level the idea of handing over the irrigation systems to water users associations was questioned. And as an alternative *abo mai* (father of water) or the concerned *tabia* (the lowest administrative unit) were suggested instead.

A dam handing over committee was set-up at *woreda* level composed of the *Woreda* irrigation expert, agriculture supervisor, development agent (DA), and representatives of *Woreda* Administration and Co-SAERT. Handing over is an ongoing activity, which takes place between Co-SAERT and the executive

committee members of the water users associations. The Commission has handed over some 19 micro dams[4] in Tigray since March 2000.

Local governance

Tigray region is divided into several levels of administrative units. The *tabia*, which constitutes several k*ushets* (villages), is the lowest level. Several *tabias* are aggregated into *woreda*s (districts). The next higher level is that of the zone; of which four zones constitute the regional government of Tigray. Hintalo Wajirat *Woreda* is the one of the 35 *woredas* of Tigray located in the southern zone.

The study sites, Hewane and Gum Selassa irrigation systems are located in Hintalo Wajirat *Woreda.* Adigudom is the main town of the district located 34 kms south of Mekelle, the regional capital.

Hintalo Wajirat *Woreda* has 19 *tabias* (sub-districts). A *tabia* has an elected *baito* (council) with one hundred members. Each *baito* (council) elects an executive committee of six people with a chairman. The office holders are responsible for work concerning economic development, social services, security and propaganda. In addition, there is a *Mahebrawe firdebet* (social court), which acts as an 'independent' body for justice.

The *tabia* administration is responsible for distribution of food relief, co-ordination of development activities such as water and soil conservation, maintenance of peace and order in the *tabia,* and the mobilisation of people for construction work on dams and roads. It is also involved in the execution of agricultural development activities.

Along with the local government, Tigray People's Liberation Front (TPLF), the ruling political party, is in operation throughout Tigray. TPLF had been at war with the central government and was able to liberate Tigray, and later took power along with the united front, the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF), in 1991.

TPLF's organisational structure stretches down to the *kushet* (village) level. The intertwining of TPLF members with government gives a clear indication of their political influence on Government. For instance, at federal level the Prime Minister of Ethiopia is the chairman of EPRDF and TPLF. At regional level, TPLF leaders and ex-combatants have assumed key government posts in Tigray. For instance, the president of Tigray regional government and the administrator of the southern zone of Tigray, where my research sites are located, are members of the central committee of TPLF. The Hintalo Wajirat *Woreda* administrator and Hewane *tabia* chairman are TPLF ex-combatants, and the same goes for the chairpersons of the women's association and other mass organisations. It appears that many government posts and mass organisation leadership positions are left for TPLF members. The relationship between TPLF

and Tigray government is like two sides of a coin. As centralised as the political order is, the lines of political and bureaucratic responsibilities are blurred, and it is difficult for those who fill roles in the TPLF and government bureaucracy, to decide where their political territory begins and ends. Although the establishment TPLF was an important measure in the political and armed struggle for the Tigrians, the two structures to a large degree compete. At the same time, since almost all power and authority rests with the TPLF, the bureaux of government responsible for the day-to-day running of Tigray have limited authority. Clearly, then the bureaucracy has an uneasy relationship with the power centres. This problem is exacerbated by structural replication and competing areas of responsibility.

Prime Minister Meles, addressing the 4th Organisational Congress, indicated the intermingling of political and government administrative interests and some of the problems this has created:

> *in the last ten years, we had major deficiencies in the relationship between organisation[5] and government. First of all, we did not provide political leadership to the government competently. …Although we had a big problem in this regard, we had another fault, which cannot be underestimated. We had a problem of jumbling together the works and procedures of government and organisation. Leaders of organisation determine the overall directions of the organisation. They evaluate the implementation. Apart from this, the government gives decisions deemed appropriate using its own decision-making structures. It also implements the decisions. Although we have said that members of organisation should not interfere in government works by transgressing, we have been at fault in implementing it seriously. We had no serious follow up that could prevent the unnecessary interference of government in organisation and vice versa by maintaining their appropriate relationship. We had faulty execution since the jumbling of political and professional leadership did not enable the development of the civil service to maintain its relative autonomy, accountability and to be governed by its procedures. (Translated from Abyotawe Democracy, Meskerem 9, 1994[6] pp. vi-vii)*

Furthermore, Prime Minister Meles, in the above mentioned report, also criticised the coercive and top-down approach of implementing government programs.

> *Indeed, we have made the farmer participate in different development activities. The development success we achieved by doing this cannot be underestimated. However, this course of action was based on agitating and partly coercing the farmer to implement what our organisation gives him as a solution. In fact, there was no as such genuine participation. We did not explain the nature and objective of a policy to the farmer properly so that he could pursue the better alternative. We also did not encourage him to suggest ideas that would improve the alternative. Since we did not follow the right principle and direction, we have contributed to the waste people's labour and capacities to develop (ibid: 4-5).*

Food-for-work program and public works

In Ethiopia public works programs such as rural road construction and water conservation have been implemented as relief and rehabilitation activities since the 1960s. The World Food Program (WFP) has supported food-for-work in the rehabilitation of degraded lands since 1975 (Braun, et al, 1991). In a national workshop on food-for-work held in 1986, it was concluded that 'public works should play a major role in assuring both short-term hunger alleviation and longer–term resource conservation' (ibid. 87). Later in 1993, the current government adopted the policy that no able-bodied person should receive gratuitous relief, which led to a guiding principle that 80% of food aid should be distributed through food-for-work (Humphrey, 1999).

In Tigray, the organization of food relief has also changed from food handouts to a food-for-work program. Drought victims are involved largely in soil and water conservation, road and micro dam construction all determined by the regional government. Thus food-for-work has become a way of life in Tigray. A study conduced in Hintalo Wajirat and Enderta *Woredas* indicates that over fifty percent of households has participated in food-for-work (Tassew, 2000). A person receives 3-kg of wheat per day if he/she participates in public works such as dam construction or soil and water conservation works. In addition, food aid recipients are obliged to participate in the cleaning of their vicinity, constructing teachers' houses or maintaining rural road for five days in a month.

In addition, local people contribute an obligatory twenty-days of free labor in a year for the implementation of public works. All able-bodied persons must participate without any payment, either in cash or in kind.

The credit institutions

In Tigray local people use both formal and informal (traditional) credit sources to overcome their financial problems. *Equb* (rotating saving group), for instance, is a traditional source of credit where the group pools members' deposits to extend a loan to one of the members who is entitled on a lottery basis. Another pervasive feature of the informal sector are village money lenders who provide small loans for short periods of time, unsecured by collateral, to people they know well. Their interest rates are much higher than other sources of credit, but they address the specific needs of their clients.

In the formal sector, credit institutions such as commercial banks and Dedebit Credit and Savings Institution (DECSI) operate in the region. DESCI is the major rural bank that operates in Tigray. It was registered in 1997 as a micro-finance institution with a capital of four million *birr* to provide credit and savings services through 12 branches and 109 sub branches (DESCI, 2001:7). It is

said to be the largest micro-credit program in Africa[7]. The objectives of DESCI are to:

- Enhance agricultural production through the provision of credit for inputs;
- Promote sales of agricultural outputs;
- Stimulate the local economy through increasing levels of economic activity and cash flows;
- Promote income generation and economic diversification among the rural poor;
- Reduce exploitation of the poorest by local money lenders; and
- Promote a savings culture in the rural area (AEMFI, 2000:34-35).

Customers deposit money in the form of group, centre and individual savings. The group saving constitutes a group tax of 5 percent of all regular loans disbursed and a group members' monthly contribution of one *Birr*. Group saving serves as collateral for the loans taken by the group members. Half of the group savings can be lent to its contributors for any purpose including consumption. Centre saving is raised from each centre members' monthly contribution of one *Birr*. Group and centre savings are compulsory. The scheme for individual savings is voluntary for individuals or an organisation (DESCI, 2001:16).

2.7 Conclusion

Historically, a significant agrarian policy shift has taken place, i.e., from tenant farming to owner cultivation. At present agriculture led-industrialization has become the policy of the current government. However, none of the various government policies pursued after the thirty years has enabled Ethiopia to feed its people adequately. And so foods for work and labor contributions to construction are a regular part of farmers' life-worlds beyond their other productive activities.

The *Derg* radical land reform of 1975 put an end to the chronic land tenure constraints, such as extensive litigation over land, diminution and fragmentation of plots, tenancy relations, lack of security and landlessness, that prevailed under the imperial regime. For the first time in Ethiopian history, land ownership was vested in the state, which gave political leverage over land use and administration to the state.

Yet, although the land hunger of peasants was addressed, the new agrarian policy introduced by the *Derg* government did not improve the life of ordinary peasants. The policy to promote socialism in rural Ethiopia through heavy-handed programs such as collectivization, villagization , resettlement, and the quota system for sales of agricultural products did not transform the life of

rural people. The long-awaited land reform in Ethiopia therefore ended up a catastrophe.

Although *Derg* considered irrigation as a 'drought-proofing' strategy, the institutional arraignments for promoting irrigation were weak, and inimical to the development of traditional irrigation systems. As a result, the department responsible for irrigation development was able to construct and/or rehabilitate few irrigation systems. And the incorporation of traditional irrigation systems into producer cooperatives contributed to the dismantling of the many longstanding irrigation systems. Water control fell into the hands of local administrators or party officials.

In all the three regimes, the uncritical top-down transfer of irrigation technology was preeminent. Priority was given to large-scale irrigation systems and the adoption of new irrigation technology with the objective of modernizing the traditional farming system. Successive governments have failed to consider the feasibility and adoption of irrigation technology due to the assumption that irrigation is a solution to drought and famine. Tigray region, for instance, has largely failed to adopt micro-dam technology. Lack of technical abilities in designing and constructing irrigation infrastructures and irrigation management has become a major problem. The government's recent drive is to increase the area under irrigation through the construction of small ponds appears to be no more than a rush to repeat the same old mistakes. The government, together with various non-governmental organizations is making huge investments believing that these small ponds offer an alternative to rainwater harvesting techniques in many parts of Ethiopia.

Notes

1 Data on irrigation in Ethiopia are unreliable. Here I attempt simply to indicate the level of irrigation development.
2 Abyssinia is the former name of Ethiopia.
3 Government organizations including Co-SAERT involved in the water sector were reorganized and merged under the umbrella Water Resources Development Bureau of Tigray (WRDBT) in 2002. WRDBT is responsible for both irrigation and water supply development in Tigray.
4 According to Berket Mekonnen, 'mobiliser' in Co-SAERT, 19 micro dams were handed over to water users association. See annex 3.
5 'Organisation' refers to the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF), the ruling political party in Ethiopia
6 According to the Ethiopian calendar 1994 corresponds to 2002 (G.C).
7 According to the 2000 Micro-credit Summit Campaign Report, as of December 31, 1999, Dedebit Credit and Savings Institution S.C. was ranked as the largest micro-credit program in Africa (AEMFI, 2000:32).

3

Irrigation Practices and Environmental Security in Hewane Irrigation System

3.1 Introduction

This chapter focuses on irrigation management practices and the struggle to preserve irrigated areas threatened by soil erosion in Hewane. The chapter examines how local government bureaucracies of different regimes have been involved in irrigation management.

In Hewane, since Imperial times the different government administrative units namely the *Chika*, the peasant association, and the *tabia baito* have handled water management issues as one of the local administrative tasks. Until now farmers have had no specific indigenous or introduced irrigation organisation of their own that gives them responsibility for water management. Farmers elect an 'irrigation intermediary', *abo mai* (father of water) at the request of the local administration. The *abo mai* is a link between the local administration and the farmers, thus making irrigation management an appendage of the local government bureaucracy.

The second section of the chapter describes the physical settings and the people of Hewane. Section three presents water allocation and water users in the irrigation system. A historical overview of past irrigation management is described in section four. Section five deals with the TPLF land redistribution and reconstruction of water rights in Hewane. Section six presents the current water management practice. The struggle to preserve the irrigated land area threatened by soil erosion and the emerging bee keeping livelihood in Hewane is discussed in section seven. The final section summarises the discussions of the chapter.

3.2 Physical Settings and the People

The Hewane irrigation system is situated in Hewane *tabia,* on the road connecting Addis Ababa with Mekelle some 55 km south of the regional capital of Tigray. The fields of the irrigation system encompass parts of the territory of four k*ushets* (villages) called Ayboto, Korora, Maine and Hewane town[1].

Hewane tabia is located at an altitude of 1800 – 2000 mts. The total area of Hewane *tabia* is 4558 hectares[2]. The cultivable land is 2405 ha (53%). There is no rainfall gauge in the *tabia* so only the regional average is available (see chapter 2). The soil types are 20% *tikur* (black), 19% *maek*l (average), 40% *huthu* (sandy), 5% *mkeyh* (red), 16% *tikur+maekl* (black+average). The soil fertility is classified as 5% *woferam* (fertile), 65% *mekakelgna* (average), 30% *rekik* (poor).

The population of Hewane *tabia* is over seven thousand. Subsistence rainfed farming is the main occupation of the people. Rainfall is variable, making the local people vulnerable to recurrent famine. The worst recurrent drought and famine took place in 1984/85, which claimed thousands of lives in the region. In addition, the area was affected by the civil war between the TPLF and the then *Derg* government that lasted seventeen years.

Inhabitants of the *tabia* mainly live in *Hedmo*, traditional houses with a roofs made of soil, stones and wood. Residents of Hewane town live in mud-plastered houses with corrugated iron sheeting and cow dung plastered floors constructed in a row on both sides of the Addis to Mekelle road. Over 95 percent of the inhabitants are Orthodox Christians practising monogamy. Children go to the only government school, which provides education up to grade eight. Many town women are engaged in selling *tela* (local beer) to supplement their income. The town has various socio-economic services including a public telephone, a police station, public water supply located at four points, two small hotels and three flourmills. Market exchange of several items such as grain, salt, cloth, honey, and agricultural and household equipment takes place on Thursdays, when the weekly market is held. Hewane town has no electricity and residents use candles and lamps during night time. The nearest health service is located at Mai Nebri *tabia* five km from the town. About twenty small shops sell basic commodities such as cloth, kerosene, salt, sugar and grains. In addition, the agricultural service co-operative sells agricultural tools such as sickles and ploughs, food items including edible oil, and sugar to farmers and residents of the town.

The bus from Mekelle takes about two and half-hours to reach Hewane on the heavily damaged road that was constructed by the Italians during the Second World War. The government is reconstructing the road, which was heavily damaged during the civil war between the TPLF and earlier *Derg* government. The bus trip not only takes a long time, but the return ticket is also expensive, costing between 0.71 to 1.41 US dollars, more than a day's wages. The high cost of transportation has forced poor farmers to use donkeys to take their agricultural products to the markets of Mekelle. It is predominantly the richer villagers who frequently go to the capital using public transport for various purposes such as visiting relatives, seeking medical treatment, and buying agricultural or household goods.

3.3 The Irrigation System

Water allocation

The Mikorer-Betmera and Adi-Mesano streams supply water to 36 ha plots in the Hewane irrigation system during *bega* (dry season). Historical evidence is lacking as to when irrigation started in this area. Local people said, 'our forefathers started irrigation long ago'. The Mikorer-Betmera stream passes along the eastern side of Hewane town, whereas, the Adi Mesano stream cuts across the farms located between Hewane town and Ayboto *Kushet*. The two streams meet at a junction called Gudif where these rivers become the Hewane River. Apart from irrigation, the river water is used for various purposes including drinking, washing clothes, cooking and watering animals.

The Hewane irrigation system starts from south of Hewane, Menkuse village, and extends to Mai Neberi *tabia*, which is about 12 kms in length. The stream passes along the up-hill side of sloping to moderately flat agriculture lands. Gravity irrigation is carried out using earth canals bifurcating from the main stream.

There are 15 diversion canals along the Hewane river that transport water to farm plots. The farmers have constructed three aqueducts at places where water cannot be diverted to the field due to the presence of gullies. The width of the earth canals ranges from 0.5 m to 1 m and that of the field canals from 0.1 m to 0.2 m. The canal intake structure is an impermanent construction made of stones and wood. Its shape and size is subject to fluctuations in water flow in the river and the changing water requirements of the users who can easily adjust the intake by changing the placement of and/or removing stones. Floods occur during the *keremt* (long rainy season), usually causing substantial damage to headwork, and bringing large quantities of silt and debris into the head reaches of the system.

There is no standard sluice gate on the diversions to control the flow of water. Farmers use grass, stone and soil to stop water flowing. The diversions delivering water to the cropped fields are usually in the form of a direct cut in the bank of the canal, which is closed with silt and stones when irrigation is completed. There is no regulator, as such, in use in the system. Opening or closing the headwork with stones regulates discharge into the canals. Water flow is stopped at the headwork by removing a few stones and letting the water flow to the river. No measuring devices are used in this system. Since cultivated fields are located on fairly steep slopes, drainage is not a problem in the area. Any excess water drains readily into the Hewane river.

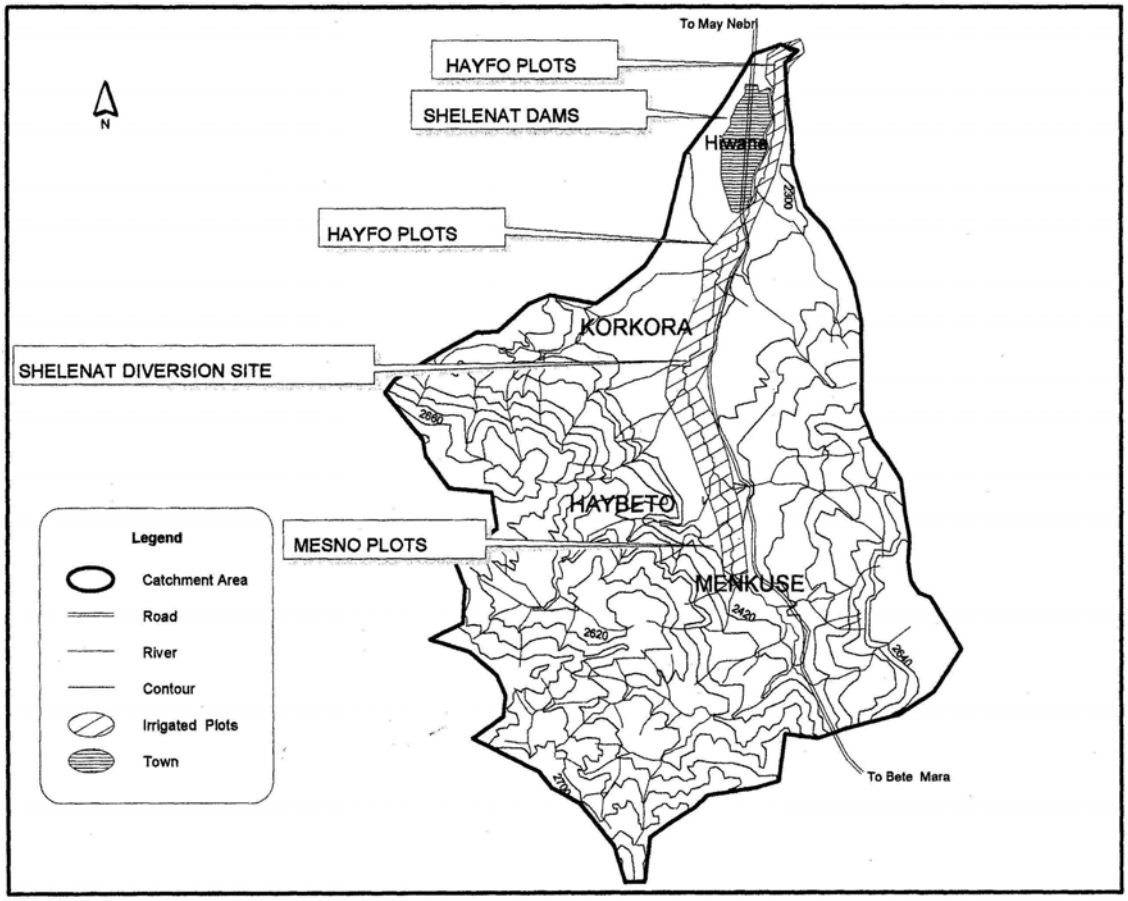


Figure 3.1 Location Map of the Hewane Irrigation System

Water availability in the Hewane river varies substantially from season to season, largely as a function of rainfall. This affects discharge from the spring, which is a source of its recharge. The *keremt* rainfall usually starts late June and peaks in August. After mid-September the rainfall stops. Farmers or the *tabia* agriculture office do not take water flow measurements in order to calculate the amount of discharge into the canals. Simple observation is employed to estimate the amount of water that could be obtained.

The water users

During the Imperial regime, two groups of irrigation water users could be identified in Hewane. The first were non-resident landlords who were not directly engaged in farming but cultivated their lands either through sharecropping arrangements or by hiring labour. The second group consisted of peasants who cultivated their own land and/or were involved in

sharecropping. Later the landlords lost control over land when rural land was nationalised in 1975 and peasants were given land use rights under the *Derg* regime. Currently, there are two types of irrigators based on the 'water allocation principle' adopted by the water committee. The principle is classifying plots into *mesno* and *hayfo*. The *mesno* (irrigation) plot holders receive river water from January onwards because they have been under the agricultural extension program 'Sasakawa Global 2000³' since 1993. In this group, 220 farmers cultivate plots ranging from 0.015 ha to 0.125 ha including 'kitchen gardens'. This group is under an obligation to use chemical fertilisers and other modern inputs and follow agricultural extension advice. The *hayfo* plot holders mainly depend on rainfed agriculture. This group, however, gets water until the end of December depending on the availability of river water. The *hayfo* group will not obtain water after January because the river water is diverted to the *mesno* irrigators. About 210 *hayfo* farmers cultivate 20 –25 ha of land planting barley, lentils, vetch and chick-peas which require two or three times watering between September and December. Individual land holding ranges from 0.25 to 0.5 ha. In addition, both *hayfo* and *mesno* irrigators cultivate rainfed plots within Hewane *tabia*.

3.4 Historical Overview of Past Irrigation Management

Water management under the Imperial Regime

The Chikashum system

Chikashum was the most important administrative post at grassroots level during the imperial regime. Two or three *goths* (hamlets) constituted a *Chikashum*. The *Chikashum* was introduced in 1942 and replaced the position of the *Feresegna,* a typical Tigrian institution. The *woreda* or *awraja* Governor normally nominated the *Chikashum* who was responsible within the governor's jurisdiction for communicating government orders or information to local people, collecting taxes, settling land disputes, maintaining public order and supervising communal work programmes. The burden of carrying out all these tasks on a day to day basis was left to an assistant *Chikashum* or *Aferchika*. The *Chikashum* was entitled to get ten percent of all the taxes collected from his area for his service. (Tigrai Rural Development Study 1976).

The Afercheka

Community men called *Afercheka* were in charge of water distribution in the villages of Hewane. Essentially the *Afercheka*'s task, on behalf of the community's residents, was to help the *Chikashum* in the performance of his duties. Villagers meet annually in the second week of September, when the

Ethiopian New Year starts, to elect the *Afercheka* among men who claim the position by tracing their lineage to the original founders of the community. If two or more persons compete for the position of *Afercheka*, selection will be carried out on a lottery basis. The *Afercheka* served for one year and was remunerated in the form of grain and access to irrigation water. He was entitled to get a one-day water turn and a half or whole *Kuna*[4] of grain from each irrigator during harvest.

The landlords and local governors were directly involved in the allocation of water. The strong economic and political position of landlords and local governors played a major role in water allocation during the imperial regime.

Table 3.1 Water Delivery Schedule in Hewane Irrigation System during the Imperial Regime (pre-1974)

Date	Plot holder
Monday	farmers
Tuesday	farmers
Wednesday	*Afercheka*
Thursday	Luel Mengesha (aristocrat and governor of Tigray)
Friday	Haile Tedla (*Atbia dagna* (local chief)
Saturday	Dejazmach Wolde Kidan Ashber (district governor)
Sunday	farmers

The landlords and *Afercheka* were also engaged during their turns of selling whatever water was not required for their own use to farmers who agreed to give a quarter of their yield. It was a common practice to bribe *Aferchika* to irrigate plots illegally. There were instances where poor farmers could not irrigate their plots according to their turn. A person who was denied getting water in his turn did not get justice. If the *Aferchika* said "I have given water to Mr. X, then a farmer who claimed the turn could not question him".

In addition, the landlords and aristocrats gave orders to the *Afercheka* whenever they wanted water for their plots. The *Afercheka* were expected to serve the interests of landlords. For instance, the feudal lords such as Girazmach[5] Haile and Dejazmach[6] Woldekidan who had farm land in Ayboto and Korora *kushets* used to write a letter to the *Afercheka* to give water distribution priority to their farms when there was shortage of water in the downstream. The *Afercheka* who received such orders presented the issue to irrigators. The irrigators would agree to forgo their turn for the landlords since they knew the negative consequences that would follow if they opposed the order. If someone refused to give water to the landlords he would be detained

in a police station. An informant told me that two *Afercheka* at that time were detained for one month in a police station since they refused to give water to the local governor.

Irrigators participated in canal cleaning and maintenance activities. The canal cleaning started immediately after the end of the rainy season in September. They used their own farm implements - sickles, shovels and hoes for canal cleaning. A farmer who did not participate in canal cleaning would be fined. The fine collected would be used to buy *tela* and *tej* (local drinks) for the irrigators who did the canal cleaning. Although water theft was common, no one dared to do it during the turn of landlords and *Afercheka's* since all knew the dire consequences that would follow. Conflict over water distribution among farmers was settled either by the *Afercheka* and/or local governors.

Water management under the Derg Regime

The peasant associations

The feudal order was dismantled along with the downfall of Emperor Haile Selasse in 1974. The proclamation that made land public ownership established peasant associations as the basic instrument through which the land reform provisions will be implemented. A peasant association was formed within a minimum area of 800 hectares, which replaced the *Chikashum* system of administration. The functions of peasant associations included the distribution of land to former tenants and landless persons, and to administer and conserve any public property within the area especially the soil, water and forest; to establish judicial tribunals to hear land disputes arising within the area; to establish marketing and credit co-operatives and to build schools, clinics and similar institutions for the area (PMAC, 1975).

Abo mai (father of water)

The agrarian reform had a significant impact on the continuity of the *Afercheka* system of irrigation water management. The *Afercheka* was replaced with an elected *Abo mai* chosen from among the irrigators. Farmers did not have a water users association or water committee to manage their irrigation system. The peasant association leaders and the *Abo mai* took over the responsibility for water management. Irrigation, like any other local administrative activities, became the responsibility of the lowest administrative unit. The peasant association called a meeting of water users towards the end of the rainy season to elect an *Abo mai* who would distribute water and organise irrigators to clean and maintain silted canals or to replace gates washed away during the rainy season. In Hewane elected *Abo mai*s serve on a one-year basis. Water distribution was carried out on a rotation basis. Plots were irrigated

immediately after the preparation was completed. If a plot was ready, it received water, whether located at the head, middle or tail end. Farmers who finished plot preparation at the same time would receive water on lottery basis. There was no time limit to irrigate a plot. Each plot obtains the water that the farmer felt sufficient.

Water Conflict Resolution

The *Abo mai* and peasant association leaders usually handled conflicts due to water theft or the damage of cropped fields because of water overflow from a canal. Water disputes between upstream and downstream villages were taken to either local governors or courts for decisions. The following case, for instance, illustrates this.

The neighbouring Korkora and Aybote *Kushets* had for a long time been involved in disputes over land and water. Ayboto *Kushet* is at the head end and receives river water first. Korkora is at the tail end with relatively good quality land. In 1978, the Ambalage *woreda* court decided that Korkora and Ayboto peasant associations should merge their farms and use the water collectively in order to settle the dispute. While Ayboto farmers accepted the court's decision, Korkora farmers rejected it on the ground that their land is of good quality. Consequently, the Ayboto farmers decided not to give them water. Then the Korkora farmers appealed to the *Awraja* (province) court. The Awraja[7] court overturned the *Woreda* court decision and gave an order that the Korkora farmers should use the water of Ayboto without merging their plots. The Ayboto farmers felt that the decision of the court was unfair and appealed to the High court. The High court overturned the decision of the Awraja court and gave an order that both peasant associations should merge their land and use the water collectively. However, this decision of the High court was not implemented. Consequently, the Korkora farmers got no water until the TPLF controlled the area.

When the district came under TPLF control, the Korkora farmers appealed to its representative and requested the reversal of the decision made during the *Derg* time. After examining the case, the TPLF official decided that half of the water should be allocated to Korkora farmers. Both villages accepted the decision and planted maize. The maize planted in Ayboto failed while that of Korkora grew well. This gave rise to a fresh conflict between the two communities. This time the TPLF representative set up a committee composed of three irrigators from both Ayboto and Korkora in order to find out the cause of the conflict. The committee reported that the crop failure in Ayboto was due to shortage of water. The TPLF representative visited Maini, Maineberi and Waza *tabias* to see the practice of water distribution in other *tabia*s. Then he

called farmers of both villages to establish an independent committee composed of three members who did not belong to the conflicting communities. The farmers elected three persons from other *tabia*s who were not involved in the conflict. After studying the situation, the committee recommended that Ayboto should get water for 20 days and Korkora for 10 days in a month.

In 1987 there was drought in the area and the rivers dried up. One of my informants told me the following story.

> *One elder from Ayboto told to the local people that he had a dream about the cause of the current drought in their locality. According to the elder's dream, the main cause for the drying up of the river was the conflict between Ayboto and Korkora villagers. The elder dreamt that he should tell the irrigators of both villages to slaughter two oxen and cook* nifro *(cooked wheat or beans,) at a place called Ayne Korkora. If old and young agreed to reconcile and dig the site where the oxen shed blood, water would come out". The villagers agreed to do so and water came out at the site they dug. Since then there has been water and peace between the two villages.*

In the following two sections, I provide how the TPLF-sponsored land redistribution resulted in reconstruction of water rights in Hewane and the current water management practice.

3.5 Land Redistribution and Reconstruction of Water Rights in Hewane

The TPLF carried out land redistribution while the Tigray region was under its control in 1990. This brought about reconstruction of water rights in the Hewane irrigation system. A key informant, 46, told me about the land redistribution. He had some 0.25 ha of irrigable land and 2 ha *hayfo* before the land redistribution.

Local people were called to a one-day meeting chaired by a TPLF combatant and *tabia* administrator to establish a land redistribution committee in Hewane. Each *Kushet* elected five people. There were 30 elected members and four secretaries serving on the committee. My informant was one of the elected members.

After the election, my informant and other committee members went to Moheni town of Rayana Zebo Awraja (a former province during the *Derg*) to receive an orientation about the intended land redistribution. About 500 committee members elected from different *tabia*s attended the meeting. During the orientation program, which took about one month, the contentious issue debated was who should get land? The TPLF officials were of the opinion that children and adults should not get equal plots of land. On the other hand, elected members were against what they considered was a discriminatory policy that favoured unequal distribution of land between children and adults.

The committee members argued on the grounds that adults can work to support themselves and that since children cannot do so they should get land that their parents could work to maintain them. The TPLF officials were saying they could not accept their proposals and that their guide lines for redistribution should be accepted. The officials scolded those who suggested equal distribution saying "what you are talking about is a *Derg* order!" While about 20 participants of the meeting supported the policy of the TPLF, the large majority opposed it. After the one-month meeting, participants went back to their *Kushet*s to implement the land redistribution according to the TPLF guidelines.

In Hewane, 16 elected committee members carried out land quality studies and classified the land into *woferam* (good quality), *mekakelgn*' (average) and *keche*' (poor quality) by asking about the yields obtained from each plot and making site visits. A second study was conducted by a group of four persons, two from each *Kushet*, to verify the first study. Following this, land was re-distributed on a lottery basis.

The implementation of land redistribution in Hewane town was not easy because access to irrigation water was linked to land rights. The Addis Ababa – Mekelle road divides the town of Hewane into two. The irrigable plots are located on the eastern side of the road. In the past, plot holders from either side of the road were able to cultivate the irrigable plots using the river water. After the land study was completed, TPLF officials gave the order to the land redistribution committee to re-distribute the irrigable land only to the irrigators who resided on the eastern side of the town. The rational was 'irrigable plots should be given to residents who own houses closer to the farms'. About six committee members supported this decision, while a large majority suggested 'let every holder of an irrigable plot in Hewane town gets a small plot even if he or she doesn't reside on the eastern side of the road'. The *Woreda* TPLF representative said, 'since May and June is fast approaching which is the sowing period it is difficult to plough and sow within the available time. So let the land be given only to those who reside along the river and next year the irrigable land will be redistributed to both residents who live on both sides of the road'[8]. The committee, before implementing such decision, called all the irrigators and told them about the intended land redistribution of TPLF. Despite the irrigators' opposition, the committee distributed rainfed and irrigable land on a lottery basis according to the guideline of TPLF officials. As a result, many farmers who reside on the western side of the road lost their irrigable land. Land redistribution in Hewane had a special impact on non-irrigators. One informant told me that non-irrigators in Hewane complain about the land redistribution implemented by TPLF. Those who lost irrigable plots in particular harboured deep resentment against irrigators and TPLF officials. He

said, when irrigators meet non-irrigators at special occasions, they attack them by saying 'you are harvesting two times in a year, and we only once. All of us come from this village, but the government made you the owners of irrigable land'.

The land redistribution committee set aside about 20 ha as pastureland, three ha for the school and two ha for different associations. Currently, the pastureland is reduced to 10 ha because the Shelenat dam reservoir has been constructed on about 10 ha of it.

I was told that 'since the land holding is small and fragmented and children did not get land as adults, the local people are not happy. In addition, the land redistribution committee was not happy since it had to implement the order of TPLF officials. Those who were happy were the ones without children. The land redistribution idea was initiated and implemented by the TPLF. Farmers were afraid of airing their complaints to them and they had no influence.

3.6 Current Water Management under the Tigray Regional Government

Water allocation and scheduling

A water committee composed of the tabia chairman, head of economic development, the development agent, *ersha* cadre (agriculture cadre), representatives of the Women's Association, Farmers' Association and the Youth Association is responsible for the water management in Hewane. However, of the water committee members, the *tabia* chairman, the *tabia* economic development head, the DA and *ersha cadre* (agriculture cadre) are the ones actively engaged in water management. If a farmer, for instance, does not get water, he goes to either the *tabia* chairman or head of economic development to report his problem.

In the Hewane irrigation system, water delivery to users is based on the principle of classifying plots into *hayfo* (plots that receive water until end of December) and *mesno* (irrigated plots). A number of factors are considered in the classification of plots. First the *tabia*'s annual plan of plots that should use chemical fertiliser and improved seeds under the 'Global 2000' program is considered. Second, observation of water flow from the three springs located at Menkuse, Ayen Korkora and Hewane town is carried out. Third, the water committee, especially the head of *tabia* economic development, the DA and agriculture cadre and *Abo mai* discuss whether the *tabia* had good or bad rainfall in the previous year. On the basis of these considerations, plots labelled as *hayfo* get water until the end of December. After the harvest of *kirmet* crops, *hayfo* farmers plant chickpea and lentil that need water two to three times until harvest time.

From early January to June the available river water is diverted to the *mesno* plots[9]. Some farmers, however, said that 'the available water could go down to the *hayfo* plots, but the government wants the *mesno* plots to be irrigated repeatedly since the farmers use chemical fertiliser'. The switching of plots from *hayfo* to *mesno* or vice versa is possible. In 2000, for instance, about one ha. *hayfo* plot was labelled as *mesno*. The following year the same plot reversed to *hayfo*.

Some farmers cultivate their *hayfo* plots assuming that they will get water. Such farmers, however, could be losers when shortage of water takes place. In 1999, for instance, 15 farmers planted vetch, chickpea and lentil on 20 *timad* plots without getting any promise from the water committee. The plots were irrigated once and due to shortage of water additional water was not available and crop failure occurred. Conflict among *hayfo* and *mesno* irrigators is not common since the water committee decides on the water allocation.

The rotational scheduling of water distribution is carried out day and night and regulates access to water. Water distribution is based on the principle that the one who sows first will get water first. Blocks of plots obtain water by turn. The water distribution depends on the water requirement of each crop in terms of frequency.

Table 3.2 Irrigation of *Mesno* Plots by Crop/vegetable

Crop/vegetable	Irrigation frequency per season
Chick pea	3
Lentil, barley	4
Maize, wheat	5
Teff (type of crop) during rainy season on *hayfo* land)	2
Onion, tomato, potato, beet root, carrot	6-7

The larger the plot, the more the water used because watering plots is based on the perception that 'the plot should be wet enough'. It is the responsibility of the farmer to close the diversion after irrigating fields. Onion and tomato are irrigated during the night.

Abo mai (father of water): the key role in water distribution

The election of *abo mai* by irrigators, at the beginning of September when the Ethiopian New Year starts, has continued until now. An *abo mai* is elected by irrigators within specific diversions to serve for one year. The number of elected *abo mai*s does not depend on the size of the irrigated area under a diversion. It comes from local preference.

In September 2000, about 50 irrigators, for instance, were called by the *tabia* chairman to a meeting to elect two *Abo mais* who would serve *for* three diversions in Hewane. In the meeting, he requested the farmers to elect the *abo mai* who would manage the water distribution. The two *abo mai*s who served in the previous year gave no report about water distribution and the problems encountered in the irrigation system. The water users nominated four farmers and two *abo mai*s were elected. The newly elected *abo mai*s received no written bylaws with regard to water management either from the former *abo mai* or the *tabia* chairman. However, they told me the following.

a) *Abo mai* distribute water in turn.
b) A person involved in water theft will be fined 50 *birr*.
c) If an *abo mai* gives water to a farmer without his turn, he will be fined 50 *birr*.
d) If a person is engaged for the second time in water theft or if the *abo* gives water to a farmer for the second time illegally, both of them will be fined 100 *birr*.
e) A person who violates the rules will be sued in *Mahberawe firdbet* (social court) and the court will collect a fine.
f) If *abo mai* commits any serious breach, he will be dismissed.

The outgoing *abo mai*s were not evaluated at the meeting. For instance, one of them had irrigated his plot outside his turn. His case was reported to the head of *tabia* economic development and he was found guilty and dismissed from his post. I asked the current *abo mai* why irrigators were not interested in evaluating the performance of outgoing *abo mai*s when such clear mistakes were committed during their term. The current *abo mai* said, 'irrigators are of the opinion that why utter bad words since the former *abo mai* will be replaced by a new one'.

Table 3.3 Number of *Abo mai*s in Hewane Irrigation System by Diversions Served

Areas served between diversions	Number of *Abo mai*	Number of diversions	Irrigated area in hectare
Meshieg to Menkuse	2	2	10
Kaena to Mairebi	2	3	4
Ayene Korkora	2	1	2
Ayene Islam	2	1	2
Hewane	2	3	12
St.George tabot maderia to Karin Berashin	2	5	6
Total	12	15	36

The water committee of the *tabia* does not decide the amount of water that should be supplied to the fields. There are 12 *abo mai*s serving in Hewane irrigation system. Every day, early in the morning, they inform farmers about the daily water distribution turns and leave the farmers to do their daily activities. The *mesno abo mais* are also responsible for the distribution of water to the *hayfo* plots

Canal cleaning and maintenance

The main maintenance-related task of the *tabia* committee is to supervise canal cleaning activities and to see that the canal is brought into operational condition. The committee sets a specific day for canal cleaning and maintenance at the end of *keremt*. Canal cleaning and maintenance is the responsibility of all irrigators. Those who lease out their plots to sharecroppers do not participate in such work. Although women participate, men largely do the work. The *abo mai* informs all irrigators the day and the place for irrigators to come for the work. The agriculture cadre allocates a 10 meters length of canal to be cleaned by each person. If the canal cleaning and maintenance work is not completed within a day, farmers are requested to continue the work the following day. Participation in the canal cleaning and maintenance is not based on plot size or water utilised by individual farmers. Those who did not participate in the task are asked to work the following day. In Ayboto *Kushet*, for instance, there are about 100 irrigators. The Ayboto *Kushet abo mai* said, 'if the canal cleaning takes three days, the first day about 60 farmers participate. In the second day the number could increase to 70 and the third day all could show up. A farmer who did not participate on the first day will be skipped a water distribution. A person who did not participate in the canal cleaning for the second time is fined five *birr*. The fine is called *Hurued*. In 2000, six farmers were fined 30 *birr*. The previous year 40 farmers failed to participate and they were fined 5 *Birr* each. The amazing thing is that the *abo mai* first pays the *hurued*, for instance, in 1999 he paid 200 *birr*. The *hurued* will not be kept for further re-investment, rather the money will be spent on drinks. The *abo mai* will buy *tela* and *tej* (local drinks) after the canal cleaning is finished for those who participated. He will collect the fine from those who did not participate some other time. A person who refuses to pay the fine will not get water.

Co-operative work in canal construction

Farmers co-operate in agricultural activities such as weeding and harvesting. The following case illustrates how an individual farmer was able to construct a five kms long earth canal with the co-operation of fellow farmers. In the Hewane irrigation system, a farmer can divert water to his field if he is capable

of constructing a canal. However, such a plot receives water on the basis of the established classification of plots, i.e. *mesno* and *hayfo*.

Abreha Haile, 64, lives in Meka Maireb, Korkora *kushet* (village). He cultivates four-*timad* of 'poor' quality land, which he received when land was redistributed by TPLF. While the nearby farm plots were irrigable, Abreha's farm used to be rainfed. One day, an idea came to him to dig a canal in order to get the water for his plot from the river. Then he consulted seven neighbouring farmers who like him received no water. The farmers agreed to canalise. They started ploughing a five-km strip of land with oxen to make an earth canal. After a few days of work they broke two yokes. However, Abreha and his friends continued the work for two months without losing hope. Then friends advised him that the canalisation idea was not feasible unless he obtained labour assistance. Towards the end the work, they sought labour assistance from Adishu *Woreda* administration. The *Woreda* mobilised 70 farmers and finished the remaining work within one day.

Water conflict management

Conflict over water takes place among irrigators, between irrigators and *abo mai* and between *Kushet*s (villages). In conflict resolution, irrigators, *abo mai*, *tabia* chairman or *tabia* head of economic affairs and *maheberawe firdebet* (social court) are all involved, depending on the seriousness of the breach committed.

Conflict among irrigators

Conflicts sometimes arise when water is being distributed. Some irrigators break canals to divert water to their fields. In other cases, water overflows the canal to the adjacent field in the absence of the plot holder, thus damaging the crop. When conflicts take place the farmers present in the field usually try to settle the matter. If the breach is a serious one such as water theft then the case will be reported to the *abo mai* who could report the case to the *mahberawe fierdebet* (social court). If the irrigator is found guilty he will be fined 50 *birr*. The court collects the fine. In some of the *kushet*s such as Ayboto, water theft is almost non-existent. According to the *abo mai* of Ayboto, water theft hardly takes place in Ayboto because farmers consider 'water as their life'. A person who is involved in water theft is highly criticised by fellow farmers and neighbours. Furthermore, he said 'the rule is not the only deterrent to taking someone's water, but the community's negative attitude towards the illegal person also matters'.

Conflict with Abo mai

I met three farmers in the compound of the *tabia* agriculture office who came from Ayboto *Kushet.* I asked one of them why they came to the *tabia*. He told me that they wanted to report to the *tabia abo wonber* (*tabia* chairman) since the *abo mai* did not give them water after they planted maize. Again I asked why the *abo mai* was not willing to give water to them? He said, 'it is a sort of revenge'. According to my informant, the person who is currently serving as *abo mai* wanted to get water illegally last year. He told him to irrigate his plot according to his turn'. The present *abo mai,* wanted to take revenge by not giving water to my informant this year.

There are instances where the *abo mai* is involved in unfair water distribution through bribes such as invitation for some drinks or getting grain. Farmers may not be bold enough to expose corrupt *abo mai*s since they fear that they may not get water. One irrigator observed unfair distribution of water. He said, '*abo mai* sometimes gives water without turn to farmers who invite him to *tela* (local beer). He tells the farmer who wants to irrigate his plot illegally, 'just irrigate your plot, I will tell the farmer who asks for water that you are irrigating due to an overflow. You should say the same thing. If he complains about the distribution of water, I will tell him that he was not at home when I went to inform him about his turn'. I asked him what would be the reaction of farmers who do not get water according to their turn? He said, 'those who were denied water enter into conflict with *abo mai*. However, usually elders or friends are involved in settling the conflict. In addition, suing and getting compensation is not common in our community'.

The *abo mai* who is elected for *mesno* plots is also responsible for the water distribution in *hayfo* plots. A *hayfo* farmer told me the following story of how the *Abo mai* discriminates against farmers in the distribution of water.

> Hayfo *irrigators do not get water when they need it. I have a plot adjacent to those of the* tabia *attorney and the* abo mai*. One should be lucky to be a plot holder adjacent to* abo mai*'s plot because one can irrigate his plot when the* abo mai *irrigates his. Last year, the* tabia *attorney and I were told by the* abo mai *to irrigate our plots. The attorney was given 9 hours to irrigate his 2-timad plot. I was to told to irrigate my 2.5 timad* hayfo *plot for two and half-hours. After the* abo mai *told us our turn, he went to* tej bet *(local bar) and forgot the supervision. I was able to irrigate my plot for 12 hours'. Then the attorney came and asked for water. By then my plot was sufficiently irrigated and I gave the water to the attorney. I harvested six quintals lentil, which I never had before. St. Gabriel gave me this because my plot was irrigated on St. Gabriel's day.*

Conflict among Kushets over water

Farmers sometimes are engaged in disputes over water at *Kushet* level. In 1998, for instance, Ayboto farmers had conflicts with Hewane farmers over *mesno* water distribution. The Ayboto *Kushet Abo mai* told me the following. 'Hewane town irrigators wanted to use two-thirds of the water because their plots are larger than the Ayboto plots but Ayboto irrigators did not agree. Finally both of them took the issue to the Hewane *tabia* chairman and head of economic development. It was decided that both *Kushet*s should use the water equally. Based on this decision, each *Kushet* irrigates its plot for 5 to 6 days until the plots are wet enough. When there is shortage of water each *timad* will be irrigated for six hours regardless of the type of plot'.

3.7 Struggles to Preserve Irrigated Land Area and Agricultural Land Quality

This section is about the effects of riverbank erosion and slumping on the livelihood of farmers cultivating both irrigable and rainfed plots in Hewane *tabia,* and about their struggle to preserve the irrigated land. Soil erosion was accelerated, among other things, due to the discontinuity of the government sponsored soil and water conservation (SWC) work in 1995. Local people had been participating in the soil and water conservation works through the food for work program. Between 1995 and 2001, under government orders, people were re-deployed on the Shelenat dam constructions, putting a stop to soil and water conservation work in Hewane.

Shelenat dams construction

The Shelenat irrigation system, with a command area of 289 hectares, was constructed by Co-SAERT and local people through a food for work program and 20 days free labour. It is located in Shelenat village some four kms north of Hewane town. The government has constructed a river diversion canal that transports water during the long rainy season from the Hewane River to the three Shelenat earth dams. The intake is situated in Korkora *Kushet* at the middle of the Hewane irrigation system (see Figure 3.1).

The Shelenat diversion canal passes along the *hayfo* plots, which get irrigation water until the end of December. The soil excavated from the Shelenat canal was piled on the canal bank, blocking water that went to the *hayfo* plots. About 100 farmers affected by the situation applied to the *tabia* and *woreda* administration seeking solution. I was informed by the site engineer that Co-SAERT had a plan to construct three outlets for *Hayfo* farmers, but the design did not come from head quarters to start the construction. Farmers did not get water until my first fieldwork was completed.[10]

One of the *hayfo* farmers affected by the construction of the diversion canal cultivates one *timad hayfo* land and two *timad* rainfed land. He and four other farmers planted maize on six-*timad hayfo* land with the assumption that they would get left over water from the *mesno* and *belg* rain (the short rains in February). The five farmers had planted maize the previous year that failed due to lack of rain and the maize stem was used as animal feed. This year, without losing hope, they planted maize again. I asked why they planted this year when they had had such a bad experience. He said 'we have faith in God'.

Photo 3.1 An outlet constructed by *hayfo* irrigators cutting Shelenat diversion canal at Korkora

While the soil excavated from the new canal was filling and blocking the canal to his *hayfo* land, he realised the problems that would take place in the future. He told his fellow farmers that they should irrigate their land before the canal became fully blocked. However, he and his friends were not entitled to use the stream water since it was diverted to the *mesno* plots. Thus they agreed to ask the Menkuse village farmers to give them water. They went to Menkuse village on St. Mary's day where local people meet at a church compound to eat and drink every month. They disclosed their concerns about the problems they would soon face because of the excavated soil now filling the canal. In addition, they mentioned how their family members were going to face food shortages if they could not irrigate their land. Then the Menkuse farmers unanimously

agreed and allowed them to irrigate their plots for 24 hours. The *Abo mai* of Menkuse gave them additional water for 48 hours realising the consequences if the plots did not get sufficient water. Later the *Abo mai* and the Korkora farmers informed the Menkuse farmers that their plots had been irrigated for 72 hours.

Soil erosion and slumping in Hewane

Soil erosion is a critical problem in Tigray. Fitsum, et al. (1999:11) report that 'Tigray's soils are believed to have lost 30-50 percent of their productive capacities compared to their original state some 500 years'. One report indicates that 'in the areas severely eroded, soil erosion is reducing crop yields by 1 percent per annum and that biological degradation (e.g. loss of soil fertility, changes in soil structure) is resulting in another 1 percent decline in crop yields' (Caldwell, 1992: 32).

The cultivable area of Hintalo Wajirat *Woreda* is 46 percent of which 62 percent is above 8 per cent slope. According to FAO studies farmlands having slopes greater than 2.5% (classified as gently sloping) are usually exposed to severe erosion hazard (REST, 2001).

Mass movement and slumping are the major problem in the Hewane irrigation system. Mitiku, et al. (2001:11) write that,

> *the main problem of the river diversion systems is the contraction of irrigable size from time to time. This is due to expansion of riverbanks to irrigable lands and increase in the depth of the riverbank that makes it difficult to use gravitational flows. For instance, two traditional river diversions in the Southern Tigray, Betmera and* Hewane*, lost more than 50% of the irrigable land between 1978 and 1990 in less than 15 years.*

Hudson (1995: 46) classified mass movement and slumping as specialised erosion and describes it as

> *a process of geological erosion, and although it may be accelerated, as in the sides of gullies, it can occur without any intervention of man… The other main cases of slumping are river-bank collapse, and coastal erosion. Landslides, slip faults, and other geo-morphological forms of mass movement are associated with saturated solid on steep slopes and unstable geological conditions.*

When I was walking along the Hewane River, I observed the river gully encroaching upon the farmlands. I asked my research assistant about the situation and he told me that river bank erosion and slumping in Hewane is a serious problem and many farmers have lost up to 0.5 ha farmland. The erosion takes place during the rainy season when the gully is flooded. A gully about 15 to 20 meters wide is created passing through *mesno* and *hayfo* farmlands.

Photo 3.2 A farmer ploughing at the foot of Hewane River bank after he lost part of his land due to gully erosion

I had a long discussion with two farmers who lost farmland due to riverbank erosion and slumping in Korkora *kushet*. The farmers, Gebreselasse Mersa *agenage gebere* (contact farmer[11]) and Desalu Redai, reported that about 40 farmers lost their farmland partially or fully due to soil erosion in Korkora. They gave me names of 20 farmers who lost both irrigated and rainfed farmlands ranging from about 0.125 ha to 0.5 ha and now engaged in bee keeping.

Table 3.4 Size of Eroded Farmlands and Number of Farmers Affected in Korkora *kushet*, Hewane *tabia*

Plot size in hectare	Number of farmers	Percentage
0.125	6	30
0.25	11	55
0.5	3	15
Total	20	100

This erosion problem is serious in Menkuse and Korora *kushets*. Among the victims of the soil erosion, 55 percent lost a quarter of hectare. For instance, six farmers lost their farmland completely due to erosion in Menkuse. The number

of victims of soil erosion in Korkora is the highest compared to the other *kushets* of Hewane.

Soil and water conservation (SWC) measures

In the early 1970s, forestation and bench terracing started in Tigray sponsored by USAID and later by UNFAO World Food Program Projects. Currently, the regional government mobilises the local people to participate in SWC works through food for work program and 20 days free labour contribution.

Table 3.5 Soil and Water Conservation Activities in Hintalo Wajirat *Woreda*

Activity	Unit	1996	1997	1998	1999	2000	Total
Stone terrace	Meter	226027	1002166	1004327	796754	614987	5544261
	Hectare	3037	1432	1435	1138	878	7920
Soil bund	Meter	840580	319814	218229	356051	434491	2169165
	Hectare	1401	533	364	593	724	3615
Check dam	Meter	51228	20883	68951	26665	19333	187060
Flood	"						
diversion	"	-	-	-	21064	1464	22528
Trench	"	-	-	-	-	15082	15082
	Hectare	-	-	-	-	25	25
Maintenance	Meter	-	-	375700	-	255794	631444
works	Hectare	-	-	626	-	426	1052

Source: *Woreda Hintalo Wajirat Ab Godana Limat* (1988-1992 (E.C), p.15

Thousands participated in the soil and water conservation activities, mainly through unpaid labour which was estimated at US $ 1,992, 515. In addition, part of the soil and water conservation activities were carried out through the food for work program supported by World Food Program, Relief Society of Tigray and Ethiopian Social Rehabilitation and Development Fund.

Table 3.6 Number of Workdays People Participated in Soil and Water Conservation in Hintalo Wajirat *Woreda*

Year	Male Farmers	Youth	Women	Total
1996	44838	38746	85713	169292
1997	22075	20486	42561	86322
1998	25479	26814	53028	105321
1999	56787	61916	113004	231707
2000	60362	64899	134069	260130

Source: *Woreda Hintalo Wajirat Ab Godana Limat* p.14

Hewane farmers are quite aware of the negative impact of soil erosion on crop production since their farming plots are shrinking every year. They have taken

some measures including constructing stone bund and planting some plants to mitigate the gully erosion and slumping, although it is washed away by flood during the *keremt* season.

The farmers have requested the local government and *Woreda* Agriculture Department to continue the soil and water conservation work, which was carried out every year by mobilising local people. However, their request did not get a positive response. As the soil and water conservation expert of the *Woreda* Agriculture Department said:

> *Soil and water conservation work stopped from 1995 when the regional government decided that the local people should participate in the construction of Shelanat dams in Hewane. Farmers used to participate in soil and water conservation works during slack periods before 1995.*
>
> *The collection of sand and stone from the riverbank for the construction of dams has also contributed to the soil erosion. In addition, some farmers are taking stone by demolishing stone bund constructed for the protection of soil from erosion since they get 6-kg wheat per one cubic meter stone. I have discussed with Co-SAERT workers about the destruction of stone bund and I was told that 'the Shelenat dam is given priority we can not help it. Even if we report to higher bodies no one listens'. Farmers' effort to mitigate the gully erosion could have been fruitful had there been the necessary support from the government.*

Bee keeping: the emerging livelihood practice

Bee keeping is widely practised all over Ethiopia, particularly in the southern, southwest and western regions. The cylindrical hives, which are usually made of reeds covered with straw and leaves, are about one meter long and 30 to 35 centimetres in diameter; they are closed on one side, and the inside is often spread with animal dung. The hives are usually suspended in sycamore trees.

Honey is used for the preparation of the fermented beverage called *taj*. Both the liquid and solid honey is sold at local markets. A different kind of honey, called *tazma,* is produced which is used for medical purposes only. It is said to have special properties for the treatment of diseases of the respiratory system.

In Hewane, many farmers are engaged in off-farm activities such as bee keeping, poultry, and working as casual labourers in construction works. Farmers affected by gully erosion and slumping are increasingly involved in bee keeping. I asked Gebreselasse Merssa *agenage gebere* (contact farmer) and Desalu Redai about the bee keeping in their village. They said,

> *In Korkor, there are farmers who own up to 40 bee colonies. The practice of bee keeping is expanding. The main reason is our plots are eroded from time to time and many of us have lost considerable size of plots. The second reason is bee keeping is a simple task, which does not need shepherds or fodder like cattle rearing. If we put dissolved sugar in the open air, the bee can suck it to make honey.*

Table 3.7 Beekeepers Affected by Gully Erosion and Slumping in Korkora *Kushet* by Ownership of Bee colonies

Number of beekeepers	Number of bee colonies
1	-
2	5
3	4
4	1
5	1
6	2
7	1
8	1
9	-
10 and above	4

Korkora beekeepers own two to five traditional beehives with the exception of one farmer who owns a modern frame beehive. The maximum number of beehives owned is forty. The honey is usually collected by fumigation, burning dry animal dung. Then all the honeycombs, save one, are removed and the beehive is replaced. Great care is usually taken to save the queen.

Case 1

Gebreselasse Mersa, 45, victim of gully erosion, has 6 family members. When land was redistributed by TPLF in 1990 he received 0.25 ha *mesno* land and 0.75 ha *hayfo* land. He lost about 0.083 ha *mesno* and 0.25 ha *hayfo* land. He attempted to stop the soil erosion by constructing stone and soil bunds which was easily washed away by heavy floods during the rainy season. Although he reported the situation, he received no support from the Hewane agriculture office. Gebereselasse is aware of the continuity of riverbank erosion and slumping in the future and thus he gave more attention to poultry and bee keeping than farming. He started poultry in 1998. He has 15 hens and sells eggs and hens. He is also engaged in bee keeping. He owns one modern frame beehive and three traditional beehives. Gebreselasse bought the modern beehive form Hewane tabia agriculture office for 48 US $ on credit in 1999. He has paid one-third of the loan although he did not harvest honey. Gebreselasse believes that it was his fault since he did not inform the agriculture office to harvest the honey on time.

Case 2

Desalu Redai, 35, victim of gully erosion, has 5 family members. When TPLF redistributed land in 1990 he received 0.75 ha *hayfo* land. Currently, he cultivates about 0.25-hectare land. He attempted to conserve the soil by constructing a stone bund and planting some trees but did not succeed. In 1997 his brother gave him one traditional beehive to supplement his income

by selling honey. Now he owns eight traditional beehives. Desalu doesn't own modern beehive because he cannot pay back the loan although he needs. He also works as daily labourer in dam construction getting 3-kg wheat per day.

Photo 3.3 Traditional and modern beehives

Case 3

Taeme Gebrehiowt, 45, victim of gully erosion, has 9 family members. He cultivates 0.62 ha rainfed plot. He has lost 0.25 ha due to soil erosion. Two oxen died because of lack of animal feed. He started bee keeping in 1987. He owns 50 traditional bee heavies. He has hopes from bee keeping. Taeme knows about the importance of a modern beehive, but he did not buy one because he cannot pay back the loan.

According to a survey of Tigray Agriculture Bureau, 8350 traditional beehives and 66 modern beehives were registered in Hintalo Wajirat *Woreda* (BoANR, 1999: 99). Korkora had 212 beehives which was the highest compared to the

other *kushets* in Hewane. Modern beehive frames are hardly used in Hewane and the neighbouring *tabias,* although the honey harvest appears to be better than from the traditional beehive. Hewane *tabia* agriculture supervisor reported that:

> *The government is making an effort to introduce modern bee keeping technology in Hewane* tabia*. For instance, 25 modern beehives were ready for sale to farmers in 2001. Within six months only three farmers had given advanced payment to purchase beehives. The reasons why they are not willing to purchase the frame beehives are: first, they would like to see how owners of them benefit; second, farmers complain about their price; third, shortage of bee technicians has seriously affected the follow up and harvesting of honey; fourth, there is only one honey extractor and casting mode in the* woreda*, which rotates from* tabia *to* tabia*. Although, farmers who bought frame hives were given training on how to collect honey, they do not have the honey extractor. The* Woreda *agriculture department is not willing to give the only honey extractor to farmers to use it by themselves. Thus bee technicians should travel from tabia to tabia to collect honey using one extractor.*

Furthermore, a bee technician told me why modern bee keeping is not widely practised.

> *The major reason is lack of technical assistance from the agriculture office, including regular follow up and being able to harvest the honey on time. I, for instance harvested only once in two years from one of the farmers who purchased frame hive from the agriculture office. Two farmers in Waza Ada Wana* tabia *who own two frame hives have so far not collected honey because there is no technician to give them the necessary guidance on how to collect it. In addition, farmers do not have the necessary equipment to harvest honey by themselves'. The second reason is that farmers are not interested to take frame hives fearing that the queen will die when it is transferred from the traditional beehive to the frame hive. They cite the incidence that took place in* kushets *(villages) like Miaine, Ayboto and Gebzia The bee technician said, since the transfer takes place during the night time the queen can die if the necessary care is not taken.*

The acute shortage of bee technicians has compelled the *Woreda* agriculture department to seek assistance from other *Woreda* and Relief Society of Tigray. At present, six months training in bee keeping is being given to 30 students who completed high school at St. Mary Agriculture Training Centre to overcome the man power problem in the region.

3.8 Conclusion

In the concluding section, I examine the relevance of the forgoing discussion to my research question which focused on the practice of irrigated agriculture and how local government bureaucracies intervene in everyday irrigation

management and irrigated agriculture; and the key interfaces and arenas shaping interactions and outcomes between agencies and farmers.

Historically, socio-economic and political control of water was exercised in Hewane by the landlords and local governors in terms of allocation and scheduling and later the TPLF's heavy-handed land redistribution also resulted in reconstruction of water rights since access to irrigation water was linked to land rights.

Hewane irrigation system management has been embedded in local governance. There have never been either government initiated or indigenous irrigators' organisations responsible for water management. The *Afercheka* and later the *Abo mai* was responsible for water distribution and organising canal cleaning and maintenance. In the absence of separate water users' organisation or committees, the links between local government and farmers has been maintained through the 'irrigation intermediary', *Afercheka* or *Abo mai,* who is the most available and visible in day to day interactions. The interaction takes place mainly to facilitate the exchange of information between the government agencies (agriculture and administration offices) and the farmers so that decisions of the former with regard to water allocation and scheduling could be enforced. In effect, such an arrangement has made irrigation management an appendage of the local government bureaucracy. I concur with Hunt and Hunt (1976:398) that '…irrigation agriculture thus clearly a resource of great structural potential; it is systematically linked with major features of the social organisation, closely linked with differential power, and embedded in the local-national linkages of states'. Although farmers elect *Abo mai* every year, such participation is often instrumental as Boelens (1998:2) notes '[a] strategy to subordinate water users and strengthen or reproduce unequal power relations'. Boelens further argues that '…farmer participation is seen as a process in which farmers should be 'included' in order to meet the objectives and strategies of others'.

Currently, officials of the *tabia* administration and agriculture department are frequently involved in the management of water allocation and conflict resolutions. Farmers often appeal to the local administration or agriculture office when they encounter problems or conflicts over water distribution. Serious breaches such as water theft are referred to the social court, which can fine the culprits.

In the Hewane system, the local government bureaucracies control access to river water. The water allocation and scheduling is dictated by the government plan to achieve 'food security' through irrigated agriculture at household level. Water allocation to users is based on the principle of classifying plots into *hayfo* and *mesno* (irrigation). The *mesno* plots have water priority over *hayfo* plots. The switching of plots from *hayfo* to *mesno* or vice versa takes place every year.

Farmers criticised the classification of plots into *mesno* and *hayfo* for water delivery, which creates uncertainty of access to water. As Diemer (1998: 100) notes, 'the notion of equity refers to people's ideas about what is fair and unfair in a given situation. These ideas are not absolute but concern of the parties involved. This applies also to distribution of irrigation water'.

The construction of the Shelenat diversion weir in Hewane is a commendable effort. However, the unintended negative effect of non-consultative irrigation intervention has resulted in erosion of water rights by blocking the *hayfo* canal. Although the farmers constructed three outlets on Shelenat diversion weir later, the government while constructing a new irrigation infrastructure should have maintained the old system, which enables *hayfo* farmers to produce. The World Water Forum points out that 'valuing the role of water in the livelihoods of rural people, who produce food, and maintain the systems for food production, is a central principle in water management for food and rural development' (World Water Forum, 2000: 45).

Furthermore, the government's decision to deploy available local labour during slack periods on the construction of the Shelenat dams, thus abandoning the soil and water conservation project, had unintended negative effect on the latter. Since soil and water conservation works were halted for over five years, gully erosion and slumping was aggravated. In other words, an agro-ecological problem mediated by political power has threatened the livelihood of farmers in Hewane. Hudson (1995: 357) writes that 'most national governments pay lip service to the idea of the conservation natural resources, but in practice soil conservation is not a vote-winning issue with the electorate. The officially declared government policies are usually not translated into action because resources are allocated to more visible programmes, which promise more immediate benefits. Long-term care of the soil cannot compete with the pressing need for schools, hospitals, or roads'. Individual farmers have made efforts to prevent the soil erosion although every year the winter flood washes away the constructed soil and stone bunds. In Tigray, as Yibabe and Esser (1999) note 'most farmers are aware of the seriousness of soil erosion on that they live at the subsistence level and cannot perceive how to take action to correct the situation. The labour needed is simply too high and the benefit too far into the future. The construction of appropriate soil and water conservation measures is not a realistic option without external assistance. Hence, they tend to push the issue to the back of their minds and hold on to the belief that God will provide for them'. In Hewane, gully erosion and slumping has compelled farmers to adopt actions meaningful to their life-worlds, that is, they are developing bee keeping, compensating for their diminishing harvest from the annually shrinking farmland.

There is great diversity of access locally to water and land – between *mesno* and *hayfo* and dry land, and between soils of different qualities of land. This helps to shape some of the complex world of opportunities and constraints which drive farmers to rent in and rent out land to gain access to other site with better fertility and water availability, or move entirely into off-farm activities to build their livelihoods, depending on their or other family resources.

In conclusion, the findings stress the political control of the State in water allocation and scheduling, but a wider social control in the *Abo mai*. The issue perhaps is that these two controls do not give the right hydraulic/technical control that ensures security and adequacy of irrigation application.

In the chapter that follows I examine the irrigation practice in Gum Selassa where the source of water is a micro dam constructed by the regional government.

Notes

1 According to the Central Statistics Authority, a settlement with two thousand persons or more is a town.
2 The data were collected from the Hentalo Wajirat Woreda Agriculture Department.
3 Sasakawa Global 2000 project was initiated in 1993 by the Sasakawa Africa Association and the Global 2000 programme with the co-operation and support of the Ethiopian government.
4 A kuna is a local basket containing 5 to 10 kilos depending on the size.
5 Initially 'Girazmach' is a title given by the Emperor to a person who fought in battle. Later, the title was even given to a person who did not participate in battle.
6 Dejazmach is also a title given by the Emperor to a person who fought in battle and is a higher level title that Girazmach.
7 Awraja was the higher administrative unit next to Woreda during the Imperial and Derg regimes.
8 The promise to re-distribute land did not materialise.
9 The production dimensions of irrigated agriculture in both Hewane and Gum Selassa irrigation systems is discussed in chapter five.
10 During my second fieldwork, I visited the Shelenat diversion. Co-SAERT did not construct the promised three outlets to the hayfo plots. However, they had allowed farmers to construct the outlets themselves. Farmers have cut the diversion canal at three points to make the outlets. The outlets are closed during the rainy season with stone, soil and wood lots to divert water to Shelenat.
11 A contact farmer is a go-between a DA and farmers (about 10 to 20 farmers) engaged in the dissemination of new techniques of farming in his village.

4
Irrigation Practices in Gum Selassa Irrigation System

4.1 Introduction

The Gum Selassa irrigation system was constructed in 1996 by the Regional Government within the framework of Sustainable Agriculture and Environmental Rehabilitation in Tigray (see chapter 2). Irrigation was introduced by pooling and redistributing farmer's holdings despite local people's scepticism about irrigation. Over the last six years between 21 and 85 percent of the plot holders have been left without the promised dam water due to sociotechnically-mediated water scarcity. This chapter then has two objectives. The first is to look into the water management of Gum Selassa irrigation system and then examine how misfits in water control have given rise to water scarcity in the irrigation system that has threatened farmers' livelihoods.

The chapter first gives an overview of the physical settings and the people. It then describes the establishment of Gum Selassa irrigation system and the construction of the micro dam. Water governance and management rules are discussed in section five. Section six examines water management tasks, while the seventh and eighth describe the cropping pattern and how water scarcity threatened the farmers' livelihoods. The conclusion reviews how different actors are involved in irrigation and interfaces in their interaction: it also briefly summarises key differences in irrigation practices between the Hewane and Gum Selassa irrigation systems.

4.2 Physical Settings and the People

The Gum Selassa irrigation system encompasses parts of the territory of Adigudom and Arra Alemsegeda[1] *tabia*s (sub-districts). It is located four kms east of Adigudom town. Adigudom is the main town of Hintalo Wajerat *Woreda* situated 39 km south of Mekelle. Gum Selassa irrigation system is at an altitude of 2061 m.a.s.l. The area is known for its flat agricultural land with no tree cover. Agricultural production is dependent on unreliable rainfall. During the last two decades, the agriculture of the *woreda* has suffered frequently from the scarcity and/or irregularity of rainfall.

Elders reported that Adigudom town was established during the first quarter of the 20th Century. During Ras Seyoum Mengesha's[2] time, the local people used to go on foot to the Dur Anbessa Michael Church for prayer services, about one hour from their villages. The villagers were compelled to ask the governor to construct a new church in their locality due to the time they spent in travel. In response to the villagers demand the church Aba Gaber Mefes Kidus was established in 1912. Following the establishment of the church, Adigudom was founded in 1915. Informants told me that the word 'Adigudom' means 'a homeland made by urge'. In 1947 people started to receive plots of land under the *chikashum* (village chief) Girazmach Bisrat Abesha. After 1948, the settlement developed into a small town.

About 8,500 people live in Adigudom town. Residents live in *Hedmo*, the traditional houses, which dominate the town. The walls of *hedmo* houses are made of stone and the roofs are of wood and soil. Fencing an individual's compound with stone is a common practice. On the stone fence residents put out cow dung to dry, which is used as fuel to cook food. Residents plant *Belese* (prickly pear cactus) to reinforce the fence. In addition, this serves as a food source since poor people eat the *Belese* fruit during winter season when there is food shortage.

A large majority of the inhabitants are Orthodox Christians. Muslims constitute about five percent of the town population. The government runs two primary and two junior secondary schools. Provision of public telephone and electricity started in 2000. Residents are supplied with public tap water. The government clinic provides health services for the residents of the town and neighbouring *tabias*. About 20 tailors and 25 retail shops exist in the town. Limited catering services include two small hotels, five *tej bet* and about 150 *tela bet* (both are local bars). People from the town and the neighbouring *tabias* come to the weekly market on Saturday to sell cereals and vegetables and purchase goods including salt, sugar, cloth, edible oil and agricultural tools. The privately owned flourmills are busy on market day since the local people also come to Adigudom to get milling services. In addition, the weekly market serves as a meeting place to recruit agricultural labourers who come from the neighbouring *tabias* such as Hintalo, Adi Kolo, Hager Selam and Ara. The town council chairman said, 'trading is developing in Adigudom compared to previous years. These days the number of retailers involved in petty trading is increasing. Many people consider commerce as a good source of income because the yield they get from farming cannot sustain their families for the whole year'.

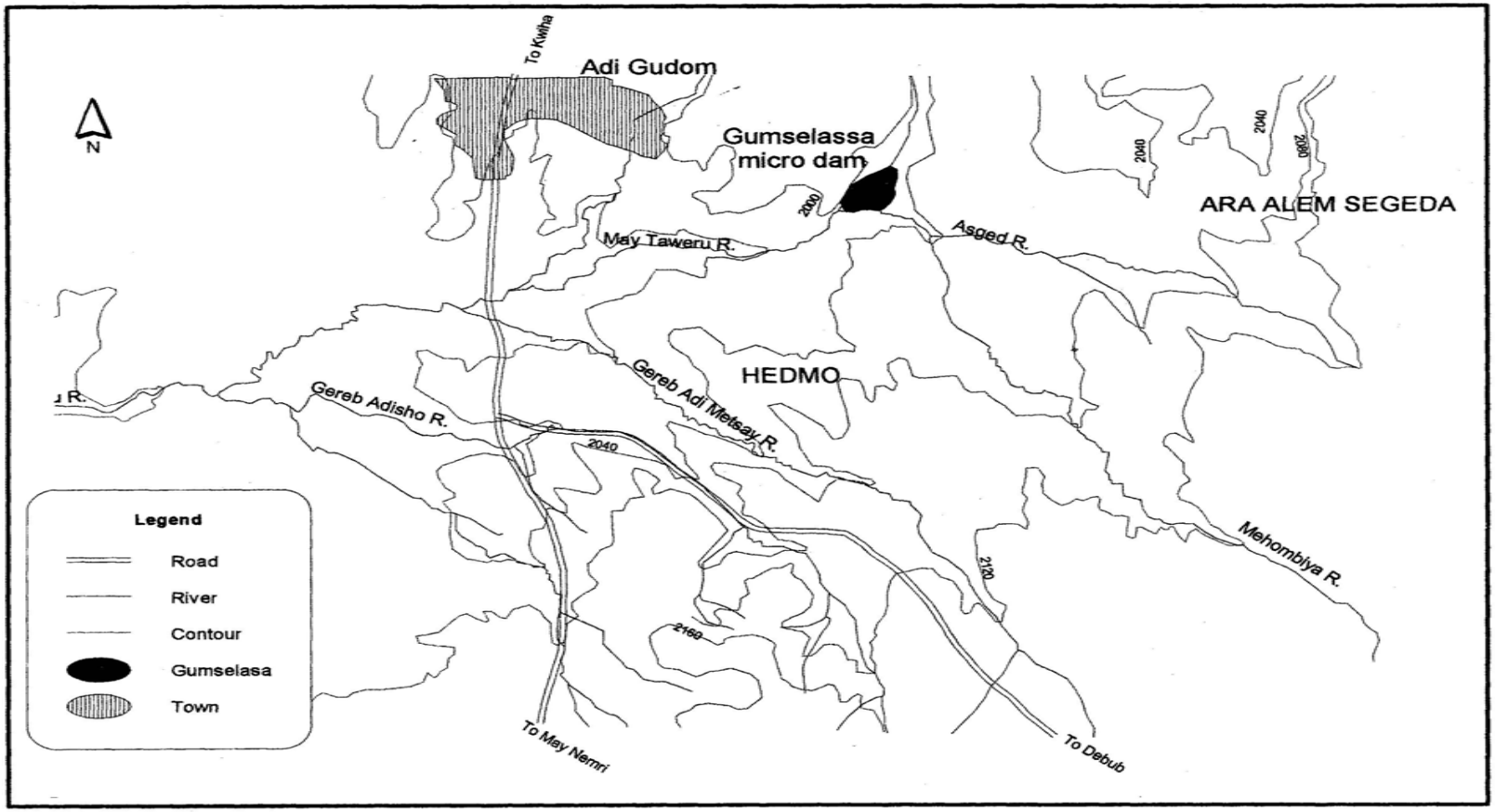


Figure 4. 1 Location Map of Gum Selassa Micro dam

4.3 Establishment of the Gum Selassa Irrigation System

Land reallocation study

The Gum Selassa micro dam was the first irrigation infrastructure constructed by the current government. There was no experience on the government's part on how to select water users and how much irrigable and rainfed land should be distributed to a farming household. Thus, the regional government set up a five-man committee to develop guidelines for land reallocation and the selection of irrigators in the Gum Selassa and Adha irrigation systems[3].

The study committee carried out a land holdings inventory to identify the size of individual land holdings and the number of farmers who were cultivating land in the reservoir and command areas prior to the construction of the micro dam. According to the inventory, 368 farmers from the three *tabia*s were cultivating 735.3 tsimdi (147.06 ha.) rainfed plots. In terms of landholdings, Adigudom farmers had the lowest area of plots (161 *tsimdi* (32.2 ha) while Arra farmers had 398 tsimdi (79.6 ha). The average plot size ranged from 1.2 (Adigudom) to 3.5 (Arra) tsimdi (see Table 4.1).

Table 4.1 Breakdown of Land Holdings of each *Tabia* in the Command and Reservoir Areas before the Construction of the Gum Selassa Dam

Tabia	Description of area	Number of land holders	Plot size range (in tsimdi)[4]	Average plot size (in tsimdi)	Total area (in tsimdi)
Arra	Reservoir	83	1 – 6	3.5	285.5
Arra	Command	55	0.5 – 4	2.1	112.5
Alem Segada	Command	90	n.d	2	176.3
Adigudom	Command	140	0.5 –2.5	1.2	161.0

Source: Bedini, et al. (1996:5)

The committee (Bedini, et al. 1996: 3-4) made the following key assumptions to determine the upper and lower limits to irrigable plot size that a household could cultivate.

- Input requirement for irrigated crops should include: seeds, labour, draught animals and inorganic fertiliser;
- A household was composed of 5 people;
- Rainfed land holding was 3 tsimdi;
- Minimum annual grain requirement for a family of 5 was set at 11.5 quintal
- *The household would directly utilises all of its land, i.e. would neither sharecrop nor rent out land* (emphasis added).

The committee recommended that a minimum of 0.2 ha and a maximum of 0.25 ha of irrigable and 0.75 ha of rainfed plot should to be allotted to farmer to

achieve food security at household level (ibid: 6). The regional government approved 0.2 ha irrigable land and 0.75 ha rainfed to a household.

The command area of the Gum Selassa irrigation system was taken as 120 ha. Based on the 0.2 ha allotment to an individual farmer, 600 farmers could get plots in the irrigation system. The committee suggested three different options of land allocation. One of the options was to allow '… only … those farmers with land displaced and those farmers with land currently in the command area to be allocated irrigated land. This option was rejected as it would reduce the number of potential beneficiaries to be ensured an acceptable level of food security and thus affect the achievement of the principal objective of the project' (ibid: A 4 – 1).

Land redistribution and selection of irrigators

The study committee identified two groups of potential irrigators. The first consisted of 368 farmers who had lost land in the reservoir and command areas. The second group of farmers was those who had no land in the command area, but cultivated close to the irrigation system. Since the first group of farmers had rights to irrigable plots, the land reallocation committee had only to select the remaining 232 farmers to make up the 600 farmers who could join the Gum Selassa irrigation system. Thus, farmers from the first group, from the reservoir or command areas (Ara and Arra Alem Segada *tabias*) whose overall land holdings had been reduced, were allocated an appropriate amount of land in the rainfed areas. The selection of the second group of farmers (Adigudom *tabia*) was based on the proximity of farmers' land and the ability to indirectly compensate 161 *tsimdi* (32.2 ha) with rainfed land to those farmers who have given away a portion of land in the command and reservoir areas.

To implement the allotment of 0.2 ha irrigable plot to a household, land redistribution was an important task for the regional government since the irrigation command area was in the hands of a relatively small number of farmers. It established a committee at *Woreda* (district) level chaired by the *woreda* administrator to carry out the land redistribution in Gum Selassa. Based on the land reallocation guideline, land was pooled from Arra, Arra Alem Segeda and Adigudom *tabia*s, and redistributed to the farmers who joined the irrigation system.

Although 600 farmers could had been designated for plots according to the study, the land reallocation committee selected 550 people[5] drawn from Adigudom, Arra Alem Segeda *tabias* and distributed 110 ha on lottery basis. It was planned to distribute the remaining 10 ha of irrigable land in the second round. Among those selected, 447 were men and 103 women received the designated 0.2 ha irrigable land. In addition, 499 farmers were each given three

timad (0.75 ha) rain-fed land to supplement the irrigated agriculture. Among those who joined the irrigation system, 51 farmers received no rain-fed plots at the time of land re-distribution and received between them 10.2 ha irrigable land to compensate what they have lost in terms of rainfed land. These farmers did not cultivate their plots themselves but leased to sharecroppers for a share of the harvest.

Farmers' reaction to the land redistribution

In the beginning, local people were suspicious of the introduction of irrigation in Gum Selassa assuming that the government would take their land. The construction of Gum Selassa dam had displaced 368 farmers who were cultivating 185 ha both in the reservoir and command areas. In addition, Gum Selassa farmers had no prior experience of irrigated agriculture. They complained that 0.2 ha land would not be sufficient for agricultural production. Consequently, they wanted to retain the rainfed land they used to plough which was relatively bigger in size. The average rainfed holding of the three *tabia*s was Arra 1.6 ha, Alem Segada 1.23 ha, and Adigudom 0.85 ha. (ibid: 7).

Thus it was not an easy task for the land redistribution committee to 'convince' the farmers. There was a strong opposition particularly from farmers in Edmo *kushet.* The committee had several meetings with the displaced farmers over a period of one month to get them to accept the irrigation project and land redistribution.[6] In the meetings farmers opposed the inclusion of farmers from Adigudom *tabia* in the intended irrigation system. The option of inter-*tabia* compensation and land allocation could exclude farmers of Adigudom *tabia*. This was due to plot sizes in Adigudom, both in the rainfed and command area, being on average smaller that those in the other two *tabia*s and so having little capacity to compensate (…). Another reason for this exclusion springs from Adigudom being in a separate *tabia* from that of Arra and Alem Segada under the new political boundaries. This would imply that Adigudom would not bear any of the costs of compensation **(**ibid.)**.**

A fifty-five year old farmer from Edmo k*ushet* (village) explained to me the Edmo farmers' opposition to the land re-distribution. He cultivates 2.1 ha of rainfed land, of which 1.25 ha is *woferit* (leased in) land. He said:

> *The land where the water reservoir is constructed belongs to Araa* tabia. *The greater part of the irrigated land used to belong to Edmo* Kushet *(village). At the beginning we were told that a dam would be constructed. After the completion of the dam construction, the* Woreda *Economic Development Head, Alemseged and Araa* tabias *chairmen, Head of* Woreda *propaganda affairs, and chairman of peasants association held meetings with farmers every week for about a month about irrigated agriculture and land re-distribution. We were informed in the meetings that all land from Araa, Adigudom and Alemsegeda* tabia *would be pooled and re-distributed. We supported the land re-distribution with Araa*

farmers because the dam was constructed on their farmland. But we felt that farmers from Adigudom should not get land from us because no land had been taken from them. Thus, 93 Edmo farmers opposed the idea of giving land to Adigudom farmers. We argued at the meetings. No one accepted it. When we said we would not give our land to Adigudom farmers, the officials said, "you are an obstacle to development, you have no say over the government land. We appealed in writing to the Woreda *Administration and elected three representatives to the* Zoba *(zonal) Administration and the Regional government. Government officials harassed our representatives and when the harassment continued we decided to increase the number of our representatives from three to five to strengthen them. I was not a representative because I was working in the* tabia ferd baito *(*tabia *tribunal) and the officials considered me a ringleader.*

Later the Head of Zoba *(zonal) Economic Development came to talk to us and had a day long meeting with Edmo farmers in the compound of Kidanemehret Church. He asked us why we opposed the intended land re-distribution. I said, 'we do not want to share our land with others'. In the meeting the* Woreda *Administrator said 'do not follow him, he is a ringleader'. The farmers said, 'we do not follow him'. He does not have land in Gum Selassa'. [My informant had no land of his own, but his father had one ha of land in Gum Selassa]. The* Woreda *Administrator said, he is arguing for his father's land'. The whole day the farmers took the same stand. The Administrator was scolding me repeatedly by saying 'you are a ringleader'. Then I said to him, 'you are in a better position than me in terms of authority, but I am older than you. Why do you scold me? From now onwards I will not talk'. Finally when the sun set the meeting adjourned without any agreement with the officials. After the meeting was adjourned, the* Zoba *and* Woreda *Administrators called me to talk privately. The* Woreda *Administrator asked me 'after you argued why did you keep quiet? I replied, 'I kept quiet because you scolded me, you disparaged me.' I was worried about whether I had committed a crime. The Zone Administrator said, 'he could have brought ideas had you not scolded him'. The* Woreda *Administrator said, 'had he been interested he could have convinced the people'. The* Woreda *Administrator said 'come to the administration some other time'. After saying this he went off with the* Zoba *Administrator. However, I did not go to the administration.*

On a certain day, farmers were called to take their plots of land according to the land re-distribution program. The farmers went to the meeting place assuming they would divide the land without including people from Adigudom. However, at the meeting they were informed that they would have to share their land with the Adigudom people. Again the farmers refused. Thus, the Woreda *Administration selected ten people among the farmers and detained them for six days. Later five of the detained farmers were accused on different grounds and sentenced from 3 to 6 months. I was also accused but I won the case. Following this, I was unable to work for a month as* Kushet *chairman because of the death of my 12-year daughter from pneumonia. The* Woreda *Administrator called the* Kushet *people to discuss my 'fault' and to pass punishment against me. Then the* Kushet *people after examining the case decided that I should be removed from office without any other punishment. Currently, I am responsible for the recruitment of militia who will be deployed in the war between Ethiopia and Eritrea.*

My informant also said, 'it used to be difficult to present personal cases to the *Woreda* Administration in the past because the officials were not willing to talk to Edmo farmers. They used to say 'go away you *admegnyoch* (rioters)!' Later, the officials changed their negative attitude saying, 'we hated you without knowing that you are good people'.

4.4 The Construction of Gum Selassa Micro dam

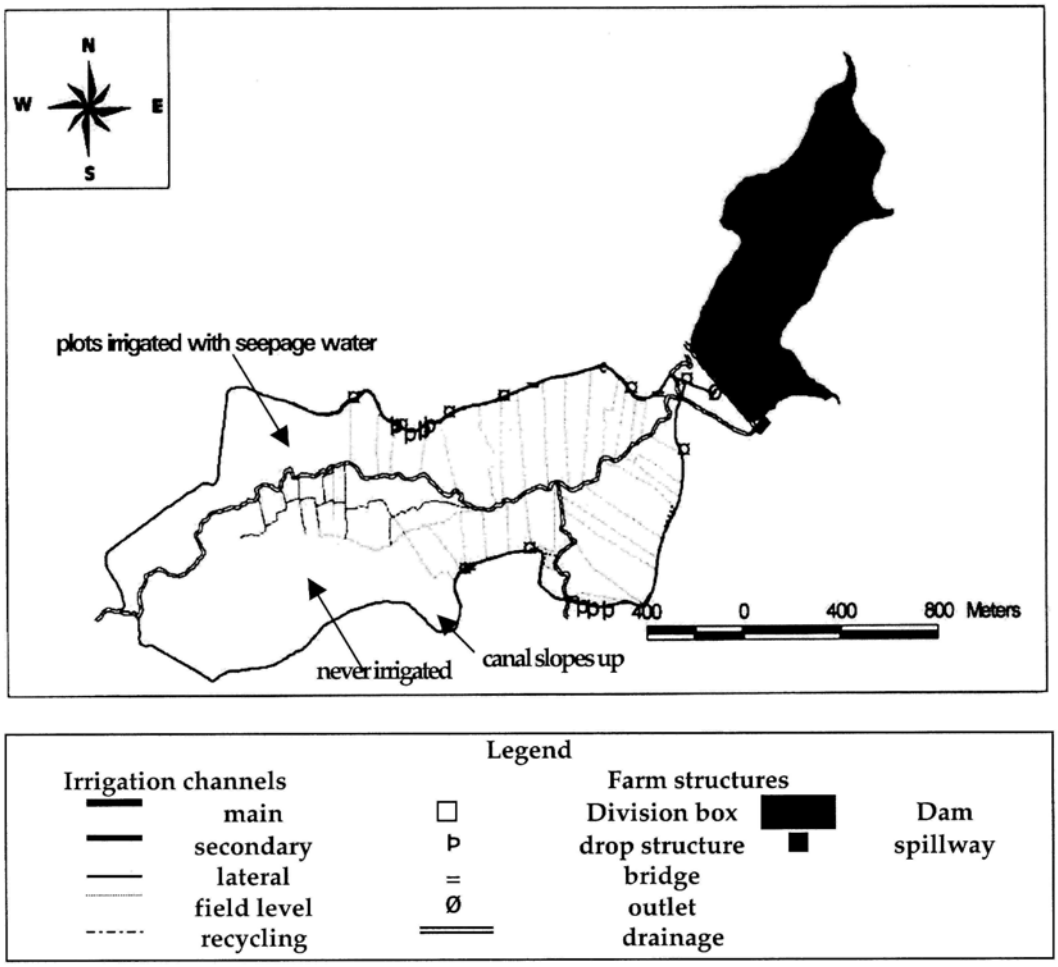
Gum Selassa irrigation system was not the first irrigation infrastructure in Adigudom. Although they were short lived, the former government had constructed three small earth dams namely, Mai Genet, Mai Debleat Adi Ake and Hay Engula through food for work programmes. Mai Genet earth dam was operational for one year and farmers planted tomato on one hectare. The other two dams have never been operational because of siltation and other technical problems.

The Gum Selassa irrigation system started operation in 1996. The construction took nearly two years, involving time 472, 000 man days. The total cost of the dam was US $ 487 720. Local people participated in the Gum Selassa dam construction through a 'food for work program'. In addition, able-bodied people provided 20 days free labour in a year for the construction work.

The total storage volume of the Gum Selassa micro dam is 1,902,000 m^3 as. Co-SAERT engineers estimated 1,366,485 m^3 net storage for the irrigation of 120 hectare land considering evaporation loss, dead storage, conveyance water losses, extreme rainfall that could not be captured, human consumption and animal consumption (Yigzaw, 1994: 45).

The canal system is 'hierarchical' (Horst 1998), in which water is distributed from the two main canals to secondary, tertiary and field canals.

Figure 4.2 Map of Gum Selassa Irrigation System



Source: Adapted from Van der Waal and Mintesinot Behailu 2001: Annex 1

The height of the concrete drop structures is about one meter. There are five division boxes along the primary canals. The longer primary canal is 3 kms while the shorter is 2.4 kms. Excess water from the fields runs to the drain where seepage water flows. In 2000, a small part of the main canal (about 100 meters) was concrete-lined by Co-SAERT.

4.5 Irrigation Governance and Authority Roles

The 'Irrigation Committee'

The Gum Selassa irrigation system is neither agency- nor farmer-managed. Different government agencies such as Co-SAERT and the Department of

Agriculture and the *Woreda* Administration are involved in its management. Such involvement has emanated from the legal provision that established Co-SAERT in 1996.

The *Woreda* committee is composed of the *Woreda* Administrator, *Woreda* Agriculture Department Head, irrigation development experts, Co-SAERT project site engineer, and the *Tabia* Chairman. At the *tabia* level, the chairman of the *tabia*, the development agent and *abo mai* are members of the committee. The Committees for Sustainable Agriculture and Environmental Rehabilitation are commonly known as 'irrigation committees'. The management of Gum Selassa irrigation system is the 'responsibility' of both irrigation committees established at *Woreda* and *tabia* level.

Every year, the Woreda Agriculture Department plans the number of demonstration plots to provide agricultural extension services, including fertiliser and improved seeds, as well as the farmland to be irrigated in the Gum Selassa irrigation system.

The Water Users Association

The Gum Selassa irrigation system had no water users association until 2000. When the regional government decided to hand over micro dams to water users in Tigray, Gum Selassa was one of the irrigation systems that 'fulfilled the pre-conditions'. I return to this under the discussion of dam handing over. Thus, in April 2000, the government established the Gum Selassa irrigation water users association with 347 farmers who cultivate 69.4 ha. Farmers who do not get dam water are not members of the association. Following the establishment of the association, Co-SAERT handed over the irrigation infrastructure to the executive committee of the association. The association does not have a written set of bylaws. According to the newly elected chairman, Kaelay Adan, literate, a TPLF member, the duties and responsibilities of the association are the following:

a) Distribution of water;
b) Mobilisation of farmers for canal cleaning and maintenance;
c) Resolving conflicts between irrigators;
d) Collection of fines from irrigators who violate *sireit* (rules); and
e) Supervising *abo mais* and farm guards.

The executive committee members were elected from both Adigudom and Araa Alem Segeda *tabia*s. The committee is composed of ten members serving as chairman, secretary, treasurer and members of control and health committees. The chairman, Kaelay Adan, was elected in his absence. The DA told him later that he had been elected.

The water users association has no legal status. It cannot open a bank account. It appears to be a water users association in name only when one looks at how the irrigation system is managed. Lines of communication are not defined. Some times the DA calls a general meeting of water users without consulting the chairman. On 10 June 2001, for instance, I met the chairman in the field when he came to attend such a meeting. I talked with him about the association until the meeting started. To begin with, he did not know why the meeting had been called. He said, 'I don't know the agenda, but I assume that there will be discussion about the problem created by cattle eating the maize and other crops in the field'. I asked him 'don't you have guards?' 'We have four', he replied, 'but they don't look after the farms properly after getting their salary'. I was surprised by this and wanted to ask him further but decided to hold this over since my main interest was to know more about how they managed the irrigation system. He told me how members of the executive committee discharged their responsibilities.

> *Eight of the ten committee members are working. There is no water wastage. This year five farmers were caught taking water illegally by breaking canals. The* abo mai *reported the case to us. The offenders were called and they were given a warning since it was the first time they had violated rules. Canal cleaning was carried out for three days this year. The first and second days about 130 farmers participated. The third day 60 farmers participated.*

I continued my discussion and asked him what measures the committee took against those who did not show up for canal cleaning. He said we had taken no measures against them. When asked why, said 'they are cursed. They are wicked. If you don't give them water they start begging saying they have children. The rule is that if a person doesn't participate in canal cleaning he will be fined. A person who takes water illegally is also fined'. In the meeting, I asked if there had ever been a general meeting of irrigators. His reply affirmatively that this year the executive committee had called a general meeting to discuss canal breaking, canal cleaning and the problem of guarding farms. About 100 farmers out of the 394 irrigators had participated. He commented 'the farmer is smart. He does not want to give his labour. Our weakness is we do not fine them. If we fined them they would come. If the farmer is under strict control he will comply'.

The general meeting called by the DA failed because there were only 14 farmers out of 394 irrigators. The DA told the executive committee members to come on June 12 for another meeting. In the second meeting where half of the executive committee members were present issues such as canals breaking, taking water illegally, crop damage by cattle entering the farm and low participation of farmers in canal cleaning were discussed. I asked the chairman

why he did not take measure against offenders and problem creators. He gave me a short answer. 'It is our fault since we did not take measures'. The Gum Selassa DA also commented about the prevailing management problems. He said, 'no one controls when farmers do not participate in canal cleaning. The farmers hardly consider the dam as their own property. For instance, if someone is seen breaking a canal, he will not be asked why he is doing so'.

Abo mai (father of water)

The practice of electing the *abo mai* responsible for the distribution of irrigation water has been adopted in Gum Selassa as in the Hewane irrigation system. Water users elect an *abo mai* every year towards the end of the rainy season in the presence of the development agent and *tabia* officials. An elected *abo mai* serves one year. During the harvesting time every farmer gives the *abo mais* one *kuna* of grain and pays US $ 0.60 for his or her salary for the year.

Four *abo mais* are in charge of water distribution in the Gum Selassa system. Two of them are responsible for the plots, which obtain water from the primary and secondary canals. The other two *abo mais* are assigned to distribute water day and night to the plots irrigated with seepage water commonly known as *tefetero* (natural).

Farm guards

In Gum Selassa sheep, cows, oxen and other animals pasture near the farm plots. Village boys often don't look after the animals properly and they thus either trample or eat crops by entering the farmlands. Thus, the water users have given the four *abo mais* the additional responsibility of serving as farm guards. Each water user pays US $ 0.60 to them each harvesting season as a form of salary. Some of the executive members have multiple responsibilities. For instance, the treasurer and one of the executive members is *abo mai* and farm guard. Thus, the guards do not attend the fields on full time basis.

The number of farm guards is not sufficient to cover all the irrigated fields and the consequent problem caused by cattle was raised at one meeting as a serious issue. Guards were complaining that they did not get their full salary since the executive committee did not make all farmers pay their US $ 0.60 per plot contribution. In 2001, the executive committee collected US $ 70.5 from 120 farmers. But if all the water users had paid this would have amounted to US $ 231.

Handing over of Gum Selassa Dam

In Hentalo Wajirat *Woreda* (district), four micro dams had been handed over to the water users of the Gum Sellassa, Maidelle, Gerbe Mihiz and Mai Gassa irrigation systems.

Following the establishment of the Gum Selassa water users association, the dam handing over committee held a meeting with the newly elected executive members of association to lay out all the objective of handing over the dams. At one of the all day meetings, elected executive committee members of other irrigation systems and experts from BoANR and Co-SAERT were present. The Co-SAERT experts said[1]:

> *From now onwards, we will not construct dams for you. It is your property whether you keep it properly or not. Co-SAERT will be involved in large-scale maintenance. If you need technical support for agriculture we will provide it for you. You should employ a guard to look after the dam. Co-SAERT will not do so. Those who do not get water at present will get water in the future when concrete canals are constructed. You will farm individually for the moment; in the future collective farming will take place'.*

4.6 Water Management Tasks

Water allocation

In principle, water allocation is the responsibility of the 'water committee'. However, erratic decisions have been taken since the Gum Selassa irrigation system started operation.

In 1996/97, when the Gum Selassa irrigation system came into operation with 16 hectares of irrigated land farmers had unsatisfactory harvests. Experts in the *Woreda* Agriculture Department reported that this was due to insufficient dam water and the farmers' lack of irrigation knowledge. Although the following year the rainfall was good, the Agriculture Department reduced the irrigated plots from 16 ha to 8.6 ha. to provide the agricultural extension services a number of demonstration sites.

Table 4.2 Distributed Land and Irrigated Plots in Gum Selassa Irrigation System

Year	Distributed Irrigable land (in ha.)	Irrigated land (in ha.)	Not irrigated land in Percentage	No of plot holders of land not irrigated
1996/97	110	16	85.5	470
1998/99	110	8.6	92.2	507
1999/00	110	64.6	41.3	227
2000/01	110	69.4	36.9	203
2001/02	110	79.9	27.4	150
2002/03	110	86.2[2]	21.6	119

Source: Hintalo Wajirat Agriculture Department

The Department and the *Woreda* administration made concerted efforts to demonstrate the role of irrigated agriculture to increasing yields. Students and

nursery workers were mobilised to teach farmers how to plant on line since there were few extension workers. Agricultural inputs such as chemical fertiliser and improved seeds were provided to the farmers. The following table shows the irrigated land without considering the Co-SAERT's dam water measurement.

Every year the *Woreda* irrigation committee was expected to decide on the area to be irrigated based on Co-SAERT's measurement of the quantity of dam water[3]. However, the size of irrigated plots did not correspond to Co-SAERT's estimation between 1998 and 2002 production years as indicated below.

Table 4.3 Co-SAERT's Estimation of Irrigable Land and Irrigated Land in Gum Selassa Irrigation System

Year	Estimated irrigable land (in ha.)	Irrigated land (in ha.)	Not irrigated land in Percentage	No. of plot holders of not irrigated land
1996/97	110	16	85.5	470
1998/99	113*	8.6	92.2	507
1999/00	83	64.6	22.2	92
2000/01	85.5	69.4	18.8	80.5
2001/02	85.5	79.9	6.5	28
2002/03	121[4]	86.2	21.6	119

Source: Co-SAERT and Hintalo Wajirat Agriculture Department

Co-SAERT is well aware of the risk that the dam might not fill because of erratic rainfall in the area. Every year the first measurement of dam water is taken towards the end of the *keremt* season (between late August and early September). The second is taken at the end of November. However, the irrigation committee does not take account of Co-SAERT's measurements. As the Woreda Agriculture Development Team Leader and the Irrigation Development Expert said,

> *'Co-SAERT's dam water measurement comes late. We do not consider their measurements. Their measurement may work more or less in the dams without seepage and other problems. We estimate the area to be irrigated in Gum Selassa by consulting the DA of Gum Selassa and other members of the irrigation committee'.*

The power to allocate water in Gum Selassa irrigation system is in the hands of the experts of the Woreda Agriculture Department. Guesswork has prevailed over the professional support of Co-SAERT. On 4 October 2002, while I was in the office of irrigation development expert discussing about the data I need, the DA of Gum Selassa irrigation system came in. The irrigation development expert and the DA started discussing the plans for the irrigable land of Gum Selassa for 2003. Earlier the Agriculture Department had set a target of 40 ha

land to be irrigated since 'the amount of rainfall was low during the *keremt* (wet) season'. The DA said the 40 ha target should be revised since farmers had told him there was insufficient dam water to irrigate 20 ha, let alone 40. The irrigation expert said, 'such issues cannot be decided only by the farmers, we will discuss it with the agriculture development team leader'. The DA left the office complaining bitterly, 'I will call the farmers and you should tell them the area of land to be irrigated in 2003. I don't want to trouble myself by advising farmers to plough large number of plots without considering the capacity of dam to supply water'.

Until 2002, not all the 110 ha farmlands of Gum Selassa were supplied with dam water. The highest share of irrigated land was 78.4 percent in 2002/03 while the lowest was 7.8 percent in 1998/99. It should be noted that 16.3 percent of the irrigated plots in 2002/03 were actually 'rainfed plots' that were not supposed to get dam water. In other words, of the 550 farmers who joined the irrigation system initially, between 119 and 470 farmers had received no water in the six years.

Water distribution

Irrigated fields are supplied with canal and seepage water from the dam. Water loss in the form of seepage is one of the major problems of Gum Selassa. Part of the irrigated fields, which currently obtain seepage water, had been labelled as 'rainfed' plots when the irrigation system was established. Farmers cultivated about 18 ha. using seepage water in 2002.

The *abo mais* assigned to distribute water using the canals go to the field about 5 o'clock in the morning to open the sluice gate and inform the farmers about the daily water distribution turn. Farmers should also be in the field to receive water. The two main canals run when sufficient numbers of farmers come to the field. At least 7 to 10 farmers should come to start the daily water distribution from one of the main canals. According to the *abo mais*, such strategy of water distribution is useful to avoid water wastage. Farmers who will obtain water in a short time stay in the field doing other activities. Those who will get water later may go away to do other activities.

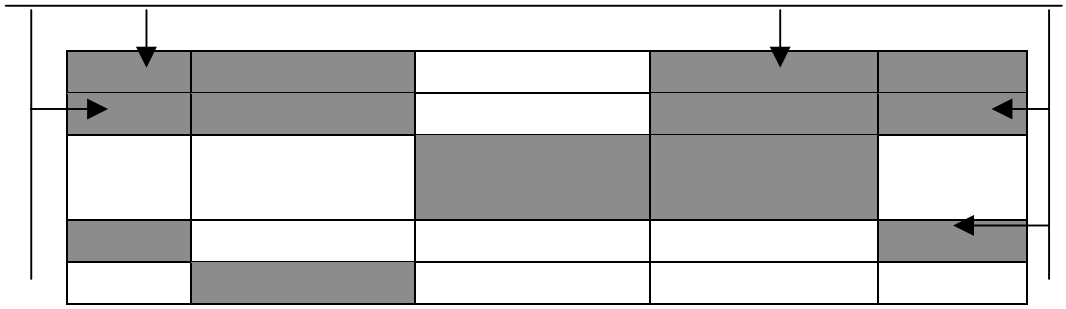
A remarkable feature of the water delivery schedule concerns the distribution of water within the field canals. Although the *abo mais* attempt to avoid water wastage by distributing water to a considerable number of farmers, the timing of plot preparation could give rise to wastage.

Farmers do not all prepare plots for planting at the same time (see Figure 4.1 below). The farmer who makes his plot ready first has the right to irrigate. As indicated in the diagram, the shaded plots are ready for sowing and need to be irrigated. The water distribution should take place following the plots prepared

for sowing, skipping the ones which are not ready. On a certain day, I also saw water being transported along the main canal to a plot located about one km away while I was talking with the *abo mais* in the field. The maize plots in between did not need water since the maize was ready for cutting. I asked the *abo mai* why they allowed a single plot to get water? They said the plot belonged to Nega who planted onion in April and the onions now needed water. Under such condition, water transported to the dispersed plots using earthen canal entails conveyance and transient loss through evaporation, seepage and flowing on plots. As Van Steenbergen (1996) notes '…where water users have scattered holdings or exchange water a systematic schedule may be difficult to achieve'.

Farmers irrigate their plots until they feel that the soil is wet enough. Some farmers reported that there is no shortage of dam water or under utilisation of water. However, there is unfair distribution of water committed by *abo mai,* as one informant complained, saying they did not give them water when they needed it. There were instances where over-irrigated plots did not give a good harvest.

Figure 4.3 Plots Preparation and Water Distribution to Individual Plots in Gum Selassa Irrigation System



The executive committee members mentioned that there was a water distribution problem particularly among *tefetero* (seepage water) users. Kidan Hailu, *abo mai* of seepage water users said:

> *My colleague Tigabu told farmers to take water out of turn. I refused to give water to such farmers since it is illegal. One day, a farmer who was told by Tigabu to irrigate his plot almost physically attacked me since I didn't give him water. I reported the case to the executive committee but there was no measure taken against Tigabu or the farmer who tried to attack me.*

Furthermore, the Agriculture Department and the DA both give orders to the executive committee or to the *abo mias*. The DA of Gum Selassa told me the following how he decided on the distribution of seepage water.

> *At a meeting held to discuss the purchase of fertiliser, 50 farmers who did not get water until 2000 requested to use the available seepage water. These farmers had several times requested water before the meeting. Following the meeting, I gave instructions to the* tefetero *abo mai to distribute water to their 9.9 ha. Another four farmers adjacent to the 50 farmers also requested to use the seepage water. One of the farmers was allowed to irrigate his half-timad plot. The other three farmers were not allowed since there was insufficient water.*

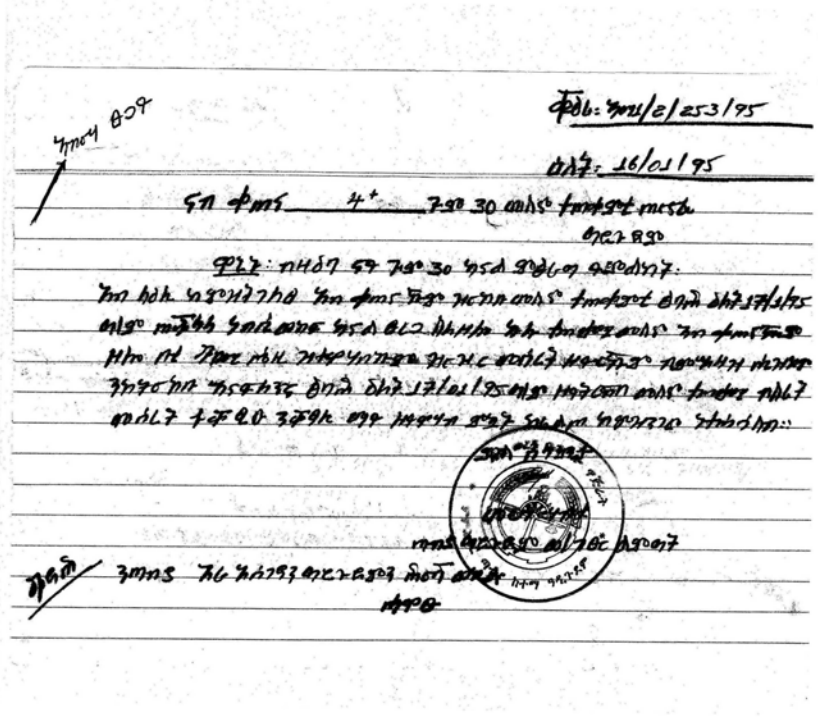
The chairman of the water users association was not consulted about the 9.9 ha plots that were irrigated with seepage water. He said, 'I saw one day the plots planted with lentil being irrigated. I asked the *abo mai* how the plots obtain water. The *abo mai* told me that the *geberna* 'agriculture' allowed the plots to be irrigated. Then I kept quiet. The executive committee was not informed about the additional plots, which were irrigated this year'.

System maintenance

The *abo mais* also organize canal cleaning and maintenance. The earth canals are usually filled up with silt, stones and grass after the *keremt* season. Canals are broken either due to over flow of water or intentionally to divert water. Towards the end of the rainy season, i.e., beginning of September, farmers are called to carry out the first major canal cleaning and maintenance. Farmers gather in one place and the *abo mais* assigns group tasks to clean certain meters of canal. Farmers are expected to bring their own shovels, digs, sickles and other tools. The *abo mias* record the attendance. If the canal cleaning work is not completed in one day, it will continue for an additional two or three days.

As already highlighted from discussions with the WUA Chairman, many farmers do not participate in canal cleaning and maintenance work. On March 3, for instance, I observed 18 farmers cleaning a canal in the field. I asked the *abo mai* how many farmers should have participated in the task. He said that 80 farmers should have participated. I asked two of the farmers who were digging canals why many of the farmers had not come to work. The first said, 'some are working on their own farm. Some are working as day labourers on the dam construction". The second said, 'the ones who participate here are cowards since if you have money to pay the US $ 0.60 fine you don't come'. The collected fine will be used to buy *tela* (local beer) for the farmers who participated in the canal cleaning. The responsibility for desilting the dam is unclear.

Lines of communication with the Agriculture Department, Co-SAERT and the Woreda administration is unclear. The following letter, for instance, was written by one of the officials of Adigudom Municipality ordering farmers to participate in canal cleaning without the knowledge of the chairman of the water users association.



25 September 2002

Abrhea Tesgaye
Zone 4 Gum Selassa irrigation water users gujele ternafe (group leader)
Adigudom

Subject: Gum Selassa canal cleaning

As indicated above, make a door-to-door call of water users in your zone for canal cleaning to be carried out on 26 September 2002 using the list of irrigators given to you earlier. Inform the water user that he will be fined according to the rule and will not get water in the future if he does not participate in the canal cleaning.

With regards,
Mersa Habtu
Adigudom tabia rural development agent
Cc
: Development Agent of Ara Asegeda and Adigudom
Hawatsu

The chairman of the water users association had no idea about the call made by the official for canal cleaning. He was not even informed when the officer made copies to the development agent. The water users had very short notice to participate in the canal cleaning. Among the expected 80 water users, 9 participated in cleaning the 110-meter long canal that transports seepage water. A person can clean 5 to 20 meters depending on the nature of the work needed. Some of the farmers did not participate assuming that they would not in any case obtain water in the coming season since the quantity of water was very low. Canal cleaning should have been organised by the water users' association chairman. He told me why he was not informed about the canal cleaning.

> *That was an arrangement made between the Gum Selassa DA and the municipality. They did not consult me. The development agent is working with two members of the executive committee of the water users association, bypassing me. In the past we communicated canal-cleaning messages to the water users through the gujele ternafe (group leader). Each gujle can have 30-40 water users. In addition, on September 26, the DA allowed farmers, without consulting me, to irrigate their plots on the grounds that the crops did not get sufficient keremt rain.*

I asked the municipality officer why he called the water users to participate in the canal cleaning when it was the responsibility of the chairman. He said 'the development agent of Gum Selassa told me that the chairman of the water users association was ill and I wrote the letter to facilitate the canal cleaning'. I told him that the chairman was not ill. I asked him if the chairman was ill why he did not contact the other members of the executive committee of the water users association. He said, 'now I realise that the development agent misinformed me and this was a mistake'.

Later the DA reported why he was bypassing the chairman:

> *The chairman is a guard for a relief organisation and is not working for the irrigation system. Farm guards of the irrigation system, for instance, do not carry out their duties properly. Cattle damaged one-forth of the plants. Animals also trampled the onion farm. The water table in many plots has risen, causing water logging and salt build-up in soils. Water was found at 0.75-cm depth soil pit. Salinity problems have fully affected 34 plots and partially affected some 64 plots. The main reason for salinity is over-irrigating plots, which is the weakness of the executive committee of water users association.*

Conflict resolution

Conflict over water is not a serious problem in the Gum Selassa irrigation system. Some conflicts have been reported but in most cases the *abo mais* or the irrigators resolve such conflicts themselves. The DA and Agriculture Department resolve serious breaches such as stealing water. More water

conflicts take place among the users of seepage water than users who obtain water from the canals.

Soil Salinity: the creeping problem

Salinity has been associated with irrigated agriculture since its early beginnings. One reason is that irrigation often exacerbates the effects of salinity, which occurs naturally. Kijne, et al. (1998: 1) writes that 'the best estimates indicate that roughly one-third of the irrigated land of the major irrigated land in the major irrigation countries is already badly affected by salinity or is expected to become so in the near future'.

In Gum Selassa, soil salinity has become a concern. The soil there is classified as Vertisols. The DA reported that 19.6 ha (22.7%) of the plots irrigated in 2002, 6.8 ha plots had been affected with a high level of salinity and 12.8 ha low salinity. Mitiku, et al, (2002: 86) note that 'in some fields irrigation canals have induced seepage and created water logged condition in some fields. After the moisture level recedes salt encrustations are formed inducing salinization of the soil. Observations are also made where salts sleek and barren spots are formed due to sodicity (Gum Selassa, Hizaeti Wodicheber and Felege)'.

The following case illustrates the perceptions of a farmer on how soil salinity has affected his crop production.

> *Berhan Abdurhaman, 65, has 0.2 ha irrigable land in Gum Selassa. Berhan leased out the plot after cultivating for two years since he found it difficult to run his small shop along with farming. The sharecropper cultivated maize on half of the plot. Berhan received one quintal unshelled maize according to their agreement while expecting 3 quintals. He believes that he had a poor harvest in 2002 due to soil salinity. His plot is covered with salt. At Berhan's plot, water was found in a pit of 0.75-m depth.*

The DA of Gum Selassa put the blame for the salinity on the executive committee of the water users association since they were responsible for the over irrigated which raised the water level in the fields. A farmer irrigates his plot until he feels it wet enough. There is no established norm as far as crop water requirement is concerned. Mitiku, et al. (ibid.) note that 'irrigation schedules are not commensurate with the properties of the soil, the crop characteristics and weather variability. Recommendations are given as a package without considering the specific site conditions. This is because of the lack of databases for soils and long-term climatic variables'. Some farmers commented that the *abo mais* make unfair water distribution by allowing farmers to over irrigate. It is common to over irrigate plots assuming that it will help crop growth. There is also a lack of follow-up on the part of *abo mais*. They

usually leave the fields to do other business after they have informed farmers about their daily water turn. Mintesinot (2002: 99) confirms that 'farmers do not use proper scheduling. Regardless of the soil or crop type, water is applied when physical stress is observed. The amount of application during an irrigation event is decided by the amount of water pounding on the surface'. Mintesinot (2002) also states that farmers over irrigate, especially in the month of April and May which gave rise to waterlogging. 'Overall, extended heaving and shrinkage cycles were observed in these field, creating an optimum situation for salinity build-up in the soil profile. Progressive salt build-up has been observed for four years (ECe from 159 to 355 μS/cm. The corresponding soil pH (water) was from 7.9 to 8.4' (Mintesinot 2002: 129). Nevertheless, Mintesinot indicates that these soil salinity levels are classified as of low hazard, also with a low SAR. He also notes, however, that the Residual Sodium Carbonate value of the irrigation water is in the range of marginal suitability for irrigation.

Such data raise questions about the causes of salinity and its manifestations. It may not be farmer over-irrigation *per se* that is causing salt problems There could be challenging natural soil conditions, which are becoming manifest through the starting up of irrigation generally, but are not specifically determined by poor farmer practices.[5] This suggests that much more research is needed (and should have been done earlier) to understand the risks of salinity problems under irrigation in this area.

4.7 Cropping Pattern

The major cropping pattern proposed by the study committee for Gum Selassa irrigation system was maize (44%), potato (14%), and onion 13%, and the rest (29%) included wheat, tomato, cabbage, pepper, beetroot, spices, chickpea and lentil. Farmers planted such crops on part or all of their plot. Rainfed crops such as *teff*, vetch and barely were the crops that needed supplementary irrigation (Bedini, et al. 1996: A3-2, A-3).

As indicated in Table 4.4 below, farmers did not observe the proposed cropping pattern. Farmers, for instance, reported two major reasons for the extensive planting of maize and onion. Maize was planted for household consumption and the plant residue was used as animal feed. Farmers were motivated to plant onion for it fetches occasionally good price. The sad fact was many farmers were losers when the market was flooded with onion and the price fell. Farmers had to sell onion since they do not have storage facility to keep it until the price increases. Although the second major crop is potato, farmers are not interested because of the low demand in the market. The following case illustrates how a farmer was a loser in 2002.

Table 4.4 Proposed Cropping Pattern and Cultivated Area in Gum Selassa Irrigation System in Percentage

Year	Maize		Potato		Onion		Others[6]	
	Proposed in %	Planted in %	Proposed in %	Planted in %	Proposed in %	Planted in %	Proposed in %	Planted in %
1996	44	45	14	--	13	52.5	29	2.5
1997	44	34.8	14	2.3	13	59.3	29	2.3
1998	44	71.3	14	--	13	20.2	29	8.5
1999	44	78.6	14	0.28	13	11.8	29	9.3

Source: Bedini, et al. (1996) and Hintalo Wajirat Agriculture Department

> *Aleka Minas, is a sharecropper who leased in 0.2 ha irrigable land in Gum Selassa with a one-third share of the harvest agreement to the plot holder. In 2002, he planted onion and harvested 7 quintals. According to the sharecropping agreement, his share was 4.66 quintals which he sold for about US $19. The total cost for the purchase of onion seed, fertiliser, pesticides and hiring labourers was US $60. Excluding other cultivation costs including ploughing oxen and his own labour, he had lost over US $ 40. In other words, the farmer sold close to three quintals of onion to repay back the US $12.11 loan taken for the purchase of 37.2 kg of DAP and UREA fertiliser.*

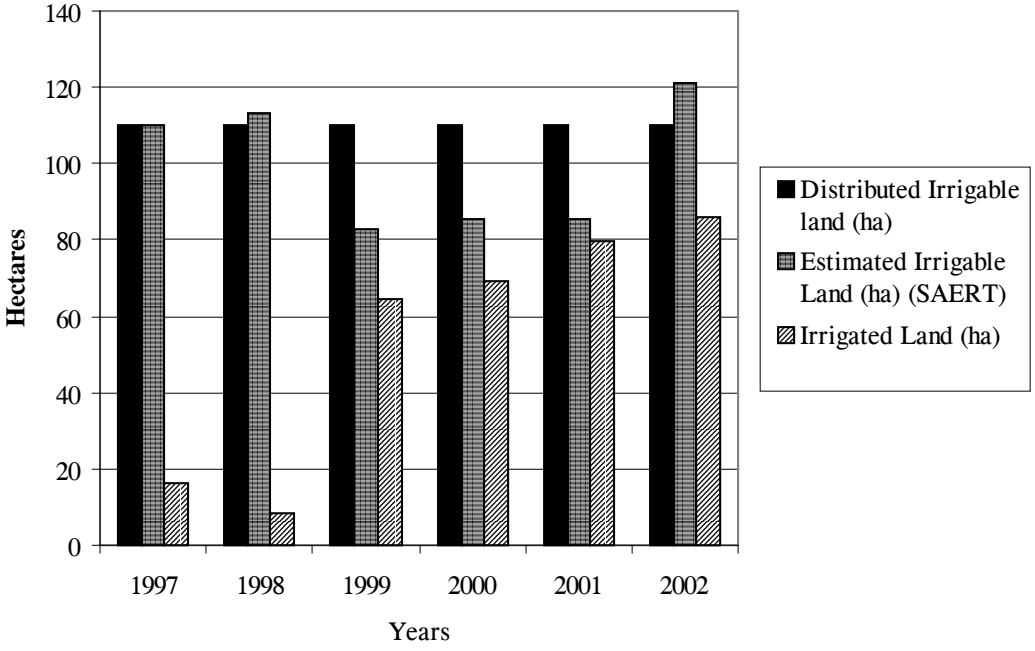
The Woreda Agriculture Department does not, furthermore, consider the cropping pattern proposed by Co-SAERT. The Agriculture Development Team Leader and the Irrigation Development Expert said, 'we advise farmers to cultivate about 80 percent of the crops as vegetables such as onion, tomato, beet root, carrot, pepper, cabbage and onion. If farmers plant these they will receive a good income. In addition, except for onion, compared to maize they do not require much water'.

4.8 Water Scarcity and Threatened Livelihoods

During one of my field visits in Gum Selassa irrigation system, I met Co-SAERT construction supervisor while he was supervising the construction of the lining of a 100-meter main canal with concrete. I asked him about the performance of the Gum Selassa canals and the problems encountered. After exchanging a few words, we walked along the canals and he showed me some of the technical problems. Then he said, 'if you want to know more about the technical problems of Gum Selassa, I will put them on paper, which I need some days to prepare'. Then I agreed and went to my hotel. After four days he gave me a five-page report in Amharic indicating the detailed technical problems of the system. In the opening paragraph of his report he wrote, 'farmers' ovation at the inaugural ceremony of Gum Selassa micro dam is a recent memory. The dam was considered as the source of hope for all Tigraian farmers. After the

dam started operation, we heard farmers' complaints such as the water lies in the canal, the canal water flows back, the water overflows the canal seepage, water logging, canals fill up with silt, there is shrinking or widening of canals'.

Figure 4.4 Distributed, Estimated and irrigated Land in Gum Selassa Irrigation System



Source: Co-SAERT and Hintalo Wajerat Agriculture Department

Not all of the 550 farmers who joined the Gum Selassa irrigation system received dam water from the start. Three groups of farmers were identified in terms of access to the available dam water although their number varies every year. The first group, mainly cultivating at the head end and middle, is water secure. The second group of farmers is water insecure but 'lucky' because they can use unreliable seepage water from the dam to cultivate what were initially labeled 'rainfed plots'. The third group of farmers has never received dam water since the irrigation system became operational. The canal located on the right-hand side does not supply water to all plots since the canal slopes up after irrigating certain farmlands (see Figure 4.2 above). In 2002, for instance, the size of irrigated land that received dam water from the two main canals of the irrigation system was 68.2 ha. excluding the 18 ha of land irrigated with seepage water. In other words, 209 farmers with 41.8 ha obtained no water from the constructed canals although Co-SAERT estimated 121 ha would be irrigated

in 2002. This group of farmers is the most affected and forced to depend on rainfall to cultivate so-called irrigable land.

The average land holding before the establishment of the Gum Selassa irrigation system was 0.85 ha to 1.6 ha. Currently, farmers who do not have access to the dam water cultivate 0.75 ha rainfed plus 0.2 ha 'irrigable' land which turned out to be rainfed.

Table 4.5 Average Household Land Holding Before and After the Establishment of Gum Selassa Irrigation System

Tabia	Land holding in ha.		
	Before Gum Selassa (rainfed)	Current in Gum Selassa	
		rainfed	irrigable
Arra	1.6		
Alem Segeda	1.23		
Adiugdom	0.85		
Gum Selassa	--	0.75	0.2

Source: Bedini, et al. (1996:3-4, 7)

The farmers affected voiced their complaints to the *Woreda* and Zone Agriculture Departments, *Woreda* Administration and Co-SAERT. Their complaints urged engineers from Co-SAERT to visit the area and view the situation for themselves. The designers agreed to prepare a new canal design to improve the water flow to the fields. One of the designers at the headquarters of Co-SAERT said 'we have noticed the canal problem. We will solve it. However, it needs the participation of farmers to dig the canal'. However, the farmers' effort to get a solution was in vain until I completed my fieldwork.

The following two examples illustrate the situation of the farmers after they joined the Gum Selassa irrigation system with the hope of getting dam water. It also shows farmers' effort to get water and the responses of government officials.

Farmer Ibrahim Giday

Ibrahim Giday, 60, with five family members is a farmer and weaver. He has three children attending primary school. Ibrahim had about 1.5 ha rainfed land before he joined the scheme. Currently, he cultivates 0.63 ha farm land in which 0.2 ha is irrigable land. Ibrahim noted:

> *My plot in the irrigation system has not had water since 1996. In 1998, the development agent informed me and other farmers to prepare our plots and plant the crops we prefer*

since the dam water would be available in the coming year. Accordingly, we prepared our plots for onion and requested the Agriculture Department for onion seed. Later they told us to plant maize because the land is 'suitable' for maize. Then I bought 5 kg maize seed with US $ 1.76 from the Agriculture Department. When ready to sow the maize, I was told not to sow it because I would not get water due to shortage of dam water. I went with other farmers to the Agriculture Department to return the maize seed and get back our money. They told us that the money will not be refunded. Instead, we were advised to sell the seed if we needed the money. We argued with them saying, 'we purchased the one-kg maize for US $ 0.35 from you and the price on the market was US $ 0.17. Who else can buy our maize? They said, 'if you can't sell it, consume it'. I sowed for two consecutive years in vain. Finally, in 1999 I leased out my land to a sharecropper to get one third of a yield realising that I would not get water. Now I am fully engaged in weaving to earn my living.

Further Ibrahim pointed out:

One day, before I leased out my land, I went with two other farmers to the Woreda *Administration representing the Adigudom farmers who do not get dam water to report the water problems. The Administration told us that water could not be transported to our fields since the canal is not lined with cement. They promised us dam water when the canal was lined with cement.*

Farmer Hadera G/Egziabeher

Hadera, 53, is a farmer with two oxen. He used to cultivate 0.75 ha rainfed land before he joined the irrigation system. Hadera has 0.2 ha 'irrigable land and 0.3 ha rainfed land. In addition, he cultivates 1.15 ha. *woferit* (leased) land. He mentioned:

My plot has not had dam water since 1996. The farmers who do not get dam water had applied to the Woreda *Administration and* Woreda *Agriculture Department. We were told that 'the water can not reach our fields because the canal is not constructed with cement. When it is cemented you will get water and you will be members of the water users association'. We suggested to the officials that 'why can we not get water on a rotation basis if there is shortage of water?' The officials replied that 'it is due to chance that you are at the tail-end'.*

Since 1999, I have been employed as a guard in Co-SAERT to get 90 Kgs of wheat a month because I can't harvest two times a year like other irrigators. I hire labourer to cultivate my farm when I am on duty at Co-SAERT.

Farmers particularly cultivating at the tail end are not certain as to which type of crop they should plant every year because water allocation decisions vary from time to time. In a meeting I attended a farmer reported that he had been planting chickpea all the time because the crop can withstand moisture stress.

He asked in the meeting whether he could plant onion or maize that year. The newly elected chairman of the water users association replied, 'this year the dam water is enough, you can plant whatever you want'. In the same meeting, a farmer asked the Head of Economic Development of Adigudom *tabia* who was chairing the meeting to return their land taken when they joined the Gum Selassa irrigation system if the government was not able to provide dam water for their plots. The chairman replied, 'this issue is beyond my capacity'.

4.9 Conclusion

In the Gum Selassa irrigation system local government bureaucracies had the socio-economic and political control of water. Although the 'irrigation committee' was formed with members mainly drawn from government organisations, its involvement in the management of Gum Selassa irrigation system was very low. The Agriculture Department, the Woreda Administration and to some extent Co-SAERT were the main actors in water management. However the Agriculture Department had disregarded the technical support of Co-SAERT, had failed to carry out regular water measurement of dam water and its decision as to what land to irrigate was pure guess work. For the previous last six years, 21 to 92 percent of the land had not been irrigated.

The water reservoir had a serious seepage problem though the amount of seepage water was unknown, which did not help much in observing the water rights of irrigators. The guesswork in the water allocation tempted the Agriculture Department to reduce the size of irrigable plots to obviate shortage of water a practice farmers complained of since every year there was 'left over water' in the reservoir.

The social effect of irrigation technology was a reduction in cultivable land. Rainfed plot sizes were reduced on the assumption that less land would be needed when irrigated, but many farmers did not receive the promised water. The 0.2 ha of 'irrigable' land allocated to farmers, without the dam water remained only rainfed. Conversely, a group of 'lucky' farmers with rainfed plots (about 16 percent of the plots when the irrigation system was established), who were not supposed to obtain water from the irrigation system, were able to water their land from seepage water.

The farmers, who did not obtain water due to technical problem on the right hand canal, voiced their complaints to the *Woreda* and Zone Agriculture Departments, *Woreda* Administration and CO-SAERT. However, they did not get their problems resolved because of the lack of attention from the government bureaucracies. Water scarcity in the context of Gum Selassa, as Vincent (1997: 1) points out, is 'a social condition, reflecting not simply supply and demand; but also the institutions and social relations mediating them'.

When the so-called 'water users association' was established, farmers without access to dam water were excluded, leaving them without the obvious means to negotiate their water-use rights. Since many farmers lost hope of getting dam water they leased out their plots which had a negative impact on the amount of grain they could collect (see chapter 5) from sharecroppers. In most cases plot holders collected only one-third of the harvest. Some farmers actually dropped farming as an occupation and engaged in other activities to earn their living. It had indeed led to Vincent's assertion (2001) that:

> *'unless there is new action to recognise both the roles water plays in rural livelihoods and people's capacity to manage their water sustainably and with social justice, water scarcity threatens to change people's options in production, employment, and exchange, and the relations among these activities, in ways that will exclude the small producer'*

Initially, the irrigation intervention was designed and the size of irrigable land was determined with a certain cropping pattern in mind. However, neither farmers nor the Agriculture Department observed the designed cropping pattern, illustrating how different actors redesign planned intervention in the process of implementation.

There was no change in irrigation management after the establishment of the water users association, which had not been formed at the request of farmers. It was established just before the handing over of the dam since the handing over process required a receiving body of a committee – the ten-man executive committee of the water users association. Many water users, particularly those who leased out their land do not know of its existence. In fact the decision to transfer the micro dams to water users was a sheer 'load shedding' exercise on the part of the government. Co-SAERT, after constructing irrigation infrastructures, was interested to withdraw. Thus the dam handing over was an exercise to fill the vacuum created by the sudden withdrawal of Co-SAERT.

The water users association, with little experience of irrigation management and few resources, was not even able to pay the salary of the dam guard employed by Co-SAERT, and so the service was discontinued. Furthermore, it is difficult to see how the new water users association could carry out its function successfully under a situation where the majority of the plot holders distanced themselves from irrigated agriculture by leasing out their plots to sharecroppers. It appears that there was no appropriate incentive structure for sharecroppers to take over management responsibilities while cultivating on a temporary basis. Under such cultivation arrangements it is difficult to put greater emphasis on the water users association to be managed effectively. In addition the Gum Selassa water users association has no legal status. Lines of

communication with the Agriculture Department, Co-SAERT and *Woreda* Administration are not clear. Accountability is not defined.

The responsibility to manage the established irrigation systems in Tigray is a grey area due to the absence of an irrigation water use and management policy at regional level. BoANR and Co-SAERT on one hand claim that water users associations are established, and on the other the Tigray Co-operative Promotion Office, recently assigned to organize water users, does not consider them as water users association since they have no legal status.

In Gum Selassa, despite local opposition, land reallocation and plot size determination process took place with the belief that the recommended plot size would help achieve food security at household level. The food security objective spurred the government to *mobilise the region's resources including land and labour to develop irrigated agriculture* without giving due attention to the shortcomings reported by the land reallocation study committee. *The committee* reported the complex nature of the model used to decide the plot size, which did not encourage the participation of interested parties in the process of determining plots size. In other words, the heavy-handed intervention process was top-down. Setting of 'arbitrary' benchmarks for household food requirements was a major setback because many of the farmers who cultivate for themselves are not able to meet their food requirements. Mitiku, et al (2001: 13) write that 'the current size of average irrigable holding is determined to be 0.2 ha regardless of the agroecology, soil type, access to market and farmers objectives', and they argue therefore that ' …there is a need to determine the economically viable plot size considering soil type, the dominant cropping pattern and the agroecology'.

Soil salinity has become a source of concern for Gum Selassa irrigators. It was reported that 22.7 percent of the plots irrigated in 2002 were affected by salt. Many of the plots are located where seepage water comes out. Kijne, et al (1998: vii) indicate that 'technical problems that have led to large-scale, irrigation-induced salinity are well known. They include, among others, poor on-farm water use efficiency, and inadequate standards of construction operation, and maintenance of the irrigation and drainage facilities'. As irrigators believed the soil salinity was one of the causes for their poor harvests. This chapter has suggested however, that more needs to be known about the basic water and salt balance of the Gum Selasse region now that irrigation has been started, before farmers' practices alone are blamed for the problem.

What are the similarities and differences between Gum Selassa and Hewane irrigation systems? In both irrigation systems, local government bureaucracy is embedded in irrigation management. By establishing incapacitated water user associations and/or 'irrigation committees' the local government has maintained water control in particular and irrigation management in general in

the irrigation systems. By doing so irrigation management has remained an appendage to the local government bureaucracies.

In Hewane, water allocation practice is based on the classification of plots into *mesno* and *hayfo.* Although, switching of plot from *mesno* to *hayfo* or vice-versa takes place, in general water rights of the two groups of irrigators are observed. In Gum Selassa water allocation decision appears to be ad hoc. There is no integration between Co-SAERT and the Department of Agriculture. Irrigators' water right varies from year to year. Due to socio-technically mediated water scarcity the livelihood of many irrigators is threatened. The failure of the ambitious plan to irrigate 110 hectares has affected the lives of farmers.

In both irrigation systems cropping patterns are not observed; and water supply is from head to tail, leaving tail enders vulnerable to water scarcity. The sources of water have entailed different water management in the irrigation systems. In Hewane the number of *abo mais* engaged in water distribution is much higher than in Gum Selassa since water is distributed day and night. However, due to the availability of seepage in Gum Selassa, water distribution is also carried out during the night.

The following chapter explores the practice of irrigated agriculture and intended household food security in both the Hewane and the Gum Selassa irrigation systems.

Notes

1 Arra and Arra Alemsegeda tabias were merged into the Arra Alemesegeda tabia.
2 Ras Seyoum was an aristocrat and governor of Tigray region during the Imperial regime.
3 The committee was composed of agricultural economists, a rural sociologist, an engineer and economist drawn from Mekelle University College, the Relief Society of Tigray, and the Bureau of Natural Resources and Co-SAERT.
4 Tsimdi (Tigregna) or timad (Amharic) = 0.25 ha.
5 Interview with irrigation expert of the Hentalo Wajirat Agriculture Department
6 Interview with the Woreda Irrigation Development Expert.
7 Interview with the chairman of the water users association.
8 Total irrigated land over 18 ha rainfed plots that received seepage water.
9 A sample of the measurement of dam water and estimated irrigable area for 2000 is provided in the appendix.
10 The computation of not irrigated land and plot holders is based on the 110 ha that was distributed to farmers. Irrigated land included over 18 ha plots, which were classified as rainfed but used seepage water.
11 Personal communications (Vincent, 2003) suggest the following possibilities. There could be naturally-occurring saline soil bands at depth stabilised under rainfed vertisol use and long-term regional water movement in this area, that have been made mobile by the start-up

of irrigation. There could also be irrigation water quality problems resulting from the collection of runoff draining across or seeping through these soils and lands. Erratic coverage of irrigated area that leaves some fields saturated and others fallow can also be triggering salinity problems in certain fields, and exacerbating the aforementioned problems if they are present. Washing out of soluble salts in these soils could be affecting the soil structure and thus reducing soil permeability. Low yields could also be due to very low phosphorus and nitrogen in the soil, not only salinity problems.

12 Others include tomato, cabbage, beetroot and pepper.

5
Irrigated Agriculture and Household Food Security

5.1 Introduction

In this chapter, I focus on farmers' cultivation strategies and the government's interventions to achieve 'household food security'. By examining household irrigated production dynamics in Hewane and Gum Selassa, I show the value of irrigated agriculture in the life-worlds of irrigators.

Irrigated agriculture has benefited some households by providing an opportunity to increase agricultural production—through double cropping—and by taking advantage of modern technologies and high-yielding crops that called for intensive farming. When the regional government established the Gum Selassa irrigation system, one of the key assumptions was that plot holders would neither sharecrop nor rent out land to achieve food security at household level (Bedini et al., 1996). In other words, plot holders were expected to cultivate the irrigable land themselves with available household labour. However, a majority of the water users were involved in leasing out irrigable plots to sharecroppers and collecting one-third of the yield. This has had serious implications for household food security and irrigation management. The regional government believed that farmers could mitigate the recurrent drought and famine with the introduction of irrigated agriculture, provision of credit and agricultural extension services. However, the government assumption based on the 'right mix' did not bring about the intended outcome in Gum Selassa and Hewane.

The chapter discusses first the practice of irrigated agriculture in Hewane and Gum Selassa irrigation systems. Following this, household production dynamics are examined taking into consideration of the organisation of labour, access to agricultural inputs and markets. The practice of *woferit* (sharecropping) and its implications for household food consumption is presented in section four. The conclusion summarises the key production dynamics shaping the value of irrigated agriculture in the life-worlds of irrigators.

5.2 Irrigated Agriculture in Gum Selassa and Hewane

Gum Selassa and Hewane irrigation systems are located in Hintalo Wajirat *Woreda* at a distance of 20 km in the midland agro-ecological zone. In Hewane farmers cultivate irrigable plots ranging from 0.015 ha to 0.125 ha. Holdings of rainfed plots range from 0.25 ha to 0.5 ha. In Gum Selassa, the standard irrigable plot is 0.2 ha and the rainfed 0.75 ha. as allocated by the government when the Gum Selassa irrigation system was established.

Agricultural tasks and seasons

Mixed farming communities obtain their livelihood in varying proportions from both arable crops and livestock. In Hewane and Gum Selassa farmers keep oxen, the only source of traction in the farming system. A few households raise goats, sheep, cows, and chickens, mainly for the market. Most of the dairy products—milk and yoghurt are consumed at home. Butter is sold at markets.

In Tigray, about 85 percent of the farmers use ox-plough cultivation (Mitiku et al., 2001). Ploughing is practised with two oxen yoked to a plough. The yoke is a wooden bar fastened over the necks of two oxen. Almost every farmer prepares the wooden parts of the plough himself. The Ethiopian plough belongs to the category of breaking ploughs. It does not turn the soil, but simply breaks it. Thus ploughing has to be repeated three to four times before an adequate seedbed is prepared. After sowing, the seeds are covered by means of another ploughing, which becomes a substitute for harrowing. Small plots located on hillsides are cultivated with hand tools such as the hoe.

In Hewane, farmers without oxen constitute close to one-third. Farmers can purchase oxen through credit obtainable from the Dedebit Saving and Credit Institution (DESCI).

Table 5. 1 Ownership of Oxen in Hewane by Kushet, 2001

Kushet	0 ox	1 ox	2 oxen	3 oxen and above
Hewan town	137	60	44	4
Ayboto	13	44	103	-
Maine	22	42	12	-
Korkora	20	26	80	-
Total	192 (31.6%)	172(28.3%)	239(39.3%)	4 (0.08%)

Source: Hewane Tabia Agriculture Office

This credit institution operates throughout Tigray region. According to Hewane DESCI branch, farmers took out loans to purchase 2680 oxen over the period

1997 to 2000. However, the inventory taken by the *tabia* agriculture office showed that 415 farmers had only 666 oxen in 2000. The apparent discrepancy in the ownership of oxen, and loan for the purchase of oxen and farmers strategies in paying their loans is discussed in Chapter 7.

Farmers who cannot get credit or are not willing to take credit to purchase oxen make different arrangements with ox owners to prepare their land. Farmers with one pair of oxen lend their plough team to farmers without oxen after they have first ploughed their own plots; payment in kind ranges from one to two days of labour for one day of the ploughing team or a cash payment ranging from 3.50 to 4.60 US $ per day.

Lifinti is an arrangement made between two farmers with one ox to team up their oxen and plough their plots in turns. The teamed up oxen will be used to plough the fields of each farmer for a number of days in turn. *Lifinti* is common among farmers where their plots are adjacent. Oxenless farmers are at a disadvantage because their land is always the last to be prepared which can result in late sowing of crops or in the planting of short season crops. *Lifinti* is also practised to get labour support during ploughing, weeding, or threshing.

Farmers cultivate crops both on rainfed and irrigated plots. In the rainfed fields, the type of crop to be planted, the soil type and the crop sown in the previous season determine the frequency and timing of ploughing. Teff, for instance, needs a very fine seedbed, which requires ploughing four to six times whereas for pulses two to three rounds are sufficient. An onion plot is ploughed five times every two weeks. If a farmer decides to sow barley or wheat on the plot that had been sown with *teff* the previous season, he ploughs the plot once in May and the second ploughing takes place in mid June when he sows the barley or wheat. On the other hand, if a farmer wants to sow vetch or chickpea the ploughing time is different. If barley or wheat was sown then he ploughs the plot in February or March and a second time in May. The third ploughing takes place in July by making wide furrows so that water can be collected to make the soil wet. A week later the farmer will sow *teff* by ploughing it again.

In the irrigated fields farmers used to scatter seed by hand when sowing wheat and maize. Farmers resisted in the beginning sowing in lines when the development agents advised them to do so. But later they started sowing in lines after repeated efforts by the Agriculture Department. The sowing of chickpeas and lentil in the *hayfo* plots of Hewane takes place in November. In the rainfed fields farmers sow wheat, barley, oats, chickpeas, onion and *teff*. If onion is to be planted in the rainy season, then some 15 or more people participate to finish the planting within one day in time for the rains. The plot holder will either arrange *lifinti* (mutual exchange of labour for agricultural activities) or hire labourers. If the farmer can not deploy many people, it will take him 2-3 days to plant.

Men, women and young persons participate in weeding activities. Weeding is carried out by hand and hoe. Farmers dig up the soil vigorously, disturbing the roots and leaving the young plants lying over. It would appear that such violent treatment might reduce yields. Late in the season, the lower leaves are stripped from the stalks and used for fodder.

Box 5.1 Calendar of Agricultural Tasks in Gum Selassa and Hewane Irrigation System (irrigated farming during the dry season)

Tasks	Month
Ploughing	
Ploughing plots (5-6 times). A plot is watered to soften the soil if it was sown with *teff* in the previous season. Land is prepared by watering plots for sowing.	October – December
Sowing	
--After seven days, the water-soaked maize will be sowed. Then the plot will be watered after fifteen days.	
Teff is not sown during the dry season.	January
--Onion, carrot, cabbages, tomato	February – March
Weeding	
Planted crops	February - April
Harvesting	
Maize, onion, carrot, cabbages, tomato,	May - June

Box 5.2 Calendar of Agricultural Tasks in Hewane Irrigation System (rainfed farming during the wet season)

Tasks	Month
Ploughing	
Ploughing plots four times immediately after harvest	June
Sowing	
Wheat, barley, oats, vetch , chickpeas, horse beans	July
Teff	July 25 to August 5
Weeding	
Planted crops	September
Harvesting	
Wheat, barley	October
Vetch, chickpeas, teff	November
***Hayfo* plots in Hewane**	
Ploughing (three times)	October
Sowing	
Chickpeas, vetch , lentil, barley	November
Weeding	
Harvesting	February - March

Farmers with family members carry out the harvesting of crops using a sickle. Exchange of labour in harvesting could also take place on a reciprocal basis with friends or relatives if a farmer is in need of labour assistance. In addition, farmers can hire labour during harvesting time. Oxen do most of the threshing by trampling the outspread sheaves until the grain drops out. Wooden forks and shovels are then used to toss the grain to the wind and to sort the chaff from the grain. A further cleaning operation is performed with sieves and bowls.

Crops cultivated in irrigated fields and yield

The two cropping seasons are the *meher* season that gets rainfall starting late June and peaks during July-August and the lesser season *belg* which gets rain during February and March. Though this can be used for a second crop, it is considered unreliable. Major cultivated cereals are wheat, barley, sorghum, *teff*, millet and maize. Major pulses are chickpea, horse beans, lentils and vetch.

Farmers in the irrigation systems are expected to cultivate the crops proposed by the development agents although as shown in chapter four they do not seriously follow their advice. In addition, wheat, barley, tomato, pepper and leafy vegetables are also grown within a proposed cropping mix.

Table 5.2 Average Yield of Crops and Vegetables Cultivated Under Irrigated and Rainfed Conditions at Hintalo Wajirat Woreda Level

Crop/Vegetable	Irrigation with extension services (in quintal/ha)			Rainfed (in quintal/ha)		
	Max	Aver	Min.	Max	Aver	Min
Maize	64.5	52.5	37	14	11	8
Onion	119.5	99.625	56.5	26	18	12
Tomato	266.15	206	143	72	65	40
Peper	111	71	68	70	62	55
Potato	170	118	65	40	30	26
Beet root	268	214.25	161.5	-	-	-
Cabbage	360	260	160	-	-	-
Spices	3	-	-	-	-	-
Check pea	8.5	6.5	5	8	6	0.5

Source: Hintalo Wajirat Woreda Agriculture Department

This proposed cropping pattern and mix provides a bench mark for estimating the labour requirement for each crop and determining the maximum household plot size. Wheat, *teff*, barely and vetch (pulse) are the major crops in the rainfed areas of Gum Selassa. The role of irrigation and the provision of agricultural

extension services in increasing agricultural productivity were noted at Hintalo Wajirat *Woreda* level.

Considering the most frequently cultivated crops (i.e., maize, onion and tomato) there is a huge difference in yield between rainfed and irrigated agriculture as indicated in Table 5.2 above. The maize yield, for instance, ranges from 37 quintals to 64.5 quintals under irrigated conditions, while the maximum yield only reaches up to 14 quintals per ha under rainfed conditions[1].

The average yield of maize, onion and tomato vary from year to year in Gum Selassa irrigation system. Maximum maize production, for instance, varied from 40 quintals in 1999 to 167.5 quintals in 1998. The minimum maize production also varied from 24 quintals in 1997 to 81.25 quintals in 1998.

Table 5.3 Average Yield of Maize, Onion and Tomato in Gum Selassa Irrigation System

year	Maize (*quintal[2]/ha)			Onion (quintal/ha)			Tomato (quintal/ha)		
	max	Ave.	Min	Max	Ave	Min	Max	Ave	Min
1997	62	58	24	212	200	95.84	320	254	239
1998	167.5	81.25	81.25	179	161	107	175	100	25
1999	40	35	30	90	82.5	75	-	-	-
2000	67.5	44.5	27.5	100	75	45	280	-	-
2001	72	54	36	150	120	75	-	60	45
2002	70	50	40	80	50	35	50	45	-

Source: Hintalo Wajrat Woreda Agriculture Department

In Hewane farmers cultivate maize, onion, tomato, potato, beetroot, pepper, cabbage and chickpea. The yield levels for maize, onion and tomato differ substantially between cropping years.

In both in Hewane and Gum Selassa, crop choice is limited since the development agents advise and/or instruct farmers to plant few types of crop. The threat of not receiving dam water forces farmers to accept the advice of the DAs. However, many farmers cultivate maize for its advantages in respect to household consumption and plant residue for animal feed. Following maize, onion is preferred because of the 'good income' earned from the sales. There is a tendency to plant the same type of crop, such as onion or maize, if it fetches a good income every year. This has resulted in over production of a few crops, leading to a fall in market prices in some years. Farmers normally do not plant new crops that withstand drought. However, traditionally they have cultivated chickpea and vetch since they do not require as much water as maize and onions. In Hewane, *hayfo* farmers usually plant chickpea and vetch because they have the opportunity to irrigate two or three times before the water is diverted

to the *mesno* (irrigation) group. Plants such as eucalyptus, animal feed, hops and guava are planted in kitchen gardens mainly for market.

Table 5.4 Average Yield of Maize, Onion and Tomato Cultivated in Hewane

Production	Maize (quintal/ha)			Onion (quintal/ha)			Tomato(quintal/ha)		
year	Max	Ave.	Min	Max	Ave	Min	Max	Ave	Min
1997	83	54	27	87	39	26	74	58	16
1998	83.5	72.5	68	105	97	85	97.5	85	67
1999	24	20	16	-	-	-	116	112	108
2000	80	72	64	160	120	80	160	120	80
2001	48[3]	40	28	-	56	-	80	40	-
2002	-	-	-	56	48	40	104	96	40

Source: Hintalo Wajirat Woreda Agriculture Department

Most farmers cultivate both irrigated and rainfed plots in Gum Selassa and Hewane. May and June is the harvesting time for irrigated plots. On the other hand, June is ploughing time for both rainfed and irrigated plots. Thirty-three percent of farmers reported that irrigated production interferes with rainfed agriculture or off-farm activities. One informant explained, 'irrigated agriculture interferes with rainfed agriculture. I pay much attention to irrigated agriculture, which makes it difficult to make rainfed plots ready for *meher* season. So I hire a labourer for my rainfed plots'. Another poor farmer reported, 'yes it interferes, because I do no have oxen to plough my plots. I could plough my irrigable plots by begging oxen in summer time. However, I could not plough my rainfed land because I cannot get oxen if I beg while the ox owners plough their plots. Rich farmers could use their oxen and hire labourer to plough both irrigable and rainfed plots'. One informant said 'a lot of time is spent on irrigation activities. For instance, when I am engaged in irrigation, the rainfed plot will be infected with weeds, then I have to employ a day labourer to perform the seasonal activities'.

5.3 Household Production Dynamics

Organisation of labour

Household labour

The organisation of labour in Tigray's economy is derived from the social organisation of the household unit, including also labour of household members obligated outside the unit, which is determined by social relations of gender, age and social status. Basic labour obligations within the household appear consistent across much of northern Ethiopia's agriculturists. Household members in southern Tigray divide the tasks involved in agricultural

production and part-time trade on the basis of gender, age, and social status. Women and young girls monopolise food production, including collection of fuel and water, while men and boys worked at ploughing and tending livestock. Men and women share the tasks of weeding and harvesting, although men finish the cycle with threshing and winnowing. Both sexes supplement household agricultural income; men and women could sell surplus goods such as grain, butter, honey, hides, or livestock in the local market. Women produce handicrafts (pottery or baskets) and *tela* (beer) for exchange locally.

In Gum Selassa and Hewane, almost all the informants reported that the husband controls the labour of household members. In the absence of the husband, the wife controls. Individual members of the household do not have the right to determine how to use their labour. The male household head provides guidance to his wife, children and other members. One informant said:

> *I am the one who controls the household labour. In my absence, my wife controls the labour. We have four children, two of them are attending school. My wife performs domestic activities including fetching water from river or public water points, preparing food, washing clothes and looking after the children. She also participates in agricultural activities such as weeding and cutting. The children participate in collecting firewood, taking care of the flocks and harvesting. We eat together. I buy cloth and other necessities for my family members.*

Lifinti (reciprocal labour) is a labour exchange arrangement among farmers to obtain support during weeding, harvesting or threshing. The exchange of labour is reciprocal and equally returned. As mentioned above, lifinti is also practised among farmers with one ox.

Hiring labour

Although it is difficult to find someone with irrigation experience, 40 percent of the informants hire labourers who come from the surrounding villages. In Hewane and Gum Selassa, various types of employment are practised.

Wage labourer: Plot holders hire wage labourers at times of weeding and cutting. The daily wage ranges from 0.60 cent to 1.40 US $ depending on the type of work and the supply of labour. The plot holder should provide the labourer with lunch and dinner. There is no shortage of labour, particularly during the dry season. In Adigudom, for instance, men and women of young and middle age gather Monday through Friday in the market place looking for employment.

Erbo (one fourth): A labourer is employed for one cropping season and in return obtains one fourth of the yield. The employer provides seed and oxen. The labourer receives shelter and food from the plot holder.

Bewor Kiter (monthly employment): The labourer is employed to serve for one month or more depending on the workload. He is paid 3.50-4.60 US $ equivalent monthly. The employer provides food and shelter.

Wouldeba Shalama (short-term labour contract): A labourer enters into a short-term contract with a plot holder to work from May to January to cultivate the plot. In return, he gets 8 *kuna*[4] of *teff*, 8 *kuna* of wheat and 32 *kuna* of barley. The employer should provide all the agricultural inputs, and he is under obligation to give the agreed upon grain to the labourer even when there is crop failure or a poor harvest. The labourer can sue the plot holder if the agreement is not observed.

In the following section I show how observance of Saints' day and holy days is deeply entrenched in the life-world of local people, and how it constrains the recruitment of labour in the Hewane and Gum Selassa.

Saint days, holidays and religious associations

In Tigray, the Ethiopian Orthodox Christianity plays an important role in the local inhabitants' life-worlds. People celebrate days dedicated to the Saints and holy figures every month. Saints' days are deeply ingrained in the minds of local people, so much so that they are used as calendar dates.

Table 5.5 Days Dedicated to Saints/Holy Figures

Day of Month	Name
1st	*Ledata* (birth of Mary)
5th	*Abbo* (St. Gara Manfa Qeddus)
7th	*Selassie* (Trinity)
12th	*Mikael* (St. Michael)
16th	*Kidana Maherat* (Covenant of Mercy for Mary)
19th	*Gabreel* (St. Gabriel)
21st	*Maryam* (St. Mary)
23rd	*Giyorgis* (St. George)
24th	*Takla Haymanot* (St. Takla Haymanot)
27th	*Madane Alam* (Saviour of the World)
29th	*Bala Wald* (Festival of the Son)

The people of Hewane and Gum Selassa are predominantly Orthodox Christians. There are a few Muslims. In both communities, Orthodox Christians do not carry out the primary agricultural tasks of ploughing, sowing, weeding, harvesting and threshing at weekends or on saints' days.

During one of my field trips, I arrived in Hewane on 30 May[5] 2001. I went to my small hotel and met the owner and we exchanged greetings. Later he said 'we do not work this week because of St. Mary's day.' Since I knew the 21st of the month was St. Mary's day, I asked him why he was not working on the 22nd.. He said, "although St. Mary's day was yesterday, we will not work the whole week. I couldn't chop the big tree I cut last week because we observe St. Mary and Preiclatos' for the whole week". While I was talking to the owner of the hotel, the Woreda supervisor of agriculture came to the hotel for lunch with his friends. He asked me when I had arrived in Hewane. I told him only to day. He said 'you came at the right time because these days due to St.Mary and Priclatos, villagers won't go back to work until the 4th of June'. In a playful way he queried, 'did you not see the church calendar before you came here?' I told him this had been a coincidence. He asked me because he assumed that the farmers would have free time for my interview since they did not work on St. Mary's and Priclatos days. Then I decided to discuss the celebration of saints' days with the local priests.

In the following day, I met *Meri geta* Gidey Gesse, the administrator of St. Gabriel Church. Since we already knew each other he asked me when I had arrived in Hewane. After I told him, I questioned him about the celebration in Hewane of Saint days and he agreed to explain Saints' days and *Teketay Bealat* (the ensuing holidays).

Mahiber or Tesbel is a religious association dedicated to honouring a particular saint. A group of people (usually 12) form the *mahiber* in the name of a saint (e.g. St. Michele or St. Mary). Members gather every month on the saint's day at one of the members' houses. The hosting member prepares *dabo* (bread) and *tela* (local beer). Members drink and discuss various issues of family and community concern. At the end of the day the next member to prepare the feast will be informed. The ceremony, called *tsewa,* will take place by the handing over of a pot of *tela* and bread in a small case covered with a decorated cloth and the picture of the saint to the person who is selected as the host for the following month. The person will take the *tsewa* to his house. *Tebel* members are considerate to poor members. Poor members take their turns during the post harvest time when grain is available to prepare the feast. If a poor member cannot prepare the feast, members who can afford it will help by contributing one *tasa* (can) of grain. *Meri geta* Giday (the priest) explained:

> *The purpose of* tesbel *or* ziker is 'ye nefes waga' *(the price of life). If someone prepares* tesbel *in the name St. Mary or any other saint, that the person will be entitled to veneration after death. In addition, a person who prepared a feast in the name of a Saint will share the specially exalted place in heaven where the saint lives. If someone does not prepare* tesbel*, he is lost'. Our church teaches us to prepare* tesbel*. A person who does not have bail cannot be released from a prison. Likewise, a person who did not prepare* tesbel *will not get bail after death'. One of the saints could act as bail for the person who prepared* tesbel *in his name. A person who cannot afford to prepare the* tesbel *should hold a cup of water, call the name of a saint and give the water to the guest.*

There are 'big' holidays associated with *teketay bealat* (ensuing holidays). These are Easter, St. Mary's day in the month of May and Beale Priclatos or *beale hamesa. Meri geta* Gidey said, 'a king without followers is not a king, and likewise a 'big' holy day is not 'big' without ensuing holidays'. *Teketay bealat* are holidays following the 'big' holy day. Orthodox Christians do not work on these days. According to *Meri geta* Gidey, if someone works on these days, , God will punish him or her'. In order to avoid the punishment, the person who works must confess to his *nefse abat* (father of the soul) and inform him by bowing in pray. The number of bows depends on the number of days worked. For instance, if someone worked on St. Mary's day, then he would be advised to bow up to 500 times and would be told not to work again on St. Mary's day. Orthodox Christians celebrate the following 'big' holy days.

St. Mary's day is celebrated on the 21st of every month and in the month of May it is called *debere metmak.* According to *meri geta* Gidey, St. Mary had been to a place called Debere Metmak where she gave light day and night for five days. 'Muslims[6]' living in Debere Memak were amazed by the work of St. Mary and became Christians. So the whole week is now a holiday during which work is forbidden.

Beale Praclitos is celebrated on the 3rd of June when Jesus Christ enabled the 12 disciples to speak many languages so that they could teach the gospel all over the world. Following this holiday Orthodox Christians do not work until Sunday.

*Tensay (Easter***)** celebrated on the 7th of April. This is the day in which the resurrection of Jesus Christ took place. Following this holy day Orthodox Christians do not work for a whole week.

After having discussed these various religious holidays with the priest, we went to the *tela bet,* the local beer house. There were six people in the *tela bet*

drinking. After a while, two of them, one with a sickle, decided to leave and so I asked the one with the sickle what he was doing. He said 'I came here after cutting maize stems for my cattle'. The second farmer said 'I am going to help a relative to collect eucalyptus leaves'. I then asked them why they were working on St. Mary's day. They replied 'we know it is forbidden to work on St. Mary's day. However, we are doing it without the knowledge of our *nefes abat* (fathers of soul)'. Following this, one of them commented that it was better to give fodder to their cattle since they would otherwise die. While we were discussing this, a middle-aged farmer came in. Since I noticed mud on his hands, I asked him what he had been doing. He told me, 'I have just come from my onion farm after diverting the irrigation water to the river since it was flooding the farm'. I asked him 'don't you know that it is holiday?' 'I know it is a holiday', he replied, 'but I did this because the water will damage my onions'.

Then the priest, elaborating such exceptions to the observance of saint and holidays said, 'if a child is about to die because of hunger, God says feed the child by harvesting and threshing on Sunday to save his life.' I asked the priest 'why then do you forbid people to work when many people are dying because of hunger?' He answered by saying, 'the people you are talking about can die any day, it could be on Monday or Friday. God allows us to work only on Sunday if that work enables us to save the life of a person who is dying on Sunday'.

In the household interviews, over 50 percent of the informants reported that they observe 5-7 Saint days every month. In other words, when Sundays are added to this figure then over fifty percent of the farmers do not work on 9 to 11 days in a month. Although, Saturday is not a working day, local people often engage in various activities.

Table 5.6 Number of Saints' days Observed by Informants in Hewane and Gum Selassa

No. of days	Percentage of Hewane Informants (N=30)	Percentage of Gum Selassa Informants (N=30)
2 – 4	20	23.3
5 – 7	50	56.7
8 –10	20	6.7
do not observe*	10	13.3

*Muslim informants

A person who works on holy days is considered 'Muslim'. However, due to St. Mary's day and Beale Priclatos and Saturdays and Sundays farmers do not work during about 15 days.

In sum, particularly in the month of May, farmers should plough their plots, fill eroded edges of plots, weed out plants and clean the plots. The long rainy season starts in the third week of June. Farmers are expected to make their plots ready for sowing but the work is often delayed due to the observance of religious holy days. However, as noted farmers are not always able to observe religious holy days since their observance can cause many of them to face labour constraints.

Women and irrigated agriculture

The Constitution of the Federal Democratic Republic of Ethiopia stipulates that 'women have the right to acquire, administer, control, use and transfer property. In particular, they have equal rights with men with respect to the use, transfer, administration and control of land. They shall also enjoy equal treatment in the inheritance of property' (FDRE, Proclamation No. 1/1995). There was no discrimination against women in the allocation of irrigable and rainfed land.

Traditionally women do not plough in Tigray. Ploughing is set aside for men as in most parts of Ethiopia. Before 1991, the TPLF encouraged women to plough in the liberated areas of Tigray, but this did not last long. Women are actively involved in the following agricultural activities: land preparation, planting, weeding, harvesting, threshing, storing and marketing. In the household interviews, all male informants reported that the occupation of their wives was farming.

However, despite women's active participation in farming, they are not elected as members of the executive committee of the water users association in Gum Selassa irrigation system. Women can attend the general meetings of irrigators, but many do not actively participate since they find it difficult to speak in public.

The following three cases illustrate how women who own irrigable plots earn a living in Hewane and Gum Selassa.

Deley Beza

> Deley Beza, 36, illiterate, has four children. Three of them are attending school and the eldest is a driver for SAERT. Her husband, a soldier during the Derg regime, left his family behind and got married to a woman where he was stationed.

She leases out the 0.2 ha. plot in Gum Selassa to a sharecropper because she cannot plough. In addition, she does not own oxen and the labour cost for weeding and cutting was unaffordable. Deley said, 'the sharecropper gives me up to 200 kg grain, which can sustain my family for four to five months. My son gives me 11.70 US $ every month which covers most of my living expenses. In addition, I get food aid of 50-kg wheat every month. In the past I used to brew *tela* (local beer), but now due to illness I have stopped.

My plot has never been irrigated. I have repeatedly asked the development agent of Gum Selassa, saying that, 'you re-distributed our land promising us water for our plots. Why don't you give us it now? Half of the farmers produce twice in a year, while I do not. Why do you not give us a solution?' The development agent always says 'you will get water next year'. When next year comes, he says again next year. Until now, I have not had water'.

Meaza Berhe

Meaza Berhe, 45, is a plot holder of a 0.25 ha plot in Hewane. She has two daughters. The elder is married to a combatant and lives with Meaza with her child since her husband is stationed elsewhere. The younger attends school. Meaza was divorced in 1987. She has her own house and rents out a room to earn additional income. When she divorced she obtained 0.5 ha of rainfed land. In 1990 when the TPLF redistributed land she received 0.25 ha of irrigable land. She rented out the land to receive half of the yield. In 1997, Meaza decided to cultivate herself, since *Woferit* was not beneficial. She said "one should work for oneself to support oneself. Meaza does not own oxen. She has her own strategy to get her land ploughed. She goes out to work with farmers who own oxen during weeding and other agricultural activities, which she can manage. In addition, when she prepares *tela* (local beer) she gives the *atela* (residuum of local beer), which is used as animal feed, to the owners of the oxen. In return, the farmers with oxen plough her plots free of charge. Meaza takes a small loan to purchase fertiliser, seeds and grain to prepare *tela* and to hire labourers for irrigating and harvesting. Meaza points out that women find it difficult to irrigate their plots in Hewane due to their lack of experience or when their turn falls at night time. She also told me of the difficulty in changing the irrigation program if a woman is assigned a night shift since the watering program is based on a block basis. One is required to irrigate according to his/her turn. Her daughters also participate in the cultivation of plots. Meaza plants different crops in order to achieve a better income. She is quite aware of the importance of cultivating vegetables instead of maize only, and follows the advice of development agents. She complains about the price of fertiliser.

Mulu Girmay

> Mulu Girmay, 38, lives in Hewane. After having a daughter, she divorced her husband because he wanted to have additional children. And since, unfortunately, Mulu was no longer able to give birth, the marriage ended.
>
> Mulu and her husband divided the land equally at the divorce. She received a 0.5 ha plot, of which half is irrigable. Mulu used to plant cabbages, tomato, and beetroot, which fetched a good income before the divorce. Since she no longer has a plough, her plot is leased out to a sharecropper on the agreement that she receives half the yield. The sharecropper provides the seed and she pays half of the price of the fertiliser applied. According to her agreement, in 2000 she collected 100-kg maize, which was not threshed; and two *kuna* (local unit of measurement) of *teff* from the rainfed plot. She sold 50-kg of maize for 1.75 US $ and bought 18 kg of barley which she could consume in about 12 days. Mule has her own survival strategies including working as a labourer in weeding and cutting to earn about 0.75 US $ per day, selling handicrafts, and begging grain during harvesting. In addition, her daughter who lives in Korkora provides her with some grain. She also receives food aid and edible oil.

The above three cases illustrate how difficult the life-worlds of women and how they struggle to survive. The cases also show the different livelihood strategies women employ in this struggle, such as leasing out land, remittances, working as laborer and selling local beer to earn a living.

Access to agricultural inputs and market

In Hintalo Wajirat *Woreda*, 77 percent of the households cultivate their plots in the old way without using modern agricultural inputs. The agricultural extension program has covered ten percent of the cultivable land in the *woreda* since the program started in 1996. In other words, 23 percent of the households have participated in the extension program (Woreda Hentalo Wajirat 1993(E.C)[7]: 3). In chapter seven, I discuss in detail how the 'Participatory Demonstration and Training Extension System (PADETES)' has been implemented in Hewane and Gum Selassa irrigation systems.

Among the informants, 53 percent expressed the opinion that development agents (DA) give adequate advice to farmers. But many farmers also expressed the view that sowing in line was not practised. The development agents insisted farmers had to accept the new method of sowing, yet there was strong resistance from farmers. Farmers had noticed a difference in yield when they compared the old way of sowing with the new one. Some farmers reported that sometimes the development agents did not consider farmers' opinions. One informant recalled:

> *They usually impose their ideas on us. They say 'do not sow unless we advise you to do so'. Had the extension workers taken into account our knowledge the yield would have been better. Now we have to sow in March and we harvest in June and so the winter rain comes before we harvest. The rain damages the crop residue, which we use as fodder for our cattle'. Another informant said, 'I usually plant according to the advice of the development agent. However, in 1999, I planted* teff *instead of wheat without the knowledge of the DA because I could not afford the price of wheat seed. I opted to sow* teff *because I only needed 5 cans of* teff *seed which cost about 2.33 US $, while the 25 cans of wheat needed was about 8.76 US $. Afterwards the DA got to know what I did, and said he would take me to court, which did not happen. They simply say this to frighten us'.*

Fertiliser

Farmers told me that in the past land with brown soil used to lay *meisega* (fallow) in order to improve the quality of the soil. At present, farmers hardly practice *meisega* because of the shortage of cultivable land. Farmers in the irrigation systems use more fertiliser than those in rain-fed sites. This is mainly because the extension program, which among other agricultural inputs requires the utilisation of fertilisers, is designed mainly for the irrigators. The agriculture department, which implements the extension program, urges irrigators to use fertiliser, either directly or indirectly. Farmers apply 100-kg urea and 100 kg DAP (di-ammonium phosphate) on one hectare of irrigable land. In the rain-fed plots farmers use 50 kgs urea and 50 kgs DAP.

A farmer can buy fertiliser without believing in its importance but if he refuses, he thinks he will be going against the local government. So some who purchase fertiliser sell it at a lower price and others only use a portion of it. One informant said,

> *The development agents in Hewane urge us to purchase fertiliser for both irrigable and ha*yfo *land before the cultivation season begins. We take the fertiliser whether we like it or not. The DA insists, even when we say we will not get water. The DA and agricultural cadre can nag us for a week. For instance, about 25 hectares of ha*yfo *land parched this year after fertiliser was applied due to a lack of irrigation water.*

Improved seed

Farmers are encouraged to use improved seeds, and of these they prefer the improved wheat seed. Nevertheless many used the local wheat seed called '*shehan*' even though it is expensive compared to the improved seed, since it withstands plant disease. As far as *teff* is concerned, farmers prefer their own seed because the yield is better than the improved seed.

Pesticides and insecticides

Farmers fight against plant diseases, locally known as *fenta*, *degeza* and *barnos* that attack leaves. Almost all farmers are willing to apply pesticides since they are aware of the negative impact of disease on yields. Farmers can purchase pesticides on credit, though they complain about their high price and late delivery. One informant noted:

> *In 2000, I planted onions and the harvest amounted to three quintals. Since the onions were affected by disease, the harvest was low compared with the previous year's 10 quintals. I applied insecticides, which I bought from the agriculture department. Unfortunately, I used an expired pesticide that was ineffective. Later the development agent brought a new insecticide, but it was too late since the onion was already damaged. When I tried to sell the three-quintals of onions, the price was very low. I decided to store them at home hoping the price would increase. After a few days, the onions started rotting and I was forced to sell them for 11.75 US $, when I had spent 5.88 US $ on the pesticide. If I consider my labor and the money I spent on buying the seed, then I have lost a lot of money this year.*

Farmers report animal diseases, locally known such as *samba*, *mezger*, *goitager*, that swells part of the animal's body, and *halfye,* which changes the colour of the animal and then paralyses it. Cattle vaccination is given once or twice a year. However, some farmers reported that animals do not get treatment immediately the disease is identified.

Agricultural credit

Farmers mainly get credit from the Dedebit Credit and Saving Institution. Thirty-six percent of the informants took loans for them for various purposes such as the purchase of an ox, to cover miscellaneous expenses, or to purchase of fertiliser and seed. Some farmers do not take loans because of the *gujele* (grouping) system, which entails group responsibility for loan repayment. In addition, those who had taken a loan, complained about the repayment time for settling the loan, which forces them to sell their grain immediately after the harvest when prices are at their cheapest. The provision of credit is discussed in detail in chapter seven.

In addition to obtaining loans from Dedebit, *equb*, a traditional form of saving operates. The system involves a group of people who agree each to contribute a certain amount of money either on a weekly or monthly basis. The *dagna* (chief) and *teshafe* (secretary) are responsible for the collection of the contributions. The collected money will be given to one of the members on a rotating basis. Forty-three percent of the informants are members of *equb,* each contributing 10 to 100 birr (about US$ 1.15 to 11.6).

Access to market

In Hintalo Wajirat Woreda, there are four major market places, namely, Adigudom, Hewane, Bahertseba and Hintalo. Traditionally, most exchanges take place on a particular day of the week. For instance, it is Saturday in Adigudom and Thursday in Hewane. The single day marketing system restricts the promotion of market linkages and interactions between and among *tabia*s and people. Furthermore, farmers who travel the long distance (three to four hours on foot) to sell their agricultural products will be forced to sell at a very low price since products such onion and tomatoes are perishable and worth nothing if taken back home. They therefore accept whatever price they can get rather than return home with them.

The common mode of transport is by pack animal, such as a donkey, since poor farmers cannot afford to use a truck to transport their agricultural products. They may hire or borrow a donkey to move their products to the market place and in return they are expected to work for the owner for free during the harvesting or ploughing seasons.

In Hewane, the market outlets are the nearby towns and villages. Farmers take chickpea, *teff* and *Guaya* to Adigudom, Betmera and Mai Nebri. *Teff,* wheat, potato and tomato are marketed in Mekelle. In addition, farmers sell agricultural products in the weekly market called *Hamuse gebaya* (also a Thursday market). On the other hand, retailers from Mekelle and other towns come to Hewane to purchase agricultural products including *teff*, vegetables and maize. They transport agricultural products to Mekelle by trucks.

5.4 The practice of *Woferit* (sharecropping)

Assessing the efficiency of *woferit* (sharecropping) is beyond the scope of this chapter. Share cropping has a long history. It enables local people to gain access to land. On the other hand, people with land but no income to buy agricultural inputs and labour use sharecropping to gain access to farming inputs and labour from those who do not have land. The incentive and efficiency effect of different types of smallholder leasing has generated a lot of discussion in the past and it is still very much debated. Pender and Fafchamps (2001:1) indicate that 'many economists have argued that share tenancy causes inefficient resource allocation because the share tenant receives only a fraction of the value of his marginal product of labor, thus reducing the incentive to supply labor or other inputs'. Conversely, as Pender and Fafchamps (ibid.) indicate, 'others have argued that if the tenant's work effort can be costlessly monitored and enforced by the landlord, then resource allocation can be as efficient under sharecropping as under owner-cultivation or fixed-rent tenancy'.

Several types of sharecropping exist in Ethiopia depending on the agreements made between the landowner and the tenant. As to agricultural efficiency there are mixed findings. In Tigray region, for instance, as Pender et al (2002:.39) indicate '…tenants (mainly sharecroppers) use fewer inputs and obtain lower yields at the plot level than owner-operators. This may be because restrictions on the duration of land lease contracts (no more than two years unless 'modern technologies' are used by the tenant) prevent landowners from leasing land to tenants that they know well, so that the incentive problems involved in sharecropping (i.e., tenants' incentive to use less inputs because they receive only a fraction of the output resulting) can lead to reduced farming intensity and yields'. Conversely, in the southern part of Ethiopia, Pender and Fafchamps (ibid: 21) reported that 'we do not find empirical support for the ''Marshallian'' prediction of inefficient sharecropping, since factor intensity and output value are not significantly different on tenants' own vs. sharecropped fields'.

Woferit practice during the Imperial Regime

As mentioned, *Woferit* (sharecropping) is a long-standing practice in rural Tigray. It is a type of land lease made between landlords and tenants who pay a share rent to the former. During the imperial regime, tenants cultivated with family labour, wholly or mainly leased-in land on which they were dependent for their livelihood. Peasants often used to offer inducements, such as sheep, goat, *ambasha* (bread) and honey to landlords to lease plots. Those who could not afford honey or goat had to plough the landlord's plot or cut crops free of charge. After giving such presents and free services, the peasant would inform the *Agafari* (a person who oversees the affairs of the house of the lord) that he wanted *woferit* land. The peasant would also offer the *Agafari* a small tip of about a dollar or less for drinks to persuade his lord to lease out his land. During this period some landlords and local governors were seizing peasants' land by force in Hewane. One of my informants told me about a local governor who expropriated about 1.5 ha land from four peasants. He told of how the peasants begged him to lease them back what had been their own plots by giving him honey and goat as presents.

Landlords were in an advantageous position when they leased out their lands. They collected half the yield from sharecroppers. If the yield was low, they leased the following year to another farmer. Threshing took place in the presence of the *Agfari* in the field. The farmer would transport the landowner's share by his own donkey or mule to the landowner's house. The crop residue was left for the farmer. A farmer who leased-in land had to engage in various activities including fence making for the landowner so as not to lose the *woferit*

land in the future. In addition, tenants often provided seeds and oxen when they entered into *woferit* agreements.

Current woferit practice in Hewane and Gum Selassa

Woferit is still widely practiced in Hewane and Gum Selassa irrigation systems. However, the Woreda Agriculture Department has never collected information on *woferit,* including the number of farmers involved in the practice or on the amount or size of the land cultivated under *woferit* arrangements in Gum Selassa and Hewane. I asked the irrigation expert why they did not have information about *woferit*. She said, '*woferit* is a common practice in the Woreda and there is no need to study it'. So I looked for another reliable source for information and discussed *woferit* with the person in charge of water distribution in Gum Sealass, since he had frequent contact with the farmers. Thus I talked to Aleka Minas, who served as *abo mai* (father of water) and asked him about the practice of *woferit* in the Gum Selassa irrigation system and the number of farmers who leased out their plots. Aleka Minas knows every plot holder who gets irrigation water and leases out his/her plot to a sharecropper.

Table 5.7 Plot Holders who leased Out Plots by Gender in Gum Selassa Irrigation system, 2001

Gender	WUA* members	Plot holders leased out plots	
		Number of plot holders	Percentage
Male	241	100 (41.5%)	41.5
Female	107	89 (83.2%)	83.2
Total	348	189 (54.3%)	54.3

*WAU= water users association

He reported that the newly established water users association had 348 members[8] out of which 241 (69%) were men and 107 (31%) women. The number of farmers who leased out plots numbered 189 (54.3%), 100 men (41.5%) and 89 women (83.2%) as indicated above

In Hewane, 194 farmers provided with extension services leased out their plots in 2001 (56% women as against 44% men, see Table 5.8). Among the four Kushets, Hewane town farmers constituted 71% while Ayboto made up 7%, while Maini and Korkora each 22%. In Hewane town many farmers are engaged in off-farm activities such as selling *tela* (beer), small goods including sugar, salt, etc. and many farmers do not have oxen. In addition, grazing land is limited because Shelenat Dams were constructed on the pastureland.

Table 5.8 Plot Holders who Leased out plots by Kushet and Gender in Hewane Tabia, 2001

Gender	Hewane town	Maini	Ayboto	Korkora	Total
Male	52	6	6	22	86 (44%)
Female	85	16	7	-	108 (56%)
Total	137 (71%)	22 (11%)	13 (7%)	22 (11%)	194 (100%)

Source: Hewane Tabia Agriculture office

The least engaged in leasing out plots were the Ayboto farmers. One informant said, 'the main reason is that the community labels an able bodied farmer as *set* (woman), or *dureye* (an indolent man) if a man leases out his plot'.

Negotiating Woferit

A farmer interested in leasing-in land first makes a survey of 'good' plots. After the identification of a plot, he asks the plot holder whether he is willing to lease out his land. If the plot holder agrees, negotiation will take place to determine the grain share, conditions of cultivation and *mougia* (inducement money). *Mougia* is money given to a plot holder by a sharecropper in order to persuade the former to lease out his/her plot. If the plot is of 'poor quality', the sharecropper may not give any mougia. The amounts range from 3 to 11 US $ depending on the quality of the plot. A person can get a good price in the form of *mougia* if the plot gives a 'good yield'. The amount of *mougia* may increase if two or more farmers compete for the same plot. The *mougia* (inducement money) and the quality of land are very important factors in the determination of the yield share. If the sharecropper gives a good amount of *mougia* to the plot holder he will be in a good bargaining position in the negotiation.

If there is disagreement during the first negotiation, the tenant will send a '*shimagle*' (mediator) to convince the plot holder. This second negotiation usually takes place by inviting the plot holder for beer in the local *tela bet* (beer house), usually without the knowledge of his wife. As one informant explained, ' if the wife of the plot holder knows about the intention of leasing out their plots, she may oppose the idea by saying 'why don't we cultivate it ourselves by borrowing oxen from a friend or relative?' But after an agreement is made, if the wife opposes, the husband will bluntly tell her that 'I cannot break my agreement. Next year I will not lease out our land'.

The *woferit* may involve one or more cropping seasons. In case of a *teff* plot, the plot holder can take back the land after the sharecropper has cultivated it for two years. This is because plot preparation for *teff* is time consuming and

may have required the sharecropper to plough it up to seven times. Thus, breaking a lease agreement made on *teff* land after one cropping season is socially unacceptable. *Woferit* agreements can be written or made orally in the presence of elders. The amount of grain share to be given to the plot holder ranges from one quarter to half depending on the quality of the plot. When harvesting time comes, the owner will be informed as to when the threshing will take place and he should be on the farm to take his/her share. The farmer takes the *geleba* (crop residue).

Why woferit?

Farmers reported several reasons why they leased out or leased in plots in Hewane and Gum Selassa. In the household interviews, informants were asked for their major reasons why they did so. The following table shows the percentage of farmers' responses and the ranking of the major reasons for becoming involved in *worferit* (sharecropping).

Table 5.9 Reasons Given by Farmers for *Woferit* (sharecropping) in Hewane and Gum Selassa Irrigation Systems

Reasons for	Gum Selassa		Hewane	
	% Farmers*	Rank	% Farmers	Rank
Leasing out land (N=10)				
Being a woman I can't plough	50	3	50	2
I do not have ox	10	6	20	4
Not able to purchase fertiliser	60	2	50	2
Farming interferes with off-farm activities	20	5	10	5
Shortage of household labour	40	4	30	3
Uncertainty of access to irrigation water	70	1	60	1
Leasing in land (N=5)				
Access to land	20	2	60	1
Access to irrigable land	80	1	40	2

*Multiple responses are considered

I am a woman…

A taboo against women ploughing is widespread in Tigray. In effective terms, the taboo makes dependency on men unavoidable and greatly restricts women's ability (especially if poor) to farm independently. The response 'being

a woman I can't plough' ranked second in Hewane, and third in Gum Selassa as a reason for leasing out land to sharecroppers.

However, *woferit* may not benefit women. The following case of Akaza Araya (see Table 5.10) illustrates this. Akaza, the wife of Alemu Demisu the Hewane tabia agriculture supervisor, has 0.25 *hayfo* plot in Hewane. She inherited the plot when her father died in 2000, but as she was unable to plough it, the plot was leased out to a sharecropper for half of the yield. However, in 2001 Akza's husband started cultivating the plot himself. He borrowed oxen from people whom he knew well, free of charge, and he hired labourers to cultivate the plot. Thus in 2001, Akaza harvested 550 kgs of wheat. Her husband Alemu said, 'half the plot was not well ploughed. Had it been well ploughed the production could have been greater'. In 2002, he planned to plough the plot repeatedly since his sister-in-law had agreed to lend him oxen in return for straw. He commented (illustrated in the table) that 'w*oferit* affects plot holders since they collect only a small amount of grain'.

Table 5.10 Cultivation Arrangements and Amount of Crop Collected by Akaza

Production year	Crop	Amount of crop collected (in Kg)	Rainfall	Cultivation arrangement
1999	Barley	100	good	*woferit*
2000	Teff	100	poor	*woferit*
2001*	Wheat	550	good	self

*Sharecropping stopped

Conversely, there are husbands who are interested in leasing out family plots against the interest of their wives. Tibika Haile, development agent serving as home economist in Hewane, told me the following case of Tiblese Berhan who lives in Hewane.

Tiblese Brehan lives with her husband in Hewane. Each of them have 0.5 ha plots. The husband leased out his 0.5 ha plot to a sharecropper. According to the agreement, the sharecropper takes the straw. As a result shortage of animal feed forced Tiblese to sell her grain to purchase fodder. Tiblese was not happy with the situation and told her husband to discontinue lease land. But the husband continued to do so. While Tiblese was considering separationg from her husband, she met Tibika, the development agent, and told her all about her problem. She decided to help them settle their problem by discussing it with Tiblese's husband. The husband told Tibika that he had difficulty in ploughing because he only had one ox. Tibika advised him to purchase another ox on credit obtainable from the Dedebit Saving and Credit Institution. The husband

was convinced and purchased an ox, and since then the couple have been at peace. Tiblese was pregnant when she decided to separate. Later she a gave birth to a baby girl, and asked Tibika to be a godmother to strengthen her relationship with her. Tibika agreed.

Tibika told me about the problems women face in cultivating their plots. She said, 'If a woman does not have a husband or a family member who can plough, she will be forced to lease out her plot to a sharecropper. In addition, the husband decides on the utilisation of the household money, grain and plot'. She also elaborated on the problems that women encounter when they lease their plots to sharecroppers. She said, 'if the plot is rainfed it could be located far away, making it difficult for the woman to control. She is unable to supervise the cultivation due to the distance and likewise cannot control the harvest. In most cases women take what the sharecroppers give them. In the case of fertiliser application, sharecroppers can cheat such women. If honest they will apply the fertiliser and charge the woman according to their agreement, but if not then they can report that fertiliser has been applied when it has not and charge for the cost. Diligent and capable women cultivate their plots themselves'.

'Let the sharecropper buy the fertiliser'

In Hewane and Gum Selassa a Participatory Demonstration and Training Extension System (PADETS) has been implemented since 1996/97. Chemical fertiliser is one input that farmers are supposed to apply in order to increase agricultural productivity. And the agriculture department and local administration coercively persuade farmers to purchase chemical fertiliser. Intimidated farmers purchase fertiliser willy-nilly, while others opt to lease out their plots so as to avoid purchasing fertiliser. Many farmers were not willing to purchase it because of its high price and the problems incurred because of the timing of loan repayments as mentioned earlier (see chapter 7 for an in-depth discussion). Hence, farmers consider sharecropping as means of distancing themselves from the purchase of fertiliser, since the sharecropper does the buying. As the development agent of Gum Selassa put it, the farmers say 'let the sharecropper buy the fertiliser'.

Shortage of household labour

Informants ranked shortage of household labour as the fourth and third reason in Gum Selassa and Hewane respectively for leasing out plots. As I outlined earlier, several factors contribute to this, among them, the interference of irrigated agriculture with rainfed cultivation and the taboo against undertaking major agricultural tasks on saints' days. Another reason is the cost of employing

labourers due to high wage rates at certain seasons of the year; the price fluctuates between 0.70 and 1.40 US dollars. In addition, employers are under the obligation to provide food and shelter to the labourer.

Uncertainty of access to irrigation water

Farmers of Gum Selassa and Hewane listed uncertainty of access to irrigation water as their primary reason for leasing out plots. Between 21 and 85 percent of the plot holders in Gum Selassa had not received the promised dam water for over six years. Likewise, in Hewane, the switching of plots from *hayfo* to *mesno* or vice versa takes place, which creates uncertainty of access to water. Farmers frustrated with the situation have often opted to lease out their plots (see chapter 3 and 4 for in-depth discussion).

Competition for cultivable land and irrigation water

Sharecroppers reported that access to irrigable land is the first reason for leasing in land in their villages. Nega Tsegay, a rich farmer who leases in land, told me why he remains highly interested in *woferit*.

> 'Wolad set ena tiru massa wodeh atlekem' *(literally, one would not give up willingly a childbearing woman and fertile land). If the land is good I will agree to give half of the yield to the plot holder. If the plot is of poor quality, I will agree to give one fourth of the yield. If the plot is good, the plot holder will be invited for* tela, *and a person known to us both will act as mediator and try to convince the owner by saying 'why not get half of the yield without toiling in the field'. If good land is obtained I will start ploughing the next day because the plot holder's wife may disagree when she is informed about the* woferit. *Once I have started ploughing, the husband will tell her that the land is ploughed, which would make it difficult to cancel the agreement. At present, I have 1 ha irrigable land which is cultivated by wage labourers. I would like to have more* woferit *land, but the labour cost of cultivation is high.*

In Hewane and Gum Selassa, agriculture is the major economic activity both in terms of input of household labour and of income, either in cash or kind. The basic modes of accessing land for cultivation are state-sponsored land distribution, land inheritance, lease and *woferit* (sharecropping).

The average land holding of individual farmers has been in decline in rural Tigray. In Hintalo Wajrtat Woreda, the average amount of arable land per household is 1.48 ha. Population pressure and land redistribution are often mentioned as factors for the decrease.

When the TPLF carried out land redistribution in Hintalo Wajirat Woreda in 1990, a three-man committee called the '*meret meklo committee*' was established. Villagers elected members to the committee which was responsible for assessing and determining the quality and size of land to be allotted to

individual farmers. On the basis of 'land fertility', the arable land was classified into three types: w*oferam* (good quality), *mekakelgna* (average quality) and *rekik* (poor quality). In the land classification, the size of land is commensurate with its fertility as indicated in Table 5.11 below.

Table 5.11 Classification of Arable Land by Type and Land Share

Land type	*Mulu Geber* (full share of land)
Woferam (good quality)	0.25 ha. (1 timad)
Mekakelgna (average quality)	0.5 ha (2 timad)
Rekik (poor quality)	1 ha. (4 timad).

A husband and wife obtained one *mulu geber* (full share of land). A female aged 16 or a male aged 22 was entitled to half a *geber* of land, and a child one-eighth of a *geber*. Local people who met the criteria received their land type by lottery. Farmers pointed out the shortcomings of the land re-distribution. One informant commented, 'I do not think the land study was carried out properly because the committee's land classification was based on guesswork. In addition, the decision to give children unequal shares of the plots was unfair. We did not make our complaints to the officials because of fear of detention'.

The land re-distribution has given rise to land fragmentation. The source of fragmentation was the distribution of plots to individuals based on the fertility of plots scattered all over the *kushets* (villages). Since the available land was classified as of good, average and poor quality, people received fragmented plots of the different types in various locations. In addition, when a household member established his/her own family, they have the right to take their share from the household's plot, which was cultivated collectively. One informant in Gum Selassa said:

> *I have 0.2 ha of irrigable land and 0.5 ha rainfed. I leased out the rainfed plot to get half of the yield. There is fragmentation of land holdings because my plots are located at different sites. If you consider the distance of my plots from my hamlet, the kitchen garden is about 50 mts., rainfed land about 3.5 kms and irrigation plot about 2 kms.*

In Gum Selassa, 56 percent of the informants reported that the 0.2 ha plot allotted to a water user was unrealistic in terms of available household resources, including labour and oxen. One informant said, 'it is not realistic because I have two oxen and I finish ploughing my plot in a short time. Thus, I am cultivating *woferit* plots to fully utilise my oxen'. Conversely, another informant said, 'it is not realistic because I don't have oxen to plough all my

plots. Thus I am forced to lease out my rainfed plot to a sharecropper'. This highlights the role of oxen in whether to share crop or not. In central Tigray, Asmelash (1995) noted the same point, stating that a household with oxen and labour, had the possibility to access additional land through sharecropping.

Landlessness and inequality in land holding have become a concern to the local government. According to the Head of Economic Development of Hewane Tabia, about 600 villagers have asked government to provide them with land. The landless includes returnees from resettlement areas located in the south and southwest of Ethiopia and young people who have recently established independent families. During the 1984/85 drought and famine, the former government re-settled thousands of Tigrians in the south and south west of Ethiopia due to the recurring drought that hit Tigray. When the war between the TPLF and the then central government was over and the new government assumed power, many Tigrians returned from the resettlements to their homes.

In an attempt to curb the problem of landlessness in Hewane, the *tabia* administration has planned to redistribute 19 hectares of land registered in the names of women's, farmers' and youth associations, and deceased people without heirs, to 136 villagers who have returned from the settlement areas. The returnees had to be 15 years old in 1990 when the TPLF distributed land. Each person was to be allotted 0.25 ha of rainfed land. In addition, 4 ha of steep hilly land that was unsuitable for farming, was to be distributed to 16 landless people for the planting of trees.

Shared yield and household food consumption

In the 2000 cropping season, a large majority of the informants who leased out their plots in Gum Selassa and Hewane had agreed to collect one-fourth to one-third of the yield respectively. From the household interviews we may conclude that 80% of those in Hewane and 90% in Gum Selassa who leased out their plots collected one-third of the harvest in 2000. The *abo mais* and the development agents had also reported that a large majority of the plot holders collected one-third of the yield from the plots they had leased out.

The household grain consumption is to a large extent a function of the yield collected from the leased out land. Between 70 to 80 percent of the households consumed the grain collected with for 4 to 7 months. There is, therefore, a serious food shortage among plot holders who consumed the grain in less than four months. I met one plot holder of about 70, working on the plot he rented out to obtain one third of the yield in Gum Selassa. He said 'I could consume the grain I obtain from my rented out plots in 2 to 3 months. So, in order to sustain my family my sharecropper has hired me as a day labourer'.

Table 5.12 Duration of Household Grain Consumption Collected from Sharecroppers in Gum Selassa and Hewane, 2000

No. of months	Gum Selassa	Hewane
	Percentage of plot holders (N=10)	Percentage of plot holders (N=10)
Below 4	20	30
4 – 5	60	60
6 – 7	20	10

The sharecropper attempts to please the plot holder of good quality land by lending him or her money or crops so as not to lose the land. If the land is poor, the owner will not get a grain loan because production on the land is unreliable. One sharecropper said, 'those who lease me the land may request a grain loan, but I don't give it to them because the price of grain is high when they request it. When they return the grain after the harvest, the price will be lower. So, it is better to sell the grain.

5.5 Conclusion

The role of irrigation and improved agricultural inputs in increasing agricultural productivity has been discussed. In both Hewane and Gum Selassa irrigation systems production has increased by taking advantage of modern technologies and high-yielding crops that called for intensive farming. Although Woreda officials highlight these increases in yield under irrigation, they are still low for the cash crops of tomatoes and onions and uncertain for maize as the main food crop.

The government's assumption that the plot holders would cultivate the irrigated plots themselves was not realized. The water users were widely involved in sharecropping. In Gum Selassa 54% of the irrigators and in Hewane 40% leased out their plots. The proportion of female plot holders who leased out land was higher than males. The practice of *woferit* (sharecropping) in both irrigation systems illustrates the differing life worlds of local actors involved in irrigated agriculture. As Ubels (1989: 197) notes, 'for the various parties involved in an irrigation situation, the system is not a goal in itself, but part of a broader life-world, in which each party seeks to guarantee a living and pursue particular goals'. The social actors (plot holders and the sharecroppers) show their agency in their knowledgeabiltiy and capability to assess problematic situations and organize 'appropriate' responses. As Long (2001:31) notes '…the issue of policy implementation should not be restricted to the case of top-down,

planned interventions by governments, development agencies and private institutions, since local groups actively formulate and pursue their own 'development projects' that often clash with the interests of central authority'.

In the household interviews, uncertainty of access to irrigation water was ranked as the first reason to lease out plots to sharecroppers. In Gum Selassa irrigation system, due to the socio-technically-mediated water scarcity, between 21 and 85 percent of the plot holders did not get the promised water over the previous six years (see chapter 4). For many of the farmers, who had no access to water, irrigated agriculture had no meaningful place in their life-worlds. As Mitku, et. al (2001: 12) note the 'major concern in Tigray is sustaining the system by maintaining the capacity of the dams. In general, the major problems related to the micro dam systems are the discrepancy between the actual and potential capacity, rapid rate of deterioration and frustration and dissatisfaction of users with unreliable water supply'.

In the Ethiopian context, access to irrigation water is mainly maintained through access to irrigable land and in this regard, women who received plots of land in the irrigation command area had the same access as men. Gender studies have focused on the issue of equal property rights for men and women in an effort to empower women. Countries, which discriminate against women in terms of access to land, water or any other resource due to traditions, have been criticised. However in Ethiopia, the study committee and later the government while looking at the benefits obtained from a given resource such as land or water, failed to notice the taboo against ploughing for women. Women do indeed receive plots like men in the irrigation system but in Tigray they are traditionally not allowed to plough. Thus women headed households in particular are forced to lease out their plots to sharecroppers. The large majority of them collect one third of the yield. Ownership rights are vested in women, but not the means of production.

As cultivable land is limited, the government has found difficult to carry out new land redistribution. The average land holding of farmers has been on the decline in rural Tigray. Land fragmentation and landlessness have become major problems in the area. Getting access to irrigable land was the main reason for leasing in land by tenant farmers. Thus, *woferit* has become the major mode of accessing cultivable land in the two *tabias*.

What are the implications of sharecropping for household food security and irrigation management? The large majority of plot holders collect one-fourth to one-third of the yield in a cropping season but for between 70 and 80 percent of the households consumed the grain in 4 to 7 months. Household food deficit is a serious problem among the plot holders who are often forced to work as labourer because the one-third they receive is not sufficient to maintain the family.

Yield per hectare in the irrigated fields has increased compared to the rainfed agriculture. The officials of Woreda administration and experts in the agriculture department repeatedly mention the increase in yield as success. Of course the increase in agricultural productivity is a success. However, this is not such a success in terms of food security at the household level, which was the prime objective of the government when irrigated agriculture was introduced in the area. In a situation where the majority of the plot holders rent out their plots and collect only one-third of the harvest, the achievement of food security is questionable. Bush (2002:16) writes:

> *Most Ethiopian farmers have access to some land. But many lose access when poverty forces them to rent out their land (hence they lose all access for the contracted period) or to sharecrop it (in this case they receive about 50 percent of the harvest once expenses are deducted.*

Tenant sharecroppers usually give cultivation priority to their own plots instead of leased-in plots. As one sharecropper who cultivates one hectare of leased in land said, '*woferit* land and a mistress are the same. As I give priority to my wife over a mistress, I always cultivate first my own plot. As a sharecropper I decide the type of crop to be planted every season'. Sharecroppers cultivate the land for a limited period and they could be less willing to invest their time in the irrigation management.

Notes

1 FAO (1979) suggests the following ranges as good commercial yields under irrigated agriculture: Maize 6-9 tones/ha; onion 35-45 tons/ha; tomatoes 45-65 tons/ha. Thus in some years, local farmers are achieving very acceptable maize yields although these vary a lot year-to-year. Maize can yield well even under limited turns of irrigation but the timing is important. Water shortages at critical periods can greatly reduce yields. Local yields for onions and tomatoes are well below potential yields, possibly reflecting inadequate irrigation and input supply problems.
2 *10 quintals = 1 ton
3 local variety seed used
4 A kuna is a local basket containing 5 to 10 kilos depending on the size.
5 May 30 is Gunbot 22nd according to the Ethiopian calendar.
6 It is common to call non-Christians Muslims.
7 The year 1993 is according to the Ethiopian calendar which was 2000/01.
8 The information obtained from the *abo mai* did not include the 202 farmers who were not members of the water users association since they did not get dam water. The abo mai estimated that over 50 percent of the plot holders could be leasing out their plots since they did not get water.

6
Surviving in a Drought-Prone Region

6.1 Introduction

Local people do not passively await starvation triggered by a poor harvest. They deploy various means to survive under life threatening conditions of famine. Much has been written about coping strategies among communities affected by droughts and famine (Mesfin, 1984; Dessalegn, 1991; Webb, et al., 1992). Localised response to famine varies according to the intensity of the problem and abilities of different actors.

In this chapter, I discuss the coping strategies commonly observed for preventing, adjusting to, and recovering from famines and food deficits at household level in the Hewane and Gum Selassa *tabias* during the 1984/85 drought and famine. Households in the two *tabias* rarely get good harvests that can sustain the whole family for a year. In an attempt to probe in more detail coping strategies, I asked household heads to identify the means they used to overcome food shortages during the 1984/85 famine in Gum Selassa and Hewane. These spanned a combination of four key coping strategies: reductive, depleting, maintaining and regenerative strategies (Howel, 1995). The field period of this study coincided with seasons of reasonable rainfall, although a drought was being manifest by the end of the period. Thus this study could not look in detail how irrigation is reconfigured as water supplies reduce. In addition, I explored the importance of non-farm activities in generating better levels of income and food provisioning as compared with agriculture. Chapter 5 showed that over 50 percent of the farmers in the study villages had leased out their irrigable plots to sharecroppers and thus local people's food self-provisioning strategies were examined to identify the relative importance of irrigated agriculture in the making of their livelihoods.

The chapter is organised into five sections. The second section gives an overview of the 1984/85 drought and famine situation in the Tigray region, and repertoires of coping strategies vis-à-vis drought and famine deployed by local people. The situation of food deficits and food aid in Hintalo Wajirat *Woreda* (district) is presented in section three. The fourth section discusses local people's livelihood strategies in Gum Selassa and Hewane. The conclusion

summarises the critical forces shaping coping strategies and which livelihood sectors are proving most critical to survival.

6.2 The 1984/85 Drought and Famine: the problem

Drought and famine are often caused by the failure of the long rains (*meher)*. Examining rainfall data from 1961-85 (Webb et al. 1992), the worst year was 1984. Rainfall fluctuation has been a common phenomenon in the region. The 1984/85 drought and famine affected close to 20 percent of the Ethiopian population. The most affected regions were Wollo and Tigray. In Tigray, close to 1.5 million people were afflicted (Caldwell, 1992).

The southern zone of Tigray in general and Hintalo Wajirat Woreda in particular is the most affected area for food deficits. Elders reported that severe drought and famines have taken place in 1943-45, 1957, 1973-74 and 1984/85. The 1984/85 drought and famine was severe in terms of human life and livestock loss. Local people who did not have food reserves and /or money were the most affected. I was told that 932 victims of famine, who had no relatives to carry out their funeral services, were buried with the support of the police in Adigudom town. Hyenas also ate children and old people[1].

Perception of the drought among Hewane and Gum Selassa farmers appears to be remarkably similar. The major characteristic of drought as perceived by the majority of informants (90 percent) is inadequate rainfall to undertake crop cultivation during the *meher* season. Inability to provide sufficient food for households, shortage of drinking water, lack of water and food for animals are considered to be the extreme conditions of a drought and famine. As to the cause of drought in their region, over half of the informants mentioned that 'God is unhappy with us and that is why we do not get rain on time'.

Famine in memory

The following account of one family illustrates the 1984/85 drought and famine situation and the local responses in Hintalo Wajirat Woreda. The story told concerns Luele Hiluf's family, which went to Ofela resettlement in southwest Ethiopia during the Derg government.

> Luele Hiluf, 27, was born in Mai Woine *kushet* (village) which is one hour on foot from Hewane. He is a supervisor in the Hewane nursery, and has neither irrigable nor rainfed land.
>
> The Derg government announced in October 1984 that drought-affected people should go to the resettlement areas established by the government. At that time Luele's family was living in Mai Woine village which had been under the control of the Tigray People's Liberation Front (TPLF) since 1978. TPLF

provided no food relief in Mai Woine. Luele's parents sold their two oxen, two cows and a donkey to purchase food for some months for the family. In the month of December 1984 his family decided to go to Mekelle feeding center where they could get food relief. They did not disclose their decision because of possible intimidation by the TPLF if they opted for resettlement.

The trip to Ofela Resettlement

Luele's parents together with six children travelled on foot for seven hours to reach Adigudom town located 35 km south of Mekelle. Among his siblings there were children aged five and seven. After they had stayed one night in Adigudom they informed the Woreda Administration that they were willing to go to the resettlement area. The officials told them that they would go within a week. Luele's parents did not trust what they were told and feared that they would not go within a short time. However, they moved to Mekelle on the following day. The government did not provide them a vehicle and the family had to travel 11 hours on foot to arrive there. In Mekelle, they had to search for the feeding center. Later they found the registration place for resettlers in a church called Ada Michale. Immediately after registration, they received eight cans of wheat. They had to buy firewood and borrow a frying pan to toast the wheat for their meal. The following day the resettlers were taken to Zebandahero feeding center, 10 km from Mekelle. After staying at the center for 8 days they were taken to Addis by air. Among the resettlers, ill people were given medicine. The same day they traveled by bus to the resettlement area. The following day they arrived at Jimma feeding centre where they were given bread with soup. Finally they went to the Ofela settlement by truck which took them 8 hrs. In Ofela the Woreda administrator received them and ordered the peasant association leaders to handle the new settlers.

Life in Ofela resettlement

In Ofela, Luele's family received temporary shelter in a hut with a grass roof, which they shared with six other people. After two months, his family was given a house with about half a hectare of kitchen garden. The settlers were given *Kocho*[2] (local bread) and maize. When they had finished the maize, they had to start eating *Kocho,* which they had never eaten before. As a result, many people fell ill and about 50 people died. Settlers reported to the cadres that they couldn't eat *Kocho*. Finally 8 kgs of wheat flour was rationed for one person every month for one year, and sugar and lentils were rationed on a six-month basis.

Luele's parents received two oxen, a plough, household utensils and clothes from the local government. They started farming by clearing two hectares of bush, in which maize was planted. In the kitchen garden, they planted peppers, sugar cane, banana and coffee, which was sufficient for household consumption. The peppers were partly marketed. The settlers received a good harvest and so his parents bought three cows.

In 1985, the children of the settlers had to travel three hours to attend school. The following year the government opened an elementary school in Ofla attended by 1200 children. Settlers were provided with a health service at the neighbouring peasant association. Settlers were on good terms with local people. Luele said, 'the chairman of the peasant association gave me a hen to show his love for the settlers. In a few years, I had 30 hens and I sold them and bought a sheep. I started rearing sheep and I then had five sheep. I have observed that local people were interested to live on good terms with the settlers while the settlers were not that much interested. Local people would invite passers-by to drink tela (local beer). There were some settler women who married and stayed on in Ofla. Kafa and Manga are the two ethnic groups in Ofla. The Kafas are Christians'.

Back to Tigray

The grandfather of Luele wrote a letter to his son saying that Tigray is in peace and there is no drought. So on January 1992, Luele's parents decided to go back to Tigray, assuming that the situation had improved. They had to return their house and oxen on loan to the local government. Then having sold their cows, sheep and grain, they took the bus back to Tigray.

Luele's father had had 1.5 ha rainfed land in Mai Woine before he went to Ofla settlement. Thus when he returned to Mai Woine he requested land from the chairman of the t*abia*. At the beginning the response was negative since he had arrived back after land redistribution in the region had been completed. Luele's family was sad about this circumstance. Later the tabia chairman and the Woreda administration discussed the problem and made available 0.75 of *mekakelegna* (average quality) and 0.25 of *woferfam* (good quality) land to Luele's family. They then bought two oxen and went back to living in their old house. Luele explained that what they harvested in Mai Woine was about only a quarter of the Ofla harvest. The harvest his family now gets is insufficient for the whole year. Family members work on dam construction for 3 kgs of wheat per person per day. My father and mother regret their decision to abandon the Ofla resettlement'. Luele estimated that about half of the settlers did not return to their homes'.

The above case illustrates social disruption to families and how the civil war waged in Tigray made food aid distribution difficult. Migration to food relief centers was the last means for famine victims to get access to food. It also shows the resettlement programs that formed the official response to drought and famine. Returnees had difficulty in maintaining themselves since access to land in Tigray was limited and wage labor remained as one of food-provisioning strategies for returnees.

Repertoires of coping strategies with drought and famine: household responses in 1984/85

Household heads were asked to identify the coping strategies they used to overcome the chronic food shortage during the 1984/85 drought and famine in Gum Selassa and Hewane. In both *tabias,* households used food relief as the best way of coping.

Table 6.1 Coping Strategies Deployed by Households in Gum Selassa and Hewane During the 1984/85 Drought and Famine

Coping strategies	Gum Selassa (N=30)		Hewane (N=30)	
	*%HH	Rank	%HH	Rank
Reductive Strategy				
• reduction in variety of foods consumed	80	2	87	2
• cut meal size and number	50	3	83	3
• postponement of special functions (marriage, festivals)	83	8	53	5
Depleting strategy				
• sell of cattle	53	7	50	6
• sale of personal effects (jewellery, hand weapons, household goods, implements)	57	5	53	5
• sale of housing for firewood and building material	33	13	10	15
• use of reserve seeds	67	4	47	7
• use past cash savings	27	14	20	14
Maintaining strategy				
• collection of wild foods	50	8	30	11
• barter exchange with neighbours and relatives	33	13	36	9
• borrowing food from merchants	37	12	33	10
• purchase foodstuff on credit from traders	27	14	40	8
• obtain credit from money lenders	33	13	47	7
• migration of the entire household in search of relief	43	10	27	12
• remittance received from children/relatives	40	11	27	12
• food relief provided by the government/NGO	90	1	93	1
Regenerative strategy				
• change of cropping strategies	16	16	20	14
• sharecropping	20	15	23	13
• work as casual labourer within village	50	8	53	5
• work as casual labourer outside village	46	9	63	4
• engage in petty trade	56	6	53	5

*%HH= percentage of households

Table 6.1 summarises these strategies into four key groups: reductive, depleting, maintaining and regenerative strategies (Howel, 1995). As defined and used here, the reductive strategy is that characterized by curtailing food intake in terms of the size and number of meals at household level. The depleting strategy refers the process by which households gradually use up their financial and material resources. The maintaining strategy keeps the household at a given level of existence. The regenerative strategy refers to the creation anew, of an improved state.

Multiple responses were obtained since households deployed a combination of two or more strategies to cope with the famine. The rank orders for the two sites were computed on basis of the percentage of households adopting them, thus showing the relative importance of each coping strategy.

Maintaining strategy

Although the war between the former government and the TPLF affected the distribution of food relief provided by government, non-government organizations and the TPLF in the Tigray region, local people both in Hewane and Gum Selassa depended upon it.

Over 90 percent of the interviewed household heads indicated the provision of food relief as their first means of coping. In addition, households borrowed food or money from neighbors, relatives, friends or moneylenders to try to secure a basic livelihood. In Gum Selassa half of the households, and about one-third in Hewane had attempted to use wild plants such as *hamashro, tamie, hangulita, shlaale gomon and senafich gommon,* which they do not normally eat, by cooking them with salt.

Such reciprocal activities and strategies such as borrowing food from merchants, purchasing foodstuff on credit from traders, obtaining credit from money lenders and receiving remittances from children/relatives, lost their viability as the food crisis deepened as an increasingly large numbers of villagers became affected.

Migration was one of the coping strategies deployed to sustain their lives. Hendrie (1997: 117) reports that 'from the early 1980s (…) drought-induced famine began to (…) force many households—in some cases whole villages—to abandon their homes and begin migrations in search of food and/or wage-labour to buy food. In each successive year, from 1981 to 1985 the size of internal migrations escalated, such that by 1985, some 500,000 people were on the move inside the region'. During the 1984 famine many people from Hintalo Wajirat *Woreda* migrated to the feeding centre established in Mekelle. Over one-third of the informants from Gum Selassa and Hewane migrated with their family members out of their villages in search of food. Few were able to return

to their homes and many died at the food relief centres. Others were taken to the south and south west of Ethiopia for re-settlement.

Reductive strategy
A reductive strategy was the second main coping strategy adopted by households in both Hewane and Gum Selassa. It ranged from reducing the variety and quality of food consumed to postponement of special functions such as weddings. In rural households, domestic chores remain the tasks of women and grown up girls. The management of household grain consumption and preparation of food is regarded as a woman's responsibility. Women usually estimate the available food stock and calculate how long it will maintain the family. In both *tabias* over 80 percent of the interviewed informants indicated that they had reduced the amount and variety of foods consumed.

Depleting strategy
Households drew upon their productive and capital assets to purchase food as the famine worsened. In Gum Selassa 67%, and in Hewane 47% of the households consumed the seed reserved for the coming season when their entire food stocks were exhausted. Since a large majority of the farmers were subsistence farmers, only 20% in Hewane and 27% in Gum Selassa were able to use past cash savings to purchase food. Half of the informants in both *tabias* sold their livestock. Luele's family, for instance, struggled to survive for some months by selling their two oxen, two cows and a donkey in order to purchase food. At times of drought, significant numbers of farmers are forced to sell their livestock, for two reasons. First they can use the money to purchase food and secondly because of the lack of animal feed, particularly as pasturelands become parched. Unfortunately, as more cattle come onto the market prices fall and farmers usually sell their cattle at a very low price. One elderly informant said 'I bought a cow for US $ 1.50 from a respected older man so as eat to meat'. In October 2002, I went to the Adigudom livestock market to observe the effect of the shortfall of rain in the *meher* season (from June to September) in 2002 on cattle prices. The price of an ox had slumped from about US $ 140 to 60. I was told 'since we are expecting crop failure in the coming harvest due to the shortage of rain in the last *meher* season, we are forced to sell our livestock at a very low price. However, as you see few people are interested in buying our oxen or sheep'.

Regenerative strategy
Local people sought to expand their resource base by diversifying economic activities to include petty-trade and renting out their labor. Informants became

involved in casual labor both within and outside their village in order to earn income for their families. In Gum Selassa, informants rated such strategies as 7 and 8, while in Hewane they are 4 and 5 but in both cases labour migration coupled with petty trade contributed to the survival of some villagers during the 1984/85 drought.

6.3 Food Aid in Hintalo Wajirat *Woreda*

Food for Work Program

Resettlements together with emergency relief were the major responses of the Derg government to the famine of 1984-85. The government food relief distribution in Tigray during the war between TPLF and the Derg government was limited to the districts under the control of the central government. After the 1984-85 famine the Derg resettled more than half a million settlers from Wello, Tigray and Shewa to Wellega, Kafa and Illubabor. The Relief Society of Tigray (REST) and the Drought Commission established by TPLF were engaged in the distribution of food relief in the areas under the control of TPLF (Hendrie 1997).

Shortage of food in the Hintalo Wajirat Woreda is a chronic problem. A 2001 study indicated that over fifty percent of the households in Hintalo Wajirat *Woreda* had food deficits.

Table 6.2 Household Crop Harvests Correlated with Calculated Food Deficits

Woreda	Land holdings per household (ha)	Output per hectare (qt)	Average crop yield per household (qt)	Actual grain requirement per household (qt)	Food deficit/ household in	
					Qt	%
Amba Alaje	0.61	8.4	5.12	8.93	3.81	42.6
Enderta	0.83	6.4	5.31	10.27	4.96	48.3
Hintalo Wajirat	0.61	8.3	5.06	10.32	5.26	50.9
Seharti Samre	0.95	9.0	8.55	9.43	0.88	9.3
Zone average	0.75	8.03	6.02	8.94	2.92	32.6

Source: Farming Systems, Resource Management and Household Coping Strategies in Northern Ethiopia, 2001: 26

Considering the actual grain requirement per household per year (10.32 quintals) vis-a-vis the average production per household in Hintalo Wajirat

Woreda (5.06 quintals), there is a shortage of 5.26 quintals. In other words, only about 50 percent of the household grain requirement is met. A report on the integrated food security project (ibid.: 30-31) showed that 'the 1998 Woreda agriculture office assessment indicated that 20% of households have been found to have food that lasts for less than 1-2 months and 44% of the households have food for 3-4 months. Only 8% of the Woreda's households have been able to produce enough to that last for more than 7 months'.

Government and humanitarian organizations have been involved in food aid for a long time in Hintalo Wajirat *Woreda.* On average each year, over 40 thousand people, i.e., 30% *Woreda*'s population, have been provided with food relief since 1998.

Table 6.3 Recipients of Food Aid in Hintalo Wajirat *Woreda*

Year	No Recipients	Amount of Food Distributed in Quintal
1998	45415	45415*
1999	42000	42000
2000	33300	33300
2001	49100	49100
2002	34900[3]	34900

*1 quintal = 100 kg
Source: Tigray Disaster Prevention and Preparedness Commission

Food aid is distributed from April to October. Each person receives 12.5-kg wheat/maize/sorghum and 500-gram edible oil per month. Male food recipients constitute about 49 percent and female 51 percent. Adigudom, Hewane and Ara Alemsegeda are among the *tabias* in Hintalo Wajirat Woreda that receive food aid.

Table 6.4 Recipients of Food Aid by *Tabia*

Year	Hewane	Ara Alemsegeda	Adigudom
2000	2430	1710	2818
2001	2200	1100	2840

Source: Hintalo Wajirat Woreda Administration

In 2001, seven *tabias* in the Woreda faced crop failure. The *tabias* of Bahere tesba, Adi Mesno, Hewane, Ara Alemsegeda and Mai Neberi were identified as those most severely affected by the drought. The crop obtained in these *tabias* barely supported the local people for 2-3 months.

Food Security Program

In 2002, the regional government launched a European Economic Commission (EEU) and FAO funded food security program in four *tabias* of Hintalo Wajirat Woreda, and it was planned to increase the number of *tabias* to eight by 2003. The objective of the program is to increase the incomes of food insecure farmers by engaging them in various income-generating agricultural activities

The participants of the program are those who have food reserves for three months only and who are willing to carry out cattle fattening, poultry, bee keeping and/or dairying with the support of loans from the government**.** Farmers can obtain loans to purchase oxen, sheep, goats, cows, modern beehives and hens at an interest rate of 12.5%. The amount of credit ranges from US $1.20 for a hen to US $153 for a dairy cow. The loan is paid at the end of loan period, which is from 2 to 5 years depending on the type of credit taken. The purchasing is carried out by a committee composed of the chairman of the service co-operative, the treasurer, finance officer, *tabia* chairman and development agent. The farmer is not allowed to do the purchasing him/herself but should inform the purchasing committee two days before the type of animal he wishes to buy. The committee will then accompany the farmer to the market to purchase the animal chosen and will pay the merchant the agreed price.

Initially, some 1600 farmers in the four *tabias* showed interest in participating in the food security program. Later after the Agriculture Department workers had provided orientation sessions, 415 farmers registered. Of the registered farmers, 64 withdrew after daylong meetings with the food security committee because they could not accept the purchase arrangements designed by the Agriculture Department. In addition, three farmers were dropped by their *tabia* screening committee because they do not reside permanently in their *tabia*. Table 6.6 gives the final listing for the four *tabias*

Table 6.5 Participants of Food Security Program by *Tabia*

Name of *Tabia*	Planned Households	Participating Households
Ara Alemsegeda	100	70
Dejen	100	128
Adi Key	100	58
Fiker Alem	100	92
Total	400	348

Source: Hintalo Wajrat *Woreda* Agriculture Department

The reason for the drop in numbers from 1600 to 348 was as suggested earlier, primarily because many farmers were simply not interested in the purchasing

arrangement. The majority of them wished to do the purchasing themselves. The Agriculture Department set-up the arrangements as they did to avoid credit diversions. But what guarantee was there that the farmer would not simply agree with the merchant to have the money reimbursed after the committee had made its payment? The purchasing was to be carried out in the months of June and July 2002. Although, it is difficult to evaluate such a program in its early stage, so far the coverage has been limited since farmers show a lack of interest in these purchasing arrangements.Farmers involved in cattle fattening use the grazing land of their *tabias*. In addition, the Agriculture Department plans to distribute improved forage seeds, and to make available forage trees and legumes for the animals.

6.4 Livelihood Strategies in Gum Selassa and Hewane

Most households in both Hewane and Gum Selassa attempt to build flexibility into their basic livelihood pattern. Engaging in multiple activities is an important way and helps to reduce risk and uncertainty. Farming is the single most important occupation in both Gum Selassa and Hewane on which all the households depend for their living. Resource-poor farmers have designed different strategies for accessing oxen for ploughing, for instance, borrowing friends' or relative's oxen; selling crop residues to hire oxen or ploughing a neighbours' plot free of charge in return for using their oxen. Women and old people rent out their plots to sharecroppers.

Table 6.6 Farm and Non-farm Activities of Informants in Gum Selassa and Hewane

Activity	Gum Selassa	Hewane
	(N=30) Percentage	(N=30) Percentage
Farming	100	100
Unskilled wage labour	33	40
Selling animals	27	10
Selling fuel wood	7	26
Selling grain	3	13
Hair dressing and (embroidery)	3	7
Masonry	3	7
Butchery	3	--
Renting house	6	10
Selling *tela*	23	20
Retail shop	7	3
Tailor	-	3

Informants gave the various non-farm activities carried out to maintain their livelihoods. In Gum Selassa over one third and in Hewane 40 percent of the informants had engaged in unskilled wage labour in food-for-work projects such as dam construction, road maintenance, soil and water conservation, and had carried out agricultural work involving ploughing, weeding or harvesting. The third big income generating activity for the informants in both communities is the sale of *tela* (local beer) which is left for women exclusively (see Table 6.6 above).

In both *tabias* the main non-agricultural activities focused around unskilled wage labour and petty, trade including activities such as flour mill worker, retailer of small merchandise, grain retailer and tailor. Both men and women are involved in trade, but there is some division of labour: Men are engaged in selling cattle, and sheep or goats at the weekly market whereas women are the principal vendors of eggs, hens, grain, handcrafts and wood fuel. Trade in these articles is time consuming, if not tedious, as I witnessed for myself at the Hewane and Adigudom markets.

A study conducted in four *woredas* of the southern zone of Tigray also indicated that in Hintalo Wajirat woreda about 70 percent of the households did not engage in trading such as selling crops or livestock to supplement their agricultural incomes. For those involved in non-farm activities the top five major income sources were sale of crops[4] (62.6 %), daily laboring (32.2 %) and selling *tela* (local beer) (26.9 %), sale of livestock (22.9%) and petty trading of craft goods (13%). Remittances amounted to 8.7 % (REST, 2001: 32).

Livelihood trajectories

Three of the following illustrations concern individual livelihood trajectories highlighting how local people survive under precarious environment in the study *tabias*.

Abreha Ashber

> Abreha Ashber, aged 45, comes from a farming family in Hagre Selam, 7 km from the district town, Adigudom. He migrated to Adigudom with his parents in 1973 during the severe drought that hit the northern part of Ethiopia including Tigray. Abreha was 15 years old when his parents decided to leave Hagre Selam to obtain food for their family. His father died in 1995.
>
> Abreha's parents rented a house in 1973 and have lived there since. Abreah was the eldest son, aged 15, who decided to support his parents. He discussed with a shop owner who came from Hagre Selam his interest in selling sugar, coffee and needles if he could give him products on credit. The shop owner agreed. So Abreha began bartering sugar, coffee and needles for eggs and grain. He sold the eggs in

Adigudom to pay back the shop owner in cash. This enabled him to obtain a small amount of profit and his family consumed the bartered grain. His mother also sold peppers that were bought from Mekelle by her husband. In addition, Abreha and his father worked in soil and water conservation works, receiving 4-kg of wheat or barley.

In 1977, Abreha started work in a flourmill: his relative had asked the owner to employ him. He was paid 5-6 kg of flour from people using the milling service. His family consumed the flour. But after three years he stopped the work due to a disagreement with the mill owner. Later he worked with a salt merchant helping to tie up salt bars. After working for a year he managed to purchase a second-hand sewing machine, and set-up as a tailor which remains one of his occupations today. In addition, he owns a small retail shop in the town.

Abreha has successfully combined non-agricultural activities with farming. He joined the Gum Selassa irrigation system after his 0.75 ha plot was incorporated into the irrigation command area in 1996. In return, he received 0.2 ha irrigable land. His plot has received water since 1996. He also possesses two oxen. Abreha hires laborers to cultivate his plot, and is sometimes involved in its irrigation. About the 2002 harvest he explained:

> *I planted onions and the harvest came to three quintals. The harvest was low compared to previous years, which yielded 8-10 quintals, since the crop was affected by disease. I made an effort to apply pesticide, which I bought from the Agriculture Department. Unfortunately, the pesticide had expired and did not help me. The development agent brought another that was effective, but it was too late since the onion crop was already damaged. Then I tried to sell the three-quintals of onions at the market. The price was very low. I decided to store it at home hoping that the price would increase in the future. But it started rotting and I was forced to sell it for 11.75 US $. I had spent 5.88 US$ on the pesticides. If you consider other expenses, then I lost a lot of money this year.*

The woman cultivator...

Nigesti Araya

Nigesti Araya, aged 36, was born in Hewane. She has six brothers and two sisters. Only two of her brothers have attended school. Her parents were rich, and they gave 20 head of cattle as *gezmi* (dowry) when she was married at the age of 12 to a farmer.

Nigesti's family was severely affected by the 1984/85 drought and famine.
They were forced to eat just one meal a day. Nigesti employed various household food deficit coping mechanisms including collecting wheat flour food relief from the Adigudom distribution centre. In addition, she purchased flour from aid recipients at a lower price and resold it. In addition, she made baskets to sell in

local markets. She spun cotton to make cloth for the family, and while she struggled to feed her family, her husband travelled to collect food aid from Adigudom, some 20 kms from Hewane.

Later, in 1989, her marriage ended in divorce. This was precipitated when her husband sold all the cattle and leased out the family plots to a sharecropper. The divorce was concluded with a court decision since her husband was not willing to share the house with Nigesti. She received one room and a 0.25 ha irrigable plot. Nigesti took upon herself the raising of her four children, without any assistance from their father, although he did ask to take two of them.

Nigisti started cultivating her irrigable plot using hired labour. Because she has one ox, she involved in *lifinti,* an arrangement between farmers to team up oxen for ploughing. Her children, particularly the oldest son and daughter, participate in weeding and crushing soil and supervising the labourers after school. When her children are at school she supervises the employed labourers herself. When the rainy season comes she plants *teff* and wheat. In the irrigated plot she plants maize, tomato and cabbage. From the sale of these she obtains 80-90 US $. She received 400-kg of wheat or 200 kg *teff* from the rainy season harvest, which will be consumed by the family.

She also sells local beer to support her family. Nigisti managed to save 2.35 US $ each week through membership of *equb* (a saving group) which enabled her to construct two additional rooms. Although the oldest son has never attended school because his father wanted help with ploughing and other farming activities, her other children attend school. Nigisti owns one ox, two cows, two calves and one bull.

Nigisti actively follows the advice of development agents with a view to improving agricultural production. She is member of the women association. She participates in religious associations, namely Abune Aregawe, St. Mary and Selasse. She prepares the feast of St. Mary's day every six months.

Her children are well fed and clothed. They have their own bedroom. On the other hand the ex-husband has leased out his irrigable plot to a sharecropper. He works as a guard in Co-SAERT's dam construction project. I asked Nigesti whether her husband was jealous of her good life. She retorted 'he is envious of my success'.

The labourer…

Berhanu Gesesse (age 57)

Local people who live in the nearby villages come to Hewane for various purposes such as marketing, for work and to visit relatives. I met Brehanu Gesesse who came from Dejen *tabia* to look for a job in Hewane. Berhanu has four children. He is separated from his wife because he was not able to pay for the treatment costs

when his wife fell ill. Finally, his wife claimed two of the children saying that she had 'to go to holy water to save my life'. Berhanu left the other two children with a farmer to serve as shepherds where they could receive food and shelter in addition to a small income.

Berhanu and his wife have one hectare of rainfed land. Berhanu hoes half of the plot located on steep slopes, and in the plain ploughs two days for a farmer with oxen in order to use the oxen for a day to plough his own land.

Berhanu said Dejen *tabia* is frequently affected by drought. The majority of the local people migrate to Adishu, Wajirat and Hewane to look for employment to supplement their income. In 2000, for instance, he applied fertiliser, which he bought on credit. The harvest was poor and Berhanu had nothing to sell to pay back the loan. Hence he worked as a labourer in Hewane to earn money. I asked Berhanu why he was not working at the dam construction site. He said this was because no one would give him dinner there as he came without his wife. He said, 'those who come with their wives can work at the dam'. When he works in Hewane as a labourer on individuals' plots, he is provided with shelter and food. Berhanu also sometimes returns to his village to carry out agricultural activities.

Farming as future occupation

Informants were asked about their children's education and occupations. The majority send school-age children to school. 50% of such children in Gum Selassa and 70% in Hewane attend school (see Table 6.7).

Table 6.7 Education/Occupation of Informants' Children in Hewane and Gum Selassa

Occupation	Hewane (N=30)	Percentage	Gum Selassa (N=30)	Percentage
Student	15	50	21	70
Government/NGO	5	17	2	7
employee	4	13	2	7
Militia/soldier	5	17	3	10
Farmer	4	13	4	13
Shepherd	14	47	17	57
Not attending school	6	20	5	17
Illiterate	3	10	2	7

Over 80% of the informants were dissatisfied with the current agricultural situation, and saw no promising future in agriculture. Regarding alternatives to agriculture, one informant said 'we have no option, except to toil here'. The main reasons for this lack of prospects include recurrent drought, lack of

capital, shortage of labor, land scarcity, and low productivity. And the high price of various agricultural inputs account for their low use.

A notable attitudinal change towards work in agriculture has been observed in recent years. The changes are largely directed to educating children. While parents still practice farming as their main occupation, they now invest in the education of their children. It is considered to be the way out of farming as an occupation.

I talked to a teacher of Hewane primary school about students' participation in education, who said:

> *We have 1150 students on the school roll. Girls constitute 48 percent of the student population. The dropout rate is about one percent. About 30 percent of the students do not regularly attend their classes. They say that their parents need them to help in farming and other domestic activities'. These days children whose fathers have gone to the war front are expected to handle the farming activities. On the other hand, parents advise their children to pursue education saying 'you should learn if you do not want to be a farmer like me'. But in practice, they urge them to help during school hours by saying 'first fill your stomach'. The teacher said, 'parents do not follow up the academic performance of their child. When they are called for consultation they get angry by saying 'I came from my work'. The whole picture shows that agricultural labour shortages forces parents to use the labour of their children. Nevertheless, parents do not want their children to continue in farming.*

6.5 Conclusion

The chapter has discussed the different coping strategies practiced widely during severe food shortages and had indicated other food provisioning and livelihood strategies that exist apart from farming.

Local people employed four main types of coping strategy during the famine of 1984/85. Households ranked food relief provided by the government or NGOs as the first and most important strategy for maintaining the life of family members. As the food crisis worsened many people perished. Social networks and kin groups could not provide much assistance to victims of famine since all were struggling to survive. The gravity of the situation was noted when the Adigudom police took responsibility for carrying out burial services for the drought victims because either kin has died or neighbours were incapacitated. The following couplets again indicate the situation:

> Mr. Seventy-Seven, [5]
> Your soul will be damned unto eternity.
> For you have severed the mother from her child,
> And kin from kin! (Fekade, 1998: 212)

Loaded with reeds, here comes a donkey!

Burying the dead these days, is a rare event to be[6] (ibid.:194)

Local people expressed through poems why they were not sharing the pains of others by saying:

I swapped my mother for a *taba*[7] of beans,
I swapped my daughter for a *taba* of beans,
I swapped my wife for a *taba* of beans,
In order to fill my belly,
Thinking the bad days will not pass. (ibid.: 81)

On that evil year
Let not my mother come to visit me,
Let not my father come,
Let not my uncle come,
One Berr[8] worth of beans is not enough for supper. (ibid.:57)

The above two couplets show that even immediate family members were not able to help one another, which runs against Ethiopian tradition. In many parts of rural Ethiopia, kindness in welcoming guests or strangers by inviting them to coffee or milk is a common practice.

Dependence on food relief as the first strategy to cope with drought induced famine shows the extent to which households were vulnerable. The Tigray region has been hit by recurrent drought for many years, and this has a negative impact on agricultural production. As a result, households have no food reserves to fall back on at such times. Moreover, as Pottier (1999: 143) comments 'famines indeed come mostly at the 'tail end of a long-term process of increasing vulnerability… to food supply shocks'. Dagnew (1995) clearly indicates that famine stricken households deciding to migrate could only survive with the availability of food relief.

Food relief was followed by reducing food consumption as a strategy to cope with the drought and famine that affected villages of Tigray. Farmers knew that famine would occur if the expected rains failed. Some reductive strategies were adopted before the food crisis occurred, while others followed later. Women in particular play an important role in organizing any reductive strategy since household food management is often left to them. A study conducted in the Southern Zone of Tigray has indicated that most households cope with food deficits by reducing the number of meals and the quality of food (REST, 2001) and it is a commonly observed in other parts of Ethiopia. For example, Dessalegn (1991) reports that this was common in the 1984/85 famine in Wollo.

Resorting to selling farm implements and livestock affects post-famine farming activities. Fekade (1998) collected Amharic poems composed by local

people about the 1984/85 drought and famine that took place in most parts of Ethiopia including northern Shawa, central Ethiopia. The translated poems convey the drought and famine experiences in a vivid and imaginative way.

> Let us not mention this Seventy-Seven,
> I parted with my pregnant cow,
> For a mere two-day's lunch. (Fekade, 1998: 50)
> Having sold my *mofar* (a ploughshare)
> Having sold my *qanbar* (a yoke)
> As I am negotiating [prices for] my children
> *Baherwa*[9] came to the rescue,
> Wearing sandals. (ibid.: 72-74)
>
> Having sold all my cattle,
> I was negotiating the selling price of my kids,
> When the Red Cross arrived,
> Rolling on huge tyres. (ibid.: 201)

Resettlement of the drought affected people of Tigray in south and southwest Ethiopia was the principal official response to the 1984-85 drought and famine. State-sponsored population resettlement schemes grew in importance in the early 1960s in Ethiopia. During the Derg regime thousands of people were resettled in south and Southwest Ethiopia. The Derge government claimed that this program was voluntary: 'the resettlement programme which the Government of Ethiopia has been encouraging was not imposed upon the peasants but has grown from the people's own instinct for survival. The need to move to more congenial lands and better pastures was felt by villagers themselves who gathered their possessions and made the long trek away from the drought-prone areas- long before any formal movement of people had been instituted' (RRC, 1985: 239). Yet, though the resettlement was intended to be voluntary and a large proportion of settlers were famine victims, targets were turned into quotas, food aid was used as a trap, and coercion and victimisation became commonplace.

The Relief and Rehabilitation Commission reported that 'their movement away from the arid northern regions was utterly disorganised, however. The families in search of better fields had only a vague idea of where exactly they were heading, they didn't know how long they would be on the move. They were literally risking their lives by leaving the barren terraces, which brought only a harvest of hunger, for the unknown world filled with hopes of a better life. Many did in fact fall ill on the way and die' (RRC: ibid). Ex-settlers who came back to their villages after the TPLF 1990's land redistribution faced problems getting land. Many of the landless adults in Hewane, for instance, are returnees.

War was one the factors which deepened the famine crisis. The war between the TPLF and the then central govern affected food relief distribution. Luele's family, for instance, was not able to obtain food relief and so they decided to participate in the government sponsored settlement scheme. The TPLF criticised the settlement program on two grounds. First, local people were forced to move to the settlement areas with out their consent. Second, it was considered as a means to depopulate the area so that the TPLF armed struggle would lose ground.

The data presented in this chapter and at various earlier points in the analysis indicate that the Hintalo Wajirat Woreda (district) is still food insecure and over 30 percent of the population still receive food aid. Gum Selassa and Hewane *tabias* are located in the same agro-ecological zone. Farming has been and still remains the main source of livelihood. Except for those in the two irrigation systems, the farmers depend entirely on rainfed agriculture.

The top-down food security program aimed at increasing the incomes of food insecure households by engaging farmers in various agricultural activities had major drawbacks. Initially 1600 farmers showed interest in the four *tabias* of the program, but only 22 percent of the farmers were able to take out credit. The Department of Agriculture did not trust that farmers to use the money for the purpose intended and the farmers did not like their purchasing arrangements.

A few farmers, like Abreha, and women like Nigesti, manage to combine farming and non-farming activities in Gum Selassa and Hewane *tabias.* Abreha's story illustrates how agricultural production is constrained by institutional factors such as extension services and the market. However, the large majority of local people are not involved in non-farm activities, not because they have not the hours to do so - a point strongly underlined in a study conducted on off-farm employment in Enderta and Adigudom (Ara Asegeda and Fekrealem tabias included) in Hintalo Wajirat *Woreda* – but because, as 66% of them indicate, there is no off farm employment in their district (Woldenhanna and Oskam, 2001: 355).

In sum, then, food relief is the most important strategy at times of severe food shortage and is often needed by some families in less insecure times. Although the majority of the informants did not see a promising future in agriculture, farming occupation remains the major source of livelihoods in rural Tigray.

Notes

1 Interview with the ex-police chief of Hintalo Wajirat Woreda.
2 Kocho is a staple food in the south and south-west Ethiopia.
3 According to Tigray Disaster Prevention and Preparedness Commission, the number of food aid recipients was 48000. However due to shortage of food supply only 34900 received it.
4 Small merchants involved in grain retailing
5 According to Ethiopian calendar, Seventy-Seven corresponds to 1984/85.
6 Those that are alive had no energy to bury the dead.
7 A small earthen ware container used for measuring grain.
8 The Berr (usually written Birr) is the Ethiopian currency, which is valued at about 8.56 US $.
9 'Baherwa is the name given to the American woman who brought emergency food to Rasa. The woman symbolized the generous distribution of food, oil and milk by the NGO in question.

7

Wielding and Yielding in 'Participatory Development': The arena of coercive persuasion?[1]

7.1 Introduction

'Participation' has become the dominant ideology in rural development programs to counter 'top-down' technocratic approaches that see local people largely as passive recipients of development intervention (Chambers, 1983; Cooke and Kothari 2001). Moreover, as Cernea (1985:10) points out, even where participation is considered as central to rural development programs, it 'is more myth than reality'.

This chapter looks at the arena of coercive persuasion[2] pertaining to the diffusion of fertiliser technology in the context of the growing vogue for 'Participatory Demonstration and Training Extension System (PADETES) in Hewane and Gum Selassa irrigation systems. The use of chemical fertiliser has been widely promoted in rural Tigray. Despite skepticism and resistance from farmers, its aggressive promotion by extension workers and local government officials has contributed to farmers distancing themselves from cultivating irrigable plots, which is manifested in the leasing out of plots to sharecroppers (see chapter 5). But by 2002, after eight years of promoting the use of chemical fertilizer, the regional government rescinded its policy of coercive persuasion. This led in 2002 to a significant drop in the number of irrigators (by 55 percent) and rainfed farmers (by 69 percent) purchasing fertilizers.

The second section of the chapter briefly presents the aims and implementation strategy of Participatory Demonstration and Training Extension System (PADETES). Enforcing the purchasing of chemical fertiliser is discussed in section three, and section four examines why farmers are not willing to purchase fertiliser. Sections five and six discuss how local people yield to the wielders of 'participatory development' and 'participation' in labour-intensive public work programs. Section seven examines the provision of credit and the debt trap that farmers encounter. The conclusion pinpoints key role of bureaucratic actors and arenas shaping agricultural practices and livelihoods in the two irrigated areas.

7.2 Participatory Demonstration and Training Extension System (PADETES)

The Agricultural Development-Led Industrialisation (ADLI) is the dominant development strategy adopted by the government of Ethiopia. To complement this, in 1994/1995, a national agricultural extension scheme (the Participatory Demonstration and Training Extension System, PADETES) was established, which combines technology transfer and human resource development. One of its objectives is to 'empower' farmers to participate actively in the development process. Farmer participation thus constitutes an important element in demonstrations[3] to be carried out in their fields.

In Tigray, the Bureau of Agriculture and Natural Resources (BoANR) provides extension services for the entire region. These services focus on the adoption of new farming techniques such as the use of chemical fertiliser and improved seeds, irrigation, soil and water conservation, poultry, bee-keeping, cattle breeding, home economics and animal disease control.

Provision of agricultural extension is planned at region, zone, *and woreda* and *tabia* levels. Targets are set for each *tabia* based on cultivable land size and population. The *tabia* agriculture office is responsible for implementing the annual plan at local level. The office is composed of a supervisor and development agents (DAs). Development agents are responsible for 'convincing' farmers to make use of agricultural extension services. The *tabia* agriculture office works closely with the *tabia* administration, *ersha cadre* (agricultural cadres), and agenage *gebere* (contact farmers) who are elected by farmers. The *ersha cadres* teach farmers about the application of chemical fertiliser, the importance of improved seeds and new techniques of farming. Under each e*rsha cadre* there are *agenagne gebere* (contact farmers) who act as go-betweens to groups of 10 –20 farmers. Each *agenagne gebere* communicates to farmers what has been decided by the agriculture office. In addition, he registers the farmers who should purchase chemical fertiliser each year, working with the idea of a model *gebere* (model farmer) who is 'fast' to adopt the new techniques and as a result achieves a much increased harvest. Hence the *model gebere* is instrumental for the demonstration of the importance of extension services. The *agenagne gebere and ersha cadres provide* a free service.

At Hintalo Wajirat *Woreda* (district) level, the number of cultivated plots applying chemical fertiliser has increased in leaps and bounds, i.e. from 60 to 2840 hectares in six years, as shown in Table 7.1 below. Close to ten percent of the cultivated land used chemical fertiliser for the season 2000/01.

Table 7.1 Chemical Fertiliser Application (1995-2001) in Hintalo Wajirat *Woreda*

Year	Cultivated Plots in hectares	Percentage of cultivated Plots /total cultivated land in the *woreda*	No. of farmers using chemical fertiliser	Percentage of farmers /Household heads in *woreda*
1995/96	60	0.2	120	0.3
1996/97	676.25	2.4	1596	4.5
1997/98	2008.875	7	5440	15.25
1998/99	2038.75	7.14	5876	16.5
1999/00	2544.25	8.29	7448	20.9
2000/01	2840.625	9.9	8246	23.1

Source: *Woreda* Hintalo Wajirat Ab Godana Lemat (1988-1992[4]) p.3

At *woreda* level, the chemical fertiliser applied in 1995/96 consisted of 60 quintals of DAP and 60 quintals of UREA. By 2000/01 the fertiliser applied had increased to 1690 quintals of DAP and 1455 quintals of UREA. In the *woreda*, 23 percent of the farmers used chemical fertiliser.

7.3 Enforcing the Sales of Chemical Fertiliser: Imposing Technology?

Purchasing fertiliser

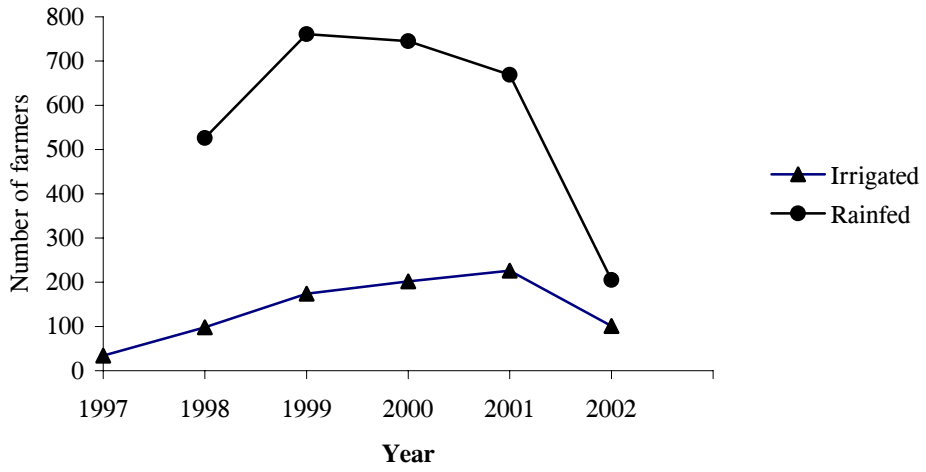
Before the introduction of PADETES, six 'model' farmers who cultivated *hayfo* land in Hewane showed interest in participating in the 'Global'[5] demonstration exercise in 1992. The model farmers were assumed to be influential in the *tabia*. Each 'model' farmer received 75 kg of improved wheat seed and 50 kg of DAP fertiliser. The harvest was impressive, with a maximum of 10 quintals of wheat per half a hectare. My research assistant, for instance, harvested 7 quintals of wheat from a half-hectare plot. Farmers from different villages were invited to witness the increased yields obtained with fertiliser application. Surprised local people asked many questions. The development agent and the model farmers gave detailed explanations on how they achieved such good harvests using chemical fertiliser and improved seeds. Later, the agriculture department asked the six 'model' farmers to convince other farmers to use chemical fertiliser and improved seeds in the following agricultural season. Accordingly, the model farmers managed to persuade about 100 farmers to purchase fertiliser and improved seeds.

In Hewane, the Participatory Demonstration[6] and Training Extension System (PADETS) became operational in 1996/97. Every year the *tabia* agriculture office holds a meeting with *ersha cadre* (agricultural cadres) and *agenagne gebere* to inform them of the planned target set for each *kushet* with regard to the sale of chemical fertiliser to farmers. Between December and February a group of people composed of the *kushet ternafe* (farmer in charge of a

village), the *gote ternafe* (farmer in charge of a hamlet) and the *ersha cadre* conduct a survey of individual plots (*melemla tinat*) and calculate the amount of fertiliser that should be applied to each plot. After the *melemla tinat* is completed, each *kushet* will send a list of farmers who have 'agreed' and signed to purchase fertiliser to the *tabia* agriculture office. The *tabia* agriculture office then sends this list to the *Woreda* Agriculture Department which checks this against the proposed target set for the *tabia* level. If the proposed target is less than the target, the *tabia* is ordered to re-examine the proposed plan. The *tabia* agriculture office gives an order to the DA and *ersha cadre* to convince those farmers who had shown no interest in purchasing fertiliser to meet the planned target. Farmers who object to or complain about the use of fertiliser inform the *kushet ternafe*. The *kushet ternafe* reports farmers' objections in writing to the *tabia ternafe* and Development Agent. On the basis of the report, the DA, *tabia ternafe* and *kushet ternafe* will make visits to plots to verify the farmers' objections or complaints.

At the start, the size of plots applied with chemical fertiliser in Hewane was small because farmers were uncertain about the contribution of fertiliser to improving soil fertility (Figure 7.1). In the following year, farmers were not interested in purchasing fertiliser because the technical recommendation of fertiliser application was proved wrong.

Figure 7.1 Number of Farmers Who Purchased Fertiliser in Hewane *Tabia*



Source: Hewane Agriculture Office

Farmers were advised to apply UREA and DAP simultaneously, which resulted in the parching of the crop due to shortage of water. Later the agriculture office started advising farmers to apply DAP first, when the seed was sown, and UREA at a later stage when the crop was growing. In 2000, the fertiliser application was lower since there was a shortage of water in the *tabia*.

The application of fertiliser in the Gum Selassa irrigation system started in 1996/97. Farmers were under an obligation to use fertiliser in order, according to the agriculture department, to increase the productivity of 'nutrient depleted' soil. In October 2000, I attended a meeting[7] of water users in the Gum Selassa irrigation system from Adigudom *tabia*. The head of economic development of Adigudom *tabia* chaired the meeting in the presence of the chairman of the water users association and the DA of Gum Selassa. The purpose of the meeting was to inform farmers to purchase chemical fertiliser and improved seeds on credit by forming *gujeles* (groups) and electing an *abo mai* (a father of water).

When the meeting started farmers told the chairman that there was no quorum (50 percent plus) because only 42 out of 170 irrigators were present. The chairman, without asking how many of the them were sharecroppers, replied, 'we can continue the meeting since some of the irrigators now in attendance have additional plots through *woferit* (sharecropping), which will raise the number of plot holders to about 120'. No one opposed this. The meeting continued. Farmers raised several issues including the late delivery of improved seeds and fertiliser, which gave rise to shortening of planting and harvesting time, with consequent damage to crops and crop residue in the long rains. Farmers also opposed the idea of forming *gujele* (groups) to purchase fertiliser and improved seeds on credit because of the joint liability and time spent looking for farmers to form a *gujele.* Farmers interested in taking a loan from the Dedebit Saving and Credit Institution had to establish *gujele* (see section 7.7 for in depth discussion). The farmers strongly demanded that they be allowed to take loans individually. But in the end the meeting finished with farmers being asked to form *gujeles* and elect *abo mai* if they wanted to purchase fertiliser on credit.

When questioned about how they had decided to purchase fertiliser each year, it became apparent that over two-thirds of them before 2002 had purchased chemical fertilizer through coercive persuasion.

Table 7.2 Farmers' Decisions to Purchase Chemical Fertiliser in Hewane and Gum Selassa Irrigation Systems before 2002

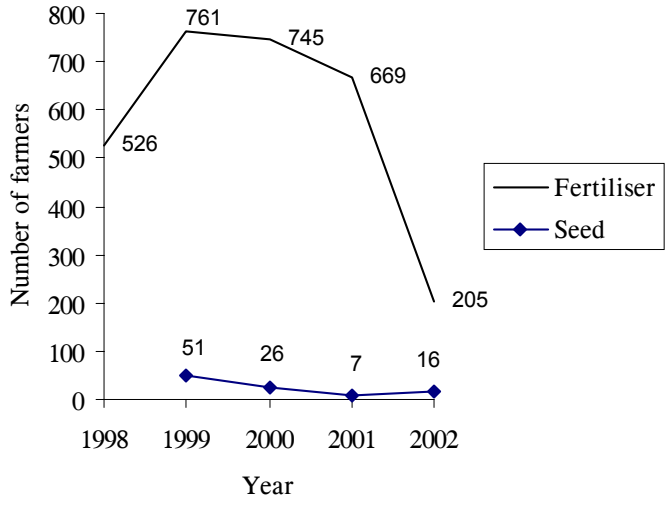
Type of decision	Hewane (N=30)	Gum Selassa (N=30)
Voluntarily	33.3	26.7
Coercively persuaded	66.7	73.3

Many farmers are not willing to apply fertiliser although it is available to them. The Gum Selassa DA, for example, noted:

> *Among the 394 farmers, about 30 percent of them purchase fertiliser voluntarily. On the other hand, about 70 percent of the farmers purchase fertiliser because we intimidate them by saying 'you will not get dam water', though we actually do not do this. The main reason why a farmer is not willing to purchase fertiliser is its high price. Many farmers prefer to lease out their irrigable plots so as not to purchase fertiliser. Plot holders say 'let the sharecropper buy the fertiliser'.*

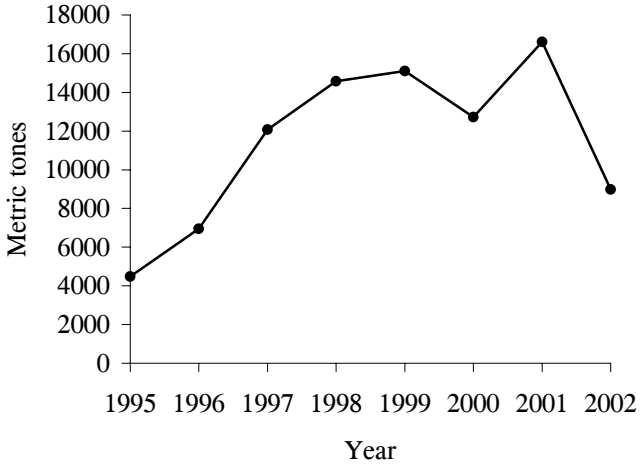
A marked difference is noted if we compare the number of farmers who purchased chemical fertiliser with the number of farmers who purchased improved wheat seed in Hewane (Figure 7.2). In half a decade, close to 10 quintals of improved wheat seed was sown on 31.5 ha. As indicated in Figure 7.2, unlike fertiliser, the number of farmers who purchase improved wheat seeds has dropped and remains very low,[8] since farmers have not been coerced into buying them. There was no sanction against a farmer who refused to purchase improved seeds.

Figure 7.2 Farmers Who Purchased Fertiliser and Improved Wheat Seed in Hewane (1998-2002)



Source: Source: Hewane Agriculture Office

Figure 7.3 Fertiliser Sales in Tigray (1995-2002)



Source: Raymakers (2002:5).

While between 2001 and 2002 fertiliser sales dropped by 46 percent in Tigray (Figure 7.3), the decrease in Hewane was as much as 69% (Figure 7.2). This sharp decline was mainly due to the decision of the Tigray regional government to end its coercive practice.

Wielders of 'participatory development'

The Agriculture Department and development agents (DAs)

The W*oreda* Agriculture Department is engaged in the guidance and supervision of extension services within the *woreda*. Periodically, each *tabia* must submit a progress report and an evaluation is carried out in the presence of development agents. For instance, in June 2001, a two-day meeting of the DAs of 19 *tabia*s of Hintalo Wajirat *Woreda* was held at the *Woreda* Agriculture Department to evaluate the sales of fertiliser. There were only three *tabias* that fulfilled their quota for fertiliser sales. Among the *tabias*, 16 including Hewane were criticised since they did not achieve the target for 2001. The DAs were told to work harder and fulfil the quota assigned to each *tabia* urgently.

Development agents (DAs) are frontline workers in day-to-day contact with farmers. Among the interviewed farmers, 57 percent expressed the view that development agents give adequate advice in respect to new farming techniques. Many, for instance, said that sowing in lines was practised once the

development agents had convinced them of its advantages. And the farmers themselves had noticed yield increases when compared with the traditional way sowing. Conversely, it was emphasised that, faced with strong resistance from farmers (as with the issue of chemical fertiliser), then development agents would apply measures of coercive persuasion.

Araya Teka, my interpreter, who resigned as a DA after eight years of service with Hintalo Wajirat *Woreda* Agriculture Department, explained as follows:

> *If I am assigned to convince 300 farmers to buy fertiliser and I only manage to recruit 200, then the* Woreda *Agriculture Department will consider me an incompetent DA. This will be followed by criticism, a warning and I may even be refused training opportunities or promotion. In addition, if I apply for transfer to another* tabia *or* Woreda *I will not be allowed.*
>
> *My strategy for convincing unwilling farmers is first to contact the elders and tell them of the importance of fertiliser so that they can convince others. I visit places where I might find people such as the* tebel *(religious association),* equb *(savings group) and church. If I urge a farmer to purchase fertiliser, he will say 'let me sell my grain' or 'let me get a loan from a rich man' or 'wait for me until I bring salt bars which I intend to sell ', all indirect reasons for saying he will not buy the fertiliser. They do not want to displease me or they are afraid that I will report the situation to officials.*
>
> *Each* kushet *(village) in a* tabia *is ranked in terms of the number of farmers who have purchased fertiliser. A* kushet *that does not meet the target will be criticised and ordered to convince the farmers who were not willing to purchase fertiliser. The DA and* ersha cadre *will make maximum effort to 'convince' farmers. Then, after all these efforts, if the target is not achieved, officials from the* Woreda *Administration, Agriculture Department and the TPLF representative will come and hold a meeting with the agriculture cadre,* tabia *officials and development agent to investigate why the planned target is not achieved. At the meeting DAs are accused of failing to 'convince' farmers. Then the officials will call a farmers meeting. At the meeting, the officials read names of those farmers who are not willing to purchase fertiliser. And each farmer will be asked why he is not willing. If the officials, after listening to the farmers' reasons, are not satisfied, they will label the unwilling farmers as 'obstacles to development'. A strict warning is given not to repeat the 'same mistake' in the future.*
>
> *Farmers can say we will not buy fertiliser, but they may in the end purchase some because of the feeling that they will lose out on some opportunities such as employment in construction work, credit, or food aid. But some farmers, after purchasing the fertiliser, will sell it to others at a cheaper price. Even officials do not believe in it. They generally accept it since they are afraid of demotion or being purged from the Party.*

Araya went on to say:

> *Some DAs employ different strategies to convince farmers. A DA may ask people whom he knows well to buy fertiliser, saying that 'if you do not buy fertiliser I will be in trouble with*

> *the officials'. And some farmers may buy to help him out. Such farmers may complain to the DA after they have purchased the fertiliser, saying 'we are in debt because of you. Why don't you help us by paying half of the credit?' Others may look for a person who can easily convince farmers. It is sometimes believed that wives can convince their husbands. For instance, a DA once tried to convince a farmer to buy fertiliser by going early in the morning to the farmer's house but after several attempts, he did not succeed. Then one day he had the idea that he should first try to convince the wife so that she would convince her husband? He spoke to the woman and she agreed to ask her husband. So she told her husband and he replied 'after nagging me is he now going to nag you? I tell you do not put me into a debt I do not know about. Do not trigger trouble'. The following day the DA went to the farmer's house to know the response. While he was talking to the woman, the husband came out of his house and said 'why don't you behave, why are you talking to a married woman in the absence of her husband?' The DA replied: 'I came here to convince you to buy fertiliser and not for other things'. The DA was shocked and dropped this idea of convincing the farmer.*

In this way, development agents (DAs) are forced to pursue different strategies - including coercive persuasion - to achieve fertilizer sales targets.

The Tabia Administration

Let us now focus on Hewane *tabia* to illustrate how the TPLF and the local administration enforce the sales of fertiliser at grassroots level since the practice is almost uniform in the district. The *tabia,* together with the workers of the *tabia* agriculture office, oversees the achievement of targets set by the *Woreda* Agriculture Department. Encouraging farmers to apply chemical fertiliser on demonstration plots is one of the most important activities undertaken by the *tabia* administration.

The chairman of Hewane *tabia*, an ex-combatant who joined TPLF in 1980, has been in office since 1995. He had been chairman of the local tribunal and farmers' association in the former TPLF controlled areas. He described to me the *tabia* administration is involved in the enforcement of fertiliser sales. His account concurs with many of the points made by Araya (see above):

> *In the first place, development agents do not know exactly which demonstration plots need fertiliser. They simply speculate that someone's plot needs fertiliser. On the other hand, a farmer can resist the purchase of chemical fertiliser by saying that 'after I applied fertiliser, I had a poor harvest', 'my crop can get parched when there is shortage of water', and 'since we can't afford the price of fertiliser let the government give it to us freely'. In addition, farmers who would like to plant teff say that although* teff *can grow faster if we apply fertiliser, it can be attacked by kubi (a type of plant disease). If fertiliser is not used, then the* teff *will grow slowly without being much attacked by kubi.*
>
> *The agricultural extension services guideline stipulates that farmers should be convinced before adopting new ideas aimed at improving agricultural productivity. Thus, farmers should be convinced to purchase fertiliser. The effort to convince farmers is carried out by*

> *agenagne gebre and ersha cadre. If they fail to convince farmers, then they will report to the tabia DA the names of those farmers who refused to purchase fertiliser. Then the tabia DA will talk to these farmers to see he can change their minds. The DA will also pass the list of farmers who are not interested in applying chemical fertiliser to the tabia chairman. The tabia chairman will call and ask the farmers why they are not willing. After listening to their complaints, if the farmers have a convincing point, I would give an order to the DA to visit the plot for further information. If the complaining farmers have no good reason not to purchase fertiliser, they will be forced willy-nilly to do the purchasing. The government is committed to helping people overcome poverty. To this end, we urge farmers to adopt new techniques of farming and agricultural inputs. We insist on particular farmers purchasing chemical fertiliser.*

The DA of Hewane further corroborates this use of coercive measures:

> *In 2001, the* tabia *agriculture office sent out a list of 61 farmers (27 % of the planned target) unwilling to purchase fertiliser to the* tabia *administration. Among them 7 farmers appealed for plot inspection to see whether fertiliser was needed. The* tabia *chairman called the farmers and we had a meeting with them. At the meeting the farmers tried to explain their reasons, but despite their complaints, they were forced to purchase the fertiliser.*

A woman, who told how she was forced to pay an advance of 61 birr for the purchase of fertiliser in the absence of her husband, provides another case of enforcement:

> *My husband has an irrigable plot in Hewane. After he signed to purchase fertiliser in 1999, he went to Mekelle for medical treatment. One evening, people from the* tabia *agriculture office came with militiamen to our house. They asked me for my husband and I told them that he had gone to Mekelle for medical reasons. Then they asked me to pay an advance of 61 birr to purchase fertiliser. I told them that I did not have any idea about what they were asking for. 'You better ask my husband when he returns from Mekelle'. They said 'there is no difference between you and your husband, you should pay the money. If you don't pay, we will report this to the* tabia *administration'. I told them that I couldn't leave my house in the evening. 'If you want the money here is the 61 birr'. So they collected the money without taking me.*

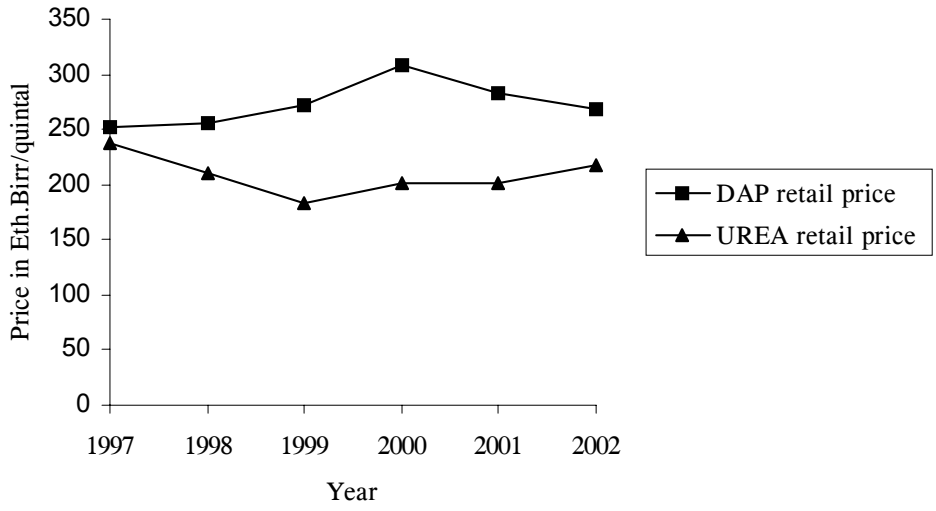
7.4 Coping with Uncertainties?

The adoption of new agricultural technology at household level is a function of access to resources and perceived benefits. Farmers consider several factors, including price, labour and time required, yield anticipated and availability of water, before using new agricultural inputs such as fertiliser or improved seeds. In the *tabias* studied, farmers purchased various inputs with a full appreciation of their positive impact on agricultural productivity. The main explanations given by the majority of farmers in Hewane and Gum Selassa for not purchasing fertiliser were its high price, the depressed crop market prices, the shortage of water, and the difficulty in paying back agricultural loans.

The price of fertiliser

The price of fertiliser has been one of its major impeding factors in rural Tigray. Raymakers (2002: 4-5) reports that farmers were not motivated to purchase fertilizer because they had difficulties in repaying the debt incurred due to low cereal prices. While the price for DAP had decreased by 5 %, that of UREA had increased by 7.6 %. In addition, the erratic and insufficient rains discourage them from using fertilizer.

Figure 7.4 Retail Price of Fertiliser in ETB/quintal in Tigray Region (1997-2002)



Source: Raymakers (2002)

A survey (see Table 7.3 below) conducted in 2001 in four w*oreda*s of the southern zone of Tigray indicated that 39 percent of respondents did not use chemical fertilizer and/or improved seeds due to the high cost.

Table 7.3 Distribution of Households by Major Reasons for not using Improved seed and/or Fertiliser in the Surveyed *Woredas*

Woreda	Proportion of Households by Reason			
	High cost	Not available	Other reasons	Total
Amba Alaje	32.9	12.9	54.2	100
Enderta	57.9	7.5	34.6	100
Hintalo Wajirat	37.1	12.9	50.0	100
Seharti Samre	24.1	22.4	53.5	100
Average	39.0	13.7	47.3	100

Source: REST (2001:34)

In Hentalo Wajirat, 37 percent of the households were not able to purchase either improved seed and or fertilizer because of the high cost. Other reasons include unwillingness and lack of water.

Depressed grain market prices, the difficulty of paying back loans and unreliable water sources

Available credit schemes require the repayment of loans during harvesting time. This forces farmers to sell their harvested stocks immediately when prices are often very low. Farmers who have experienced the struggle to repay back their loans for agricultural inputs are usually not willing any longer to risk and commit themselves to a dangerous financial venture in the future. The following case illustrates how one such farmer became a loser in 2002.

> *Aleka Minas is a sharecropper who leased in 0.2 ha irrigable land in Gum Selassa. In 2002, he planted onions and harvested 7 quintals. According to the sharecropping agreement, he collected 4.66 quintals of onions. Aleka Minas sold the onions for about US $ 19, but the total cost for the purchase of onion seed, fertiliser, pesticides and hiring labour was US $ 60. Excluding other cultivation costs including ox ploughing and his own labour, he lost over US $ 40. In other words, the farmer sold close to three quintals of onions to repay back the US $ 12.11 loan taken for the purchase of 37.2 kg of DAP and UREA fertiliser.*

Pressure to repay credit for farm inputs, then, induces asset depletion. Indeed in many cases, this struggle to repay their debts compels them to sell part of their assets, household items, livestock or oxen (for further discussion see below).

Another critical problem that farmers face is that they are not certain about the availability of river water or rain once they have applied chemical fertiliser. In fact, a number of farmers in Hewane experienced shortage of water after fertiliser application, which resulted in the parching of crops (see chapter 3). Rainfed farmers are of course also vulnerable to shortage of water when the rains fail and so are equally reluctant to apply fertiliser.

7.5 Yielding to Wielders of 'Participatory Development'

In rural Tigray, it might be said that farmers are accustomed to having to yield to the actions of heavy-handed State government bureaucracy. Yet can they not find a way around it, like other 'subordinated' people do in similar circumstances? Why do farmers purchase fertiliser under coercive persuasion? The following saying sheds light on why local people do not openly and violently confront the government and TPLF.

> *'kab hagerya zenwhat meselese wey leafe wey lewonchief' (Tigrigna)*
>
> *'The tallest sorghum in the field is either exposed to birds or a sling'*

As the tallest sorghum is exposed to birds or sling, a person who opposes the purchase of fertiliser is also vulnerable to ill treatment by local officials. Thus, many farmers are forced or wittingly convinced of the sense of opting to purchase the fertiliser; since by doing so they avoid bigger problems. My research assistant who had previously served as a DA explained this position:

> *Farmers purchase chemical fertiliser for the following reasons: a) they are convinced of the importance of fertiliser in improving soil nutrients; b) they fear that they will not get credit, food aid or employment opportunities in various construction works such as dams; c) they feel "*newodebna keyntelm*", meaning "we shouldn't betray TPLF that brought peace and development to us". Thus, by doing so they think that they are showing their support for the political party; and d) we (DAs) also tell farmers that it is Woreda's order.*

In Hewane, some farmers who purchased fertiliser without being much convinced of the validity for doing so, later resold it a cheaper price, thus suffering a financial loss. In 2000, some 81 farmers purchased fertiliser from private sources and not through the government credit scheme. Since the government price was higher, farmers were interested in purchasing from farmers who did not want to use their fertiliser. As Table 7.4 below shows, farmers who engaged in reselling fertiliser lost up to 60 percent of the original price.

Table 7.4 Price of Fertiliser in Eth. Birr in Hewane in 2000

Type of fertiliser	Government	Private	Price difference in percent
DAP 50 kg	148.62	60.00	59.6
UREA 50 kg	96.00	50.00	47.9

7.6 'Participation' in Labour-intensive Public Works Programs

Coercing farmers to in participate in public works is widely practiced in rural Tigray under the discourse of 'community participation'. In this section, I discuss the participation of local people in the construction of micro dams in Hewane.

Co-SAERT and local people constructed three micro dams called Shelenat 1, 3 and 4 in Hewane with a command area of about 289 hectares. The construction work took over five years to complete. River water is diverted to the dams during the *keremt* (wet) season using the Shelenat diversion weir located 4 kms north of Hewane. The local authorities report that the 'Shelenat dams were constructed with the participation of the Hewane people'. The

mobilization of local people for such public work is undertaken by the *tabia* administration. The Hewane *tabia* chairman described how local people 'participated' in the construction of Shelenat dam:

> *First, we explained about the importance of the dams to the local people. In addition, we informed them that they had to contribute labour to accomplish the project. Both men and women agreed and started the work. The mobilisation of labour was facilitated through 156* gujeles *(groups). Each* gujele *had 20 persons and a leader. A* gujele *records the names of those people who do not show up for work, assigns pieces of work for those that do and facilitates payment and evaluation of performance.*
>
> *The people were obliged to work from Monday to Friday. Thursday is not obligatory because it is market day. The tasks they are set normally require working from 8.30 am to 2.00 p.m., but if the assigned work is not finished then the* gujele *is obliged to carry on until 5 p.m. Those who do not come to the construction work without being exempted will appear in* maheberawe ferdbet *(social court). Persons found guilty are penalised with a fine of between 20 and 50 birr by the court. The people who do not participate in the construction work do so because they give priority to their personal work'.*

Women's 'participation' in public works

Tigray's Women's Association is also involved in mobilizing its members for the construction of micro dams in the region. The organizational structure of the association reaches down to *kushet* (village) level. The association encourages women to engage in income-generating activities such as commerce, pottery production, cattle rearing and poultry, by providing credit. It also participated in raising funds for the army deployed in the war between Ethiopia and Eritrea. The association provides short-term training for women's committees which co-ordinate women at *tabia* and village level around gender issues and women's participation in development. The association claims that it is independent of politics, government administration and religion.

The Hintalo Wajirat *Woreda* Women's Association is part of the Tigray Women's Association[9]. In the *Woreda* there are 19 *tabia* women's associations with a total of 18,200 members. Hewane *tabia* women's association[10] has 1041 members drawn from four *kushets* (villages) The chairperson commented, 'all women should be members of the association. For instance, in Hewane *kushet* all women above the age of 15 are members except 150 who are old, sick and blind'.

On becoming a member of the women's association, one is issued with a membership card. In Hewane, inhabitants do not have residential identity cards, and therefore being a card-carrying member of the women's association serves this purpose. And many informants noted that it is for this reason that they have joined the association.

I met two young married women in their twenties at an informant's house. They are members of the *kushet* women's association. They pay a three birr annual membership fee. I asked them why they had become members of the association. They did not exactly know why they joined, but they had the feeling that the annual contribution they made was meant for development activities. I asked them about the role of the association in safeguarding women's rights. They said:

> *It is decided that men and women are equal and that the rights of women should be observed. Yet, despite such a decision there are very few women who come out openly to defend their rights when they are violated.*

Photo 7.1 Women carrying bags of soil at Shelenat dam construction site

The Chairperson noted that *tabia* women participate in various development activities through membership of their association:

> *Women, for instance, participated in the construction of Shelenat dams for two years. We organised the* tabia *women into* gujele *(groups) to participate in the construction. Each gujele (group) had 20 women. At* tabia *level, 22 groups were organised. Each* gujele *had a leader, who controlled the work done by each woman. Women were involved in digging and carrying stone and soil on their backs. Some women had donkeys to transport stone and soil. They were obliged to work Monday to Friday, though they had the option not to work on Thursdays since this is market day. Every Friday the work performance of* gujele *members was evaluated. Women who were absent without good reason had to appear at the*

> gujele *meeting for evaluation. She would be asked 'why did you not appear at work while we were slogging? Which woman is not carrying soil?' A person who wants to do her own work should first accomplish the work assigned by* gujele*. 'Private work comes after development'.*

The chairperson expressed the view that the situation of women is now better than in the past, although their problems are not fully solved. Women are not elected to serve as *Abo mai* (father of water) in the irrigation system because it is difficult for them to supervise water distribution during night time. And, in general, women are not willing traditionally to participate in such activities.

7.7 Providing Credit Service and the Debt Trap

The objective of this sub-section is not to make judgements concerning the efficacy of the work of the Dedebit Credit and Saving Institution (DESCI). Rather I attempt to shed some light upon the unintended effects of credit and the debt trap. I focus on loans granted to purchase oxen, the largest type of loan given to the customers of DESCI.

Group based credit

Influenced by the experience of Grameen Bank of Bangladesh, DESCI grants group-based joint liability loans to borrowers organised in *gujele* (groups). Borrowers who form *gujele* are jointly liable for each other's loans. The structure of a *gujele* (group) is determined by the regulations and procedures imposed by DESCI. Borrowers must organise themselves into self-selected *gujeles* of 5 to 7 people, but *gujele* members cannot be husband and wife or brothers and sisters. In addition, men and women are placed in different *gujeles*. All *gujele* members must be from the same village. Seven *gujele* form a centre with a chairman and vice-chairman. The importance of the centre is to bring the many groups under central control and to serve as a forum for borrowers to share their experiences. Hewane DESCI, for instance, provides services to 47 centres established in four *tabia*s.

DESCI provides orientation on credit objectives and regulations to borrowers organised in *gujeles*. Farmers can obtain a loan within one or two weeks. All borrowers must agree to accept the approved loan.

Depending on the type of loan issued, repayments can be made every week up to only once in the year. Defaulters on a loan have to pay one percent interest every month. And, in the case of loans for the purchase of fertiliser, the interest rate increases by one percent every month if defaulted for more than eight months.

Table 7.5 Number of Loans Disbursed, Amount of Loan Disbursed and Repaid in Year 2001 and Cumulative, as of Dec.31, 2001

	During the year 2001			Cumulative		
	Male	Female	Total	Male	Female	Total
All branches						
No. of loan disbursed	53703	33403	87106	301629	213714	515343
Amount of loan disbursed	71724460.84	38765080.00	110489540.84	361447346.74	209020608.47	570467955.21
Amount of loan repaid	65141970.76	39577529.40	104719500.16	285514100.42	172532243.02	458046343.44

Source: DESCI (2002:16)

Farmers take agricultural credit to purchase oxen, fertiliser, improved seeds and pesticides. Other clients of DESCI include small traders engaged in retail businesses. Loan priority is given to poor farmers who are oxenless. Loan amounts range from 50 to 2500 birr. Loan repayment schedules vary depending on the type of loan issued. Loans to purchase oxen, for instance, should be paid in two instalments, every six months[11]. The normal rate of interest of 18 percent must be paid every six months, though for commercial loans it is 15 percent per annum.

Although DESCI's policy favors female borrowers, male clients make up about 60 percent. The cumulative loans reached an average loan repayment rate of 80 percent up to 2001 financial year when it rose to 94.7 percent.

Loan repayment

A high performance rate in credit disbursement recovery is often taken as one of the indicators of a successful credit institution. As indicated in Table 7.6, compared to other regions, Tigray has the highest credit recovery performance.

Table 7.6 Agriculture Input Credit Disbursements Recovery Performances in Percentage

Region	1997	1998	1999	2000	2001	2002
Oromiya	84.5%	86.8%	83.8%	91.2%	75.6%	NA
Amhara	96.2%	93.8%	95.5%	89.1%	75.2%	NA
Tigray	92.3%	90.7%	99.2%	99.6%	88.1%	NA
SNNPRS	79.4%	82.9%	70%	53.8%	73.3%	NA

Source: Raymakers (2002:9)

Although Tigray has a remarkable loan repayment rate at regional level, farmers complain about the loans provided by DESCI. One major source of complaint is the *megojele* (grouping) system, which imposes collective responsibility on group members who are expected to pay back defaulter's shares. Many customers are therefore more willing to take a loan individually than to participate in the group scheme. Moreover, farmers found it difficult and time consuming to recruit creditworthy borrowers to their groups.

The loan repayment schedule coincides with harvesting time, which, as I described earlier, usually forces farmers to sell their products at a low price. Farmers also sell oxen to repay their loan because the income received from the crop sales is not normally sufficient to settle the debt. Borrowers expressed their complaints about DESCI's credit in the following short statements:

> '*Maret amertuna*'
> 'Maret buried me'
>
> ' *Marete*[12] *Marete kiremt nech teff bega eser bete*'
>
> 'Marete Marete winter is like white *teff*
> Summer is my lock-up.

These sayings illustrate that borrowers who obtain loans in winter consider the loan as analogous to eating white *teff enjera* (local bread). White *teff* is a type of grain of high quality, which fetches a higher price. Hence, borrowers should make loan repayments in the summer, which is often difficult for many of them. The *tabia* administration pressurises defaulters to pay back the loan by saying 'if you do not pay the loan you will end up in prison'.

Credit field officers of the Adigudom DECSI branch office reported the following complaints from borrowers:

> *Borrowers are not interested in taking credit by forming* gujeles (*groups) because of the risks with joint liability. While the loan repayment time set by DESCI is short, they are forced to sell their crops immediately after harvest which normally fetches a low price. During droughts the loan repayment time should be extended because of crop failure. The increase of the interest rate from 12.5 to 18 % has affected their ability to pay back loans. The decision made by DESCI that borrowers who took loans for the purchase of oxen should pay in two instalments rather than once in a year has forced many farmers to sell their oxen in order to pay back the loan.*

The credit field officers are in close contact with borrowers and know how borrowers settle their debts. The officers estimated that 20 % of the borrowers pay cash from their own pockets; 40% pay by selling their property or oxen; and

40 % pay by taking loans from individuals. If the latter are local moneylenders then the interest charged per month will amount to 5 to 10% interest per month.

'*Room for manoeuvre': credit diversions*

A large majority of borrowers take loans to purchase oxen. The sub-branch managers of the credit institutions reported that over 95 percent of their borrowers who took loans to purchase oxen in the preceding year also took loans in the following year. Customers prefer this arrangement because, unlike others, the sum is paid once in a year and a new one can immediately be re-negotiated. Secondly, the amount of loan is the biggest at a maximum of 2500 birr. Thirdly, customers who acquire a loan to purchase oxen can utilise it in three ways: to fully purchase the oxen, to part-fund the purchase of oxen, leaving the remainder for other uses, or to divert totally the loan for other purposes such as constructing a house, spending on food and drinks, paying off other debts, and starting small trading enterprises including cattle fattening and grain buying and selling.

Table 7.7 Loans Issued by Dedebit Credit and Saving Institution to Adigudom Farmers to Purchase Oxen

Year	No. of borrowers	Amount in birr
1997	--[13]*	--
1998	492	519650
1999	373	822810
2000	977	1627550
2001	1491	4153710

Source: Adigudom Dedebit Credit and Saving Institution

Credit field workers estimated that about 25 % of the borrowers of DESCI divert their loans into expenditure other than the original stated purpose. The following case illustrates how one such a borrower diverts his loan.

> *Woldu Habtu, 48, who completed Grade Four schooling, is an irrigator in Hewane. He has five children. Woldu took a loan of 1000 birr from DESCI to purchase an ox in 1998. However, he did not use the loan for this purpose since he in fact already possessed his own oxen. Instead, he used the money to buy corrugated iron sheets for his new house. Woldu has not been able to pay back the loan from the harvest he collects. He pays back the loan by borrowing money from a local moneylender, at 10 percent per month interest. Then to pay back the loan to the moneylender he takes another loan from DESCI claiming that he will purchase an ox. So Woldu pays 100 birr to DESCI and 144 birr to the moneylender, making a total of 244 birr in interest to both lenders. In other words, he is trapped in a circuit of debt and is paying exorbitant interest rates.*

DESCI introduced a new loan repayment schedule for loans taken for the purchase of oxen in 2002. Borrowers are obliged to pay back their loan in two instalments, i.e., every six months, which has created widespread discontentment among borrowers. I met six representatives of *gujeles* (groups) at Hewane DESCI office who had arrived to vent their dissatisfaction with the arrangement. The representatives explained:

> *All of us have borrowed money to purchase oxen. We came here to appeal since we are requested to pay the loan in two instalments. We have not yet harvested. In addition, even if we wanted to sell our oxen, the price of an ox has gone down due to the looming drought in our district.*

Customers of DESCI usually pay back their loans by selling their oxen at a low price, losing up to 40 percent of the original price. As mentioned above borrowers often cover the deficit by taking loans from a local moneylender, though farmers indicate that loans are difficult in the middle of the year. I asked them why? They reported that 'moneylenders say that at this time of the year you are not creditworthy, but had it been at the end of the year, you could have paid back our money by taking a loan from DESCI'.

In October 2002 I had a long interview with the general manager of DESCI at the headquarters in Mekelle about the operations of the institution. I asked him why they had recently raised the interest rate and he replied 'the institution has to cover its overhead costs and should make some profit'. He also mentioned that 'borrowers who have taken a loan for one year should pay in two instalments in order to tackle the risk of loan defaulting[14].

7.8 Conclusion

Participatory Demonstration and Training Extension System (PADETES)

Fertiliser application, which forms part of a package inputs promoted by PADETES in Hintalo Wajirat *Woreda*, has been impressive since, within six years, 10 percent of all cultivated land uses chemical fertiliser. However, as the Tigray case demonstrates, the practice of agricultural extension still remains based on a diffusionist model of development. Characteristically the model is linear and linked to introduced modern technologies and organisation. Linked to this is the idea of achieving planned targets through the coercive persuasion of farmers. This was made the major concern of extensionists, credit officers and local government officials. The Agriculture Department, lacking the necessary technical capacity, recommends fertiliser application on demonstration plots which is 'a one-size fit-all' solution. Despite farmer's resistance, the DAs and intermediaries (*ersha* cadre and *agenagne gebere)* were preoccupied with fulfilling fertiliser sales quotas set for each *kushet*.

A June 2001 meeting held in the W*oreda* Agriculture Department to evaluate the sales of fertiliser indicated that 84 percent of the *tabias* were not able to meet the planned sales of fertiliser. Development agents are government employees who are tied to sets of official duties and are part of a larger bureaucratic system. The immediate concern of a development agent is to placate superior officers, who are usually located in the *woreda* or regional bureau, at some distance from the contact agent. They are rated and promoted by distant, technically oriented supervisors on the basis of their annual performance. Hence development agents are in an ambivalent position: on one hand they have to carry out their assignment, and on the other, farmers are not willing to use fertiliser. They find it difficult to communicate undifferentiated blanket recommendations to farmers, thus making no concessions to their varied economic capacities. A group of experts clearly indicated the problem with the implementation of PADETES:

> *'Gaps between participatory ideals and realities have been noted in many countries. But Ethiopia faces particular challenges. A donor-influenced participatory agenda exists in the context of historically hierarchical relations both between government and farmers and within government. In addition, technical and resource constraints are great' (University of Sussex MARENA Briefings ET 15).*

In Hewane and Gum Selassa, over two-thirds of the farmers purchased fertiliser through coercive persuasion. Although farmers were aware of the importance of chemical fertiliser in improving soil fertility, they were not willing to purchase it. Four factors provide insight into farmer's agricultural decision making: the high price of fertiliser, their bad experience with the use of chemical fertiliser (e.g. parching of crops); the inability to pay back the loan, and the obligation to pay back the loan immediately after the harvest when crop prices are relatively depressed. Turning a blind eye to these compelling factors, the government intimidated farmers and labelled them as 'obstacle to development'. In the words of Shank (1996: 7):

> *There are two major ways in which resource-poor farmers are thwarted even from using fertiliser. First with low holdings of land, oxen and pack animals, the farmer is not able to transport and utilise fertiliser to produce a marketable surplus. And, second, this low resource base reinforces the risk-aversion behaviour of the subsistence farmer making it difficult for him to optimise output for repayment of fertiliser loans rather than maximising family food security.*

As a result there is a lack of farmer participation, which, according to one recent study, is further compounded by

> *inadequate information flow from Development Agents to farmers, lack of alternative appropriate technologies that can suit the various needs of dryland farmers, lack of resources or inputs credit for undertaking the package programme, untimely delivery of production inputs and lack of market outlets for agricultural produce (Dejene, 2000: ii).*

Furthermore, the chairman of Tigray Farmers Association confirms that 'among the problems of farmers that should be mentioned include forced participation of farmers in agricultural extension program such as purchasing of agricultural inputs and soil and water conservation works' (WIC, 2001).

A voluntary choice of technology is clearly evident when we compare the purchase of chemical fertiliser with that of improved seeds. Since farmers were not coerced to purchase improved seeds, the number of farmers is very low compared to those who purchased fertiliser in Hewane. The main reasons for the low demand for improved seeds are high price and low quality, and the fact that disease and pests easily attack them.

Credit service

Lending on the basis of group liability and peer monitoring enabled DECSI to overcome problems relating to screening, monitoring, and enforcement problems. DESCI is particularly successful in loan recovery. SOS FAIM[15], commenting on the success story of DECSI reported, 'DECSI (Dedbit Credit and Savings Institution), deeply rooted in a society that found its structures through decades of resistance, shows a "credit first" approach followed by a strong development of savings oriented towards non-customers of credit; it succeeded in imposing itself on of the poorest regions of the planet'.

As Coleman (1999: 105) writes 'much of the literature on group lending focuses on its high repayment rates rather than its goal of promoting borrower welfare'. In line with these observations, customers of DESCI have encountered problems due to the loan repayment schedule, the obligation of forming *gujele* (group), and high interest rate.

Although the credit service is available, the number of customers is limited. A study in Hintalo Wajirat *Woreda*, for instance, indicates that 56.8 percent of the interviewed did not take credit at the time of the survey. The same study indicates that 71.7 percent of those who did not take up credit depended instead on local moneylenders as a source of credit Among those who took credit, 74.8 percent spent this on food consumption (REST, 2001: 30-31).

I agree with the observation of Tenikir about the negative impact of selling agricultural products at a low price in order to pay back loan on technology adoption. He writes, 'although fertiliser credit is available without collateral, the credit terms require repayment of the loan right after harvest. But, in the

immediate post harvest period, crop prices are low and thus the productivity gains from fertiliser application become limited' (Tenkir, 2002:46).

The credit field officers reported that majority of DESCI borrowers settle their debts by selling their property including oxen and/or borrowing cash from local moneylenders paying 5 to 10% interests per month. This shows to what extent customers face difficulties in paying back loans.

It is for the above set of reasons that farmers discontinue their membership of DESCI. Desertions from the program require further study in order to examine more systematically the causes for "desertions" of 'each year, more or less 12% of the customers leave the system. It seems important to specify the profile of those customers and to determine what motivates them' (S.O.S FAIM, 2000).

Political power and 'wielding participatory development'

At local level we encounter an overlapping and interpenetrating of economic, administrative and political relations and interests. An analysis of leadership in Tigray therefore demands a close scrutiny of the exercise of power and authority by individuals and groups in the region. Unfolding the sources and bases of power offers a means of understanding the nature of dominance in the name of 'participatory development'. As Long (2001:88) writes:

> *'Intervention processes are embedded in, and generate, social processes that imply aspects of power, authority and legitimization; and they are more likely to reflect and exacerbate cultural differences and conflict between social groups than they are to lead to the establishment of common perceptions and shared values. And, if this is the normal state of affairs, then it becomes unreal and foolhardy to imagine that facilitators can gently nudge or induce people and organizations towards more 'participatory' and equitable modes of integration and co-ordination. This is the paradox of neo-populist discourses and participatory methods aimed at empowering local people'.*

The meeting of water users in the Municipality of Adigudom also reveals a number of significant things. First, a powerful official was needed to chair the meeting to achieve the objective of selling fertiliser. Second, the official was not worried about the quorum since he wanted to communicate his own agenda. Third, it showed the concerted effort of the agriculture office and local administration in imposing technology on farmers.

In conclusion, the imposition of fertiliser technology on local people without considering their life-worlds has had an implication for development of irrigated agriculture. The aggressive promotion of fertiliser by extension workers and local government officials, despite scepticism and resistance from farmers has contributed to the farmers' distancing themselves from the cultivation of irrigable plots by leasing out plots to sharecroppers. Government

induced 'participation' adheres to the ideal of working for the betterment of the 'community' and in government parlance this priority takes precedence over individual needs. In other words, the conviction of the government of Ethiopia to help people overcome poverty has spearheaded coercive strategies in the name of 'participation'.

Notes

1 The title of this chapter draws upon Villarreal's (1994) coupling of processes of 'wielding and yielding' in her interesting analysis of gender and power relations in rural Mexico.
2 The key factors that distinguish coercive persuasion from other training and socialisation schemes are: 1) the reliance on intense interpersonal and psychological attack to destabilise an individual's sense of self to promote compliance; 2) the use of an organised peer group; 3) the application of interpersonal pressure to promote conformity; and 4) the manipulation of the totality of the person's social environment to stabilise behaviour once modified (Ofshe, 1992: 212). Furthermore, Wollersheim (1991:1-2) notes that 'coercive persuasion undermines the individual's defences, perception, values, attitudes, conduct, and ability to reason without physical force. The "persuasion" is accomplished by covertly overcoming the individual's will without convincing his better judgement. Its victims gradually lose their ability to make independent decisions or exercise informed consent'.
3 The size of a demonstration plot is 0.5 hectare.
4 Ethiopian Calendar.
5 Tesfay Habtu, my research assistant, who served as an ersha cadre, told me how the 'Global' agricultural extension service started in Hewane. He was one of the 'model' farmers. Sasakawa-Global 2000 is an international Non-Government Organisation that operates in several countries in sub-Saharan Africa with the mission to assist African governments to reduce poverty, increase food security and protect the natural resource base through the accelerated adoption of productivity-enhancing food production technology (Takele, 2001: 153).
6 The recommended chemical fertiliser for a hectare of rainfed land is DAP 50 kg and UREA 50 kg. For a hectare of irrigable land DAP 100 kg and UREA 100 kg.
7 The meeting was held on 8th October 2000 in the premises of Adigudom municipality.
8 Data for the year 1998 on the number of farmers who bought improved seed were not available.
9 Interview with the chairperson of the Hintalo Wajirat Woreda Women's Association.
10 Interview with, the chairperson of Hewane Women's Association.
11 Until January 2002, it was once in a year.
12 Maret is a Tigrgnia acronym for the Relief Society of Tigray (REST) which started provision of credit services before the establishment of DESCI. REST is one of the shareholders of DESCI, which contributed 50 percent of the total share.
13 Data were not available since the loans were recorded under the category of agriculture between 1994 and 1997.
14 After few months, the general manager of DESCI disclosed the reduction of the interest rate range of 15 to 18 percent to 9 to 15 percent as of January 2003 considering the level of poverty in the community. In addition, the loan repayment time has been extended to two years because of the difficulties caused by recurrent droughts in Tigray region (Walta Information Centre, 24 February 2003).

15 S.O.S FAIM is an independent non-governmental organisation, working both the South and North of the planet. In the South, it aims to provide the possibility to populations of ensuring themselves the improvement of their living conditions and to take in hand their future. At the same time it intends to sensitise and inform the populations of the North about development.

8
Conclusions

This study started off by asking a central question: How do State irrigation interventions interface with irrigators' life-worlds in Tigray, a drought-prone region of northern Ethiopia where water scarcity and uncertainty threatens agricultural production? Since the mid-1980s, successive Ethiopian governments have been engaged in the construction of irrigation infrastructure in response to drought and famine. Many of the irrigation systems have either a poor record of performance or they are not operational. And little is known about why this is so. My aim was to enquire into how the State intervened and what had been the reactions and responses of farmers to the government initiatives. Before presenting the key findings from the preceding chapters, let me recap my main theoretical approaches: a socio-technical approach to irrigation systems and an actor perspective.

8.1 Theoretical Reflections

Irrigation as a socio-technical system

In this study I interpret irrigation as a socio-technical phenomenon. The approach is useful for investigating irrigation practice and looking at how technology shapes human actions around water. Irrigation management is an arena where struggle, negotiations and encounters take place among actors such as irrigators, agricultural workers, engineers and local government officials. Particularly in drought-prone areas, water is not a free or plentiful commodity for any one to use as they wish. Seeing irrigation in this way allowed me to understand how government bureaucracies are embedded in irrigation management, and how the political, organisational and technical aspects of water control are practised in the Gum Selassa and Hewane irrigation systems.

The socio-technical approach is instrumental in identifying the social effects of irrigation technology on agricultural production. Well-designed canals, for instance, can transport water effectively to the fields to overcome moisture stress in plants. In Gum Selassa, however, due to the ill-designed canal system a section of the farmers in the command area had never obtained water since the irrigation system became operational. Plots labelled 'irrigable' turned out to be

'rainfed'. This had a negative impact on crop production and household food consumption. In addition, the introduction of irrigation in Gum Selassa reduced the plot size of individual farmers who earlier had cultivated by pooling and re-distributing rainfed land holdings.

The approach also helps us to understand technology choices and water management. In the Gum Selassa irrigation system, the use of micro-dams was taken as a water harvesting technique without giving due attention to the type of irrigation management they required. After more than five years of operation, the government attempted to hand over the irrigation infrastructure to water users without weighing up the relevance of such institutions on local conditions.

The socio-technical approach provides an insight into how irrigation management is organised and the social conditions of its use. While water distribution is an organised social practice, it is critically influenced by the sources of water. In the Hewane river diversion there are more *abo mais* (fathers of water) elected every year to handle water distributions tasks than in the Gum Selassa irrigation system, where the command area is three times larger. Interestingly, since the Gum Selassa reservoir is defective, irrigators also use seepage water, which runs continuously and can therefore be distributed both day and night.

An Actor orientation

An irrigation intervention is also an arena of struggle in which access to resources such as land and water become a focus of the dynamic interactions among different social actors. In understanding the interlocking relationships and the strategic actions of actors in State irrigation intervention, I mainly use an actor-oriented perspective. A central component of the approach is the concept of agency, which refers to the ability of actors to operate or take meaningful action within their life-worlds. In this study, irrigators were not passive recipients of the government intervention intended 'to improve' their lives. Farmers' responses to State intervention were mixed: adoption, rejection and transformation. Planners with linear thinking assumed that the availability of water, land and extension services would enable farmers to cultivate in drought-prone Tigray. However, the implementation of the government project did not go as intended and not all farmers obtained water. The water scarcity, socio-technically mediated, gave rise to a variety of livelihood strategies on the part of farmers. For instance, they engaged in leasing out their plots to sharecroppers, contrary to the expectation of planners. Women plot holders opted for petty trade such as selling *tela,* the local beer, since there was a taboo

attached to ploughing in their villages. Social interaction around state intervention thus entails the shaping and reshaping of the intervention.

State power and authority were evident in the irrigation intervention process. The government's heavy-handed policy was evident in the choice of irrigation technology, the coercive persuasion of farmers to use chemical fertiliser, and to their obligation to participate in labour-intensive public works, spurred by the modernisation ideology.

8.2 Key Findings

Using the research questions as guides, this section summarizes the key findings of earlier chapters.

On the question of agrarian policies, State intervention and irrigation development

Briefly, the study shows how agrarian policies, State agricultural interventions and irrigation development have evolved in Ethiopia since imperial times. Agriculture in general, and smallholder practice in particular, was neglected during the imperial regime. Development strategies did not focus on peasant production and the existing land tenure systems acted to constrain peasant production. Furthermore, the imperial government paid little attention to the drought and famine that affected millions of Ethiopians. The government was forced to consider these problems only when local and international pressure obliged it to do so. Although the government was interested in the modernisation of its backward economy, the strategy followed did not address the root causes of poverty and backwardness. In addition to the failure of the development strategy, recurrent drought and famine constantly compounded the problems faced by rural people.

Following the downfall of the imperial regime, the *Derg regime,* adopting a Marxist-Leninist ideology, sought to resolve the land tenure issue through the introduction of a radical land reform. It engaged in the promotion of collectivization, villagisation, forced resettlement, compulsory grain procurement, and the control of grain marketing and pricing. The government, in other words, tried to transform agrarian relations through heavy-handed state interventions. Farmers were not happy with the *Derg* reforms. As the economy collapsed and discontent grew, the government attempted to change its policy, but it was too late.

In the Ethiopian context, 'rural development' was seen simply as a transfer of modern technology, and political reforms required local people to implement government initiated programs without bringing about meaningful agrarian transformation.

Irrigation Development

Though irrigation in Ethiopia has been practised since time immemorial, the first attempt to promote irrigated agriculture was during the imperial regime in the 1950s when pump irrigation was introduced. The objective was to promote large-scale irrigation in the Awash valley. The government then planned small-scale irrigation intervention in order to settle the Afar pastoralists, which was not successful.

Although drought and famine affected millions of Ethiopians during the imperial regime, the government did not consider irrigation technology as a way of mitigating drought- induced famine. It was during the 1984/85 drought and famine that the Derg regime attempted to establish small-scale irrigation in the country as a means to increase food production in drought-prone areas. However, the regime did not create a favourable environment for irrigation development since farmers in the irrigation systems, including the longstanding ones, were required to form producer co-operatives based on collective organisation, which irrigators were unwilling to join.

The current government has adopted an Agricultural-Development-Led Industrialisation (ADLI) policy to promote rural development. The policy gives priority to the improvement of traditional agricultural practices to increase agricultural productivity. Irrigation development is one component of this policy. The government has issued a new irrigation policy whose main objective is to achieve food security at household level. Regional Commissions for Sustainable Agriculture and Environmental Rehabilitation have been established.

The Commission for Tigray (Co-SAERT), which was established in order to promote irrigation in the Tigray region, did not, however, achieve its 10-year target for micro dam construction. It constructed 44 dams, only a small proportion of the dams promised. These micro-dams had numerous technical and management problems. As a result Co-SAERT has now discontinued their construction.

At present, the Ethiopia government is encouraging farmers to construct low-cost small ponds in all drought prone areas, and as yet the social effects of the new technology are unclear.

On the question of the practices of irrigated agriculture and its value in the life-worlds of the irrigators

The study shows that farmers in Hewane and Gum Selassa cultivate both rainfed and irrigated plots. While the Hewane system obtains water from a river, the Gum Selassa irrigation system abstracts water from a micro-dam constructed by the current government. Mixed farming is practiced in both

irrigation systems. All irrigators use ox-plough cultivation. Close to one-third of the farmers do not own oxen, though they could obtain credit to purchase them. Farmers with or without oxen adopt various strategies to obtain oxen for ploughing, such as through *lifinti* (teaming up) and borrowing oxen from relatives. Household members participate in activities such as weeding, thrashing and collecting the harvests. Although women have the right to own land, they do not plough due to the taboo attached to it. Particularly women headed households are forced to lease out their plots to sharecroppers, and many are engaged in small trade selling of *tela* (local beer). Neighbors and/or kin support each other in activities such as harvesting and weeding on a reciprocal basis, which is locally known as *lifinti*. Furthermore, 40 percent of the irrigators indicated that they hire laborers whom they pay either in cash and/or grain. Observance of Saints' days and holidays is one factor that accounts for the shortage of labor in Gum Selassa and Hewane. It was found that over 50 percent of the informants observe 5-7 Saints' days or holidays dedicated to holy figures per month.

Over a period of six years, the average yield of maize, onion and tomato has increased significantly in Gum Selassa and Hewane irrigation systems. For instance, the average yield went from 24 to 167.5 quintals of maize for Gum Selassa, and for Hewane, from around 16 to 83.5 quintals (Chapter 5). Although the Agriculture Department advises farmers to observe its cropping pattern, farmers do not do so. They usually plant maize, onion, tomato and wheat. Maize is a crop preferred for household consumption, and onion because of the 'good income' earned from its sale. Furthermore, there was no effective advice given on irrigation scheduling or input supply. Water was sometimes applied in such a way that instead of irrigating crops, soils became flooded.

The study also finds that irrigated production interferes with rainfed agriculture and with off-farm activities. This is mainly because irrigated plots are harvested in May and June, which coincides with the need to plough both rainfed and irrigated plots that take advantage of the long rains.

The study indicates that no irrigator survives from rainfed and irrigated farming alone. All still need multiple livelihood strategies to survive. In addition, marketing is so insecure that farmers can lose the investments they make in agricultural inputs, which makes irrigated agricultural practices uncertain.

Credit organisation and debt trap

Although a credit service is available, the number of customers is limited. At Hintalo Wajirat *Woreda* level less than 50 percent took credit. Of those who did not take up credit, over 70 percent depended on local moneylenders. The

leading credit institution DECSI in Tigray has high repayment rates and does not look out for the welfare of its customers, particularly with respect to the repayment schedule, whereby farmers had to deal with the negative impact of having to selling agricultural products during a low price period in order to pay back their loan. Furthermore, the study shows that the majority of DESCI borrowers settle their debts by either selling their property including their oxen and/or by borrowing cash from local moneylenders, paying 5 to 10 percent interest per month.

The practice of Woferit (sharecropping)

The study documents that *Woferit* (sharecropping) is widely practised in Gum Selassa and Hewane irrigation systems. In 2001, 41.5% of men and 83.2% of women in Gum Selassa, and 44% of men and 56% of women in Hewane leased out their plots. 'Uncertainty of access to irrigation water' ranked as the first reason for leasing out land. This was followed by 'not able to purchase fertiliser' and 'being a woman I cannot plough'. A large majority of the plot holders make agreements with the farmers leasing the land to collect one-third of their harvest (Chapter 5).

The study concludes that the need to access irrigable land is the main reason for tenant farmers to lease in land. Land fragmentation and landlessness have become major problems in the region. As cultivable land is limited, further land redistribution has remained difficult on the part of the government. Thus, *woferit* (sharecropping) has been opted for as a major mode of accessing cultivable land in the two *tabias.*

On the question of intervention by local government in everyday irrigation management and irrigated agriculture, and on the key interfaces and arenas shaping the interactions and outcomes between agency staff and farmers

In principle, water allocation is the responsibility of the 'water committee' (in Hewane) and 'irrigation committee' (in Gum Selassa). However, uncoordinated water allocation decisions on the part of local government bureaucracies have compounded water scarcity in the irrigation systems.

Irrigation governance and water control

The study shows that the pattern of irrigation management has remained largely the same since the imperial regime. In all three regimes, 'irrigation practices are inherently political practices' (Mollinga, 1998:30), since the local government bureaucracy has been embedded in their management. Earlier the landlords and local governors, and later the Agriculture Department and local government bureaucracies were involved in decisions of water allocation and

conflict resolutions. Farmers had very weak negotiating power over their water rights.

In Tigray, there has never been an irrigation agency responsible for irrigation management. In the mid-90s, the government established Co-SAERT, responsible for construction of irrigation infrastructure in Tigray. Likewise, since Imperial times, there has never been either a government-initiated water users' association or indigenous irrigators' organisations responsible for water management in the Hewane irrigation system. Farmers have been requested by the local government to elect *Aferchecka* and later *Abo mai* who handle the tasks of water distribution and canal cleaning and maintenance. The link created through *Abo mai* between the local government bureaucracies and farmers has made irrigation management an appendage of the local government bureaucracy.

The study shows that, in the absence of a legal framework, the regional government attempted to establish a water users' association by simply handing over the micro-dam to water users. It was an imposition on the water users. Many farmers were not involved in its establishment nor did they participate in the water users' association. Representatives like the chairman were selected in their absence. As one informant noted, 'until recently it was the agriculture office that administered the irrigation system. But now we hear that farmers have taken over the dam'. The government did not discuss with farmers the conditions of its transfer, the power of the water users' association, nor the role of farmers or government support to sustain the irrigation system. As Vermillion (1995: 146) notes 'where farmer organizations lack full legal and political recognition to make all decisions necessary to manage the irrigation system they appear to have difficulty achieving cost efficiency, raising adequate revenue, applying sanctions and entering into contractual relationships with their parties'.

The claims of Co-SAERT that dams have been transferred to water users' associations is bogus. In terms of governance, the status of the irrigation systems is unclear. Co-SAERT's objective to bring about sustainable agriculture and environmental rehabilitation in Tigray is questionable. Interestingly, the Commission has recently transformed itself into the Bureau of Water Resources Development by merging agencies involved in the water sector, while the management of the newly constructed irrigation systems is unknown.

Reconstruction of water rights

Traditional water rights took account of the uncertainty of water supply through the construction of *mesno/hayfo* rights of use. These have continued in Hewane although only in respect to smallholdings. In Gum Selassa no attention

was initially given to the fact that there could be rainfall levels of water in the dam, to which allocation might be adapted. Predictions concerning the area to be irrigated remain unclear.

The study shows how the 1999 land re-distribution in the town of Hewane gave rise to a reconstruction of water rights. All those living in the town originally had the right of access to irrigable land. Under the TPLF re-distribution of land, the irrigators who resided closer to the river on the eastern side of the town were given all the irrigated plots. Consequently, farmers who lived on the western side of the road lost their irrigable land and water rights.

The recently constructed Shelenat diversion canal, which transports floodwater during the long rainy season to Shelenat micro dams, initially blocked the canal that went to the *hayfo* plots in Korkora k*ushet*. Here we may note an unintended negative effect of non-consultative irrigation intervention, i.e., the erosion of water rights. Although the farmers constructed three outlets on the Shelenat diversion weir, the government, while constructing the new irrigation infrastructure, did not (though they should have) maintain the old system, which had enabled *hayfo* farmers to produce. This has since been put right.

Irrigation management tasks

Every year the *Woreda* irrigation committee has to decide on the area to be irrigated based on Co-SAERT's measurement of the quantity of dam water. The study has shown, however, that the size of irrigated plots did not correspond to Co-SAERT's estimation between the 1998 and 2002 production years. The irrigation committee does not take account of the dam water measurement of Co-SAERT. The power to allocate water in the Gum Selassa irrigation system is mainly in the hands of the experts of the Woreda Agriculture Department. Guesswork has prevailed thus ignoring the professional support of Co-SAERT. The guesswork in the water allocation has tempted the Agriculture Department to reduce the size of irrigable plots to obviate shortages of water.

Until 2002, not all of the 110 ha of farmland of Gum Selassa were supplied with dam water. The highest share of irrigated land was 78.4 percent in 2002/03 while lowest was 7.5 percent in 1998/99. It was noted that 16.3 percent of the irrigated plots in 2002/03 were 'rainfed plots', which were not supposed to get dam water. In other words, among the 550 farmers who joined the irrigation system initially, between 119 and 470 of them received no water for six years

In Hewane, water allocation to users is based on the principle of classifying plots into *hayfo* and *mesno* (irrigation). The *mesno* plots have water priority over *hayfo* plots because they entail the use of improved agricultural inputs. But the switching of plots from *hayfo* to *mesno* or vice versa often takes place.

In both irrigation systems *Abo mais* are annually elected to carry out water distribution tasks. The source of water influences their number. 12 *abo mais* serve at 15 diversions in Hewane while only four are assigned to do so in Gum Selassa where only some of obtain water day and night. The availability of seepage water in Hewane means day and night distribution. While the water distribution system is an established and accepted practice, it is not always accepted by individuals. Irregularities in water distribution occur that lead to petty feuds. Rotational scheduling of water regulates access to water and is based on the principle that he who sows first gets water first. Blocks get water by turn according to the requirement of each crop. While internally rotations are largely accepted, appropriateness to improve crop yields is still only poorly understood.

Irrigators are involved in canal cleaning every year, although their participation is not as expected. The most serious issue in system maintenance is the disiltation of dams which is no ones work in Tigray. Experts of Co-SAERT have clearly indicated that most of the micro dams will not serve the expected life span time due to siltation.

The study shows that conflict resolutions are carried out at three levels, at field level involving irrigators, elders, *Abo mais* and development agents, at Department of Agriculture and *tabia* administration level, and thirdly, depending on the seriousness of the conflict, at the *Maheberawe firdebet* (social court) which can impose fines. Farmers often appeal to the local administration or Agriculture Department when they cannot solve conflict over water at field level.

Imposition of fertiliser technology drives farmers away from irrigation

Farmers in Hewane and Gum Selassa lease out plots to sharecroppers due to the inability and/or unwillingness to purchase chemical fertiliser. The study shows that in Hewane and Gum Selassa over two-thirds of the farmers purchased fertiliser through coercive persuasion, with the fear that they might be denied credit, food aid or employment opportunities in various construction works or with the threat of no access dam water. Local government bureaucracies did not pay any attention to farmers' unwillingness to purchase fertiliser. In contrast, since farmers were not coerced to purchase improved seed, the numbers buying it was very low.

Policies that encourage farmers to participate in the implementation of agricultural extension packages represent a significant shift from the top-down approach. In theory, government officials and rural development workers support the idea of farmers' participation from technology identification to

technology evaluation in the implementation of extension services. The former Minister of Agriculture is recorded as saying:

> *'It is always important to keep in mind that it is the farmer who decides on how to manage the soil. Hence, his or her views and perceptions are central to achieving [sic] sustainable pattern of management. These views will strongly be enhanced by the prices he or she receives on marketing the products, accessibility to inputs, access to credit, training opportunities, and a reliable moisture regime. If farming is not profitable, farmers are reluctant to venture on something different' (SOS Sahel,* et al *2001: 39).*

In Tigray, agricultural extension was based on the diffusionist model. Agricultural workers and local government officials were preoccupied with achieving the targets set for fertilizer sales to farmers and as a result, recommendations on fertiliser application to demonstration plots were 'a one-size fit-all' solution. As Chambers, *et al* (1989: 23) argue:

> *it is not uncommon to find extension staff distributing undifferentiated blanket recommendations to farmers, making no concession to their varied economic capacities and widely different farming systems.*

Such blanket solutions cannot work for heterogeneous farming population who Long (2001: 181) points out use a variety of strategies for solving the production and other problems they face. The perceived benefits of using agricultural packages have a marked influence on farmers' receptiveness. For individual farmers yield increase per hectare does not correspond to their technical and social conditions since local soil conditions vary a good deal, not only from one *tabia* to another but also from one field to another. Oliver de Sardan (1988: 222) also notes that 'the minimization of risks and the search for security are the focus of many economic strategies. Mistrust of high yield varieties (more risky if effective rainfall is below the average taken into account by agronomic researchers), reluctance to adopt new crops when marketing is hazardous'.

Commenting on participatory extension practice in the dry lands of southern Ethiopia, Dejene (2000: 6) maintains that 'the participatory approach is therefore considered as essential if extension is to be more client-oriented. However, our field observation shows that these principles are not followed in the current extension system. What is being practised is top-down'. Thus the Ethiopian governments desire to help people overcome poverty has resulted in spearheading coercive strategies in the name of 'participation'.

On the question of local coping strategies in respect to drought and famine, and other food provisioning/livelihood strategies apart from farming

Coping strategies with drought and famine

Local people employed a combination of four categories of coping strategies with respect to the 1984/85 drought and famine. All employed one or more of the depleting, maintaining, reductive and/or regenerative strategies to cope with drought and famine. Food relief ranked first as a strategy for survival under severe drought and famine situation.

Livelihood strategies

The data presented earlier indicate that the Hintalo Wajerat Woreda (district) is still food insecure. Over 30 percent of the population receives food aid. Gum Selassa and Hewane *tabias* are located in the same agro-ecological zone. Farming has been and still remains the main source of livelihood there. Except for the irrigators in the two irrigation systems, farmers depend entirely on rainfed agriculture. The intended level of food security has not been achieved in Gum Selassa and Hewane tabias (since 66 percent of the households consumed what they produced within 6 to 9 months), and therefore many people have to combine farming and non-farming or trading activities. However this is not easy for people since in Hintalo Wajerat *Woreda* there is a lack of jobs available in the area.

The food security program, which was aimed at increasing the incomes of food insecure households by engaging farmers in various agricultural activities, had major drawbacks. Initially 1600 farmers showed interest in the four *tabias* of the program, but only 22 percent of the farmers were able to take out credit. The Agriculture Department did not trust the farmers to use the money for the purpose intended. Another reason for the poor uptake was that the farmers themselves did not agree with the purchasing arrangements operated by the official committee.

The government's decision to deploy local labour during slack period on the construction of Shelenat dams had the unintended negative effect of halting the soil and water conservation project. This work was halted for over five years, aggravating the gully erosion and slumping in the *tabia.* In Hewane this agro-ecological problem, mediated by political power, compelled farmers to find something else. Bee keeping thus became a livelihood strategy as their harvests from the shrinking farmland declined every year.

Traditional bee keeping is expanding in Hewane. Conversely, the rate of adoption of government promoted modern bee keeping practice has been low.

The constraints quoted were the unaffordable price of frame hives and the lack of technical assistance from the Agriculture Department.

The study documents few formal and informal social organisations such as *Mahber* (religious associations) and *equb* (saving groups). These are weak social networks for developing survival strategies.

8.3 Implications of the study

I repeat here some of the implications of this study pertaining to the issue of livelihood practice, household food provisioning, irrigation access, water control, and irrigation management and governance.

First, irrigated agriculture is a complex livelihood activity and thus the analysis of existing livelihood practices is essential before embarking upon irrigation intervention. Interventions that do not consider local people's life-worlds are likely to pave the road to underdevelopment.

Second, the regional government assumed that irrigators cultivating their own plots could achieve household food security. However, the majority of plot holders, particularly women headed households, as I have shown, lease out their plots and collect one third of the yield. This had serious implications on food provisioning at household level since the anticipated amount of grain is not available for household consumption. Another factor was that the credit service, although an important input to increase agricultural production, operated loan repayment schedules coincide with harvest time when prices were at their lowest. This reduced their purchasing capacity at a time when grain prices were higher. In both instances household food consumption is affected.

Third, numerous socio-technical problems resulting from poor irrigation management frustrate irrigation interventions. These range from crop failure due to moisture stress, the lack of effective water harvesting strategies. Building irrigation infrastructure is less problematic than putting it to good productive use to service unmet demands.

Fourth, the study shows that irrigation system management is embedded in local government bureaucracy and sits uncomfortably between government bureaucracies and water users. The water users themselves or an irrigation agency might better be able to appreciate the performances of an irrigation system or deal with the issue of water equity. The local government bureaucracy, involved in numerous non-irrigation activities, finds it difficult to identify internal irrigation management problems encompassing water delivery schedules, and to make fair decisions in conflicts over water. On the other hand, the institutional viability of water user associations is questionable because or

the absence of clear water rights which demotivates farmers from participating in irrigation management.

Moreover the distancing by the bulk of farmers from irrigated agriculture through leasing out their plots to sharecroppers provides a good indication of the lack of enthusiasm amongst them to commit themselves to irrigated cultivation. Sharecroppers, on their part, cultivate the land for a limited period (one or two harvesting seasons). It appears that there is no appropriate incentive structure for sharecroppers to take over the irrigation infrastructure while they are cultivating on temporary basis. Under such cultivation arrangements it is not surprising that water user associations under-perform.

Fifth, bureaucratic performance highlights a lack of expert knowledge and capacity in designing functional systems that provide what is needed in Gum Selassa. Furthermore, the absence of water management expertise has been noted in irrigation scheduling in both sites.

8.4 Looking to the Future

The need for irrigation systems on the part of farmers of Gum Selassa and Hewane is there, but the provision of irrigation and agricultural services does not dovetail effectively with the life-worlds of farmers. Although the provision of water, land and agricultural inputs to irrigators is a big stride towards mitigating drought-induced famine, other measures must be put in place to enable irrigators to provide their families with adequate food.

- Inappropriate irrigation technology contributes to social disruption and a waste of resources. Thus, technology choices should be commensurate with the capacity of the final users of irrigation infrastructure. The technology choice appears to be uncritically adopted. Faulty maintenance of the infrastructure, seepage, siltation and environmental deterioration are obvious problems, which are not dealt with adequately.

- Irrigation development should take into account not only the provision of water but also the agricultural production system

- Intrusive practices, such as coercing farmers to adopt modern agricultural technologies like fertilizer packages, are inimical. Farmers are knowledgeable and struggle to reconstruct life cycles to bring about security and dignity for themselves. Acknowledging this and giving greater respect to their own potential and options can enhance development intervention. New reflections on how to maintain soil fertility and yield acceptable to farmers should be sought.

- The need for more defined and coherent institutional arrangements in irrigation development is essential. There is a need to have a clear and well-defined policy on the handing over of micro dams to farmers, which should be specific as to the respective roles of farmers and government after hand over.

- An area of concern is the preoccupation of government and NGOs to simply construct irrigation infrastructure to solve production problems in drought prone areas. In years of recurrent drought, rivers and micro dams dry out and groundwater levels drop. Hence, under these circumstances irrigated agriculture is more vulnerable to drought than some less intensive forms of agriculture. As farmers have smaller and smaller plots, irrigation development in these areas may not be a fully effective means to mitigate recurrent drought and food insecurity.

- Differential access to water contributes to weak operation of the irrigation system. The provision for special water distribution arrangements at times of water scarcity can increase farmers' participation in irrigation management.

- Considering recurrent droughts in Tigary, food aid probably needs to continue. However, there is a need to work out how to link food-for-work to sound and wider investments.

8.5 On the Need for Further Research

This study has attempted to look into the social dimensions of irrigation with particular emphasis on state intervention and life-worlds of farmers. It is hoped that more research will be addressed to the question of farmers' knowledge, to options for irrigation that recognise the life-worlds and environment of farmers, and to the technical optimisation of irrigation without the preoccupation for bureaucracy.

In conclusion, as Chambers *et al* (1989) say, like all development activities, irrigation works when it contributes to the individual's need for 'subsistence, security and self-respect', and that the 'environment can be made valuable by first valuing the people who live in it'.

Appendix:

Co-SAERT's Estimation of Irrigable Area in Gum Selassa in 2000/01

Gumsellasa

- Elevation at initial (1st) reading (04/13/92) = NPL - 0.81 = 1957.69m
- Elevation at 2nd reading (27/1/93) - NPL - 1.02m = 1957.5 m
- capacity at initial reading = 1,490,000 m^3, A = 42 ha
- capacity at 2nd reading = 1,400,000 m^3, A = 41ha
- Difference in capacity = 90,000 m^3
- Evaporation loss between the two readings = 63958 m^3

Seepage loss = 90,000 − 63958 m^3 = 26,042 m^3
= 840 m^3/d

⇒ storage at the beginning of sept = 1,490,000 m^3 → 42ha
- seepage loss = 25,200 m^3
- evaporation loss = 63958 m^3

storage at the end of sept = 1,490,000 − (25200 + 63958)
= 1,400,840 m^3

⇒ storage at the beginning of oct = 1,400,840 m^3 → A = 41ha.
- seepage loss = 25200 m^3
- evaporation loss = 62598 m^3

storage at the end of oct = 1,400,840 − (25200 + 62598)
= 1,313,042 m^3

⇒ storage at the beginning of NOV = 1,313,042 m^3 → A = 40.5ha.
- seepage loss = 25200 m^3
- evap= loss = 53217 m^3

storage at the end of NOV = 1,313,042 m^3 − (25200 + 53217)
= 1,234,625 m^3

⇒ storage at the beginning of DEC = 1,234,625 m^3 → A = 38ha.
- seepage loss = 25200 m^3
- evap= loss = 44734 m^3
- Irriga need = 109 852

storage at the Begd of DEC = 1,054,834

⇐ storage at the beginning of January = $1{,}054{,}839\,m^3$ → 35ha

- seepage loss = $25200\,m^3$
- evap^n loss = $47124\,m^3$
- Irrig^n need = $127703\,m^3$

storage at the end of Jan = $1{,}054{,}839\,m^3 - (25200 + 47124 + 127703)$
= $854{,}812\,m^3$

⇐ storage at the beginning of Feb = $854{,}812\,m^3$ → A = 33ha

- seepage loss = $25200\,m^3$
- evap^n loss = $48233\,m^3$
- Irrig^n need = $219608\,m^3$

storage at the end of Feb = $561{,}771\,m^3$

⇐ storage at the beginning of March = $561{,}771\,m^3$ → 25ha.

- Seepage loss = $25200\,m^3$
- evap^n loss = $41220\,m^3$
- Irrigation need = $221979\,m^3$

storage at the end of March = $561771 - (25200 + 41220 + 221979)$
= $273{,}392\,m^3$

⇐ storage at the beginning of April = $273{,}392\,m^3$ → A = 19ha.

- seepage loss = $25200\,m^3$
- evap^n loss = $34131\,m^3$
- Irrig^n need = $112845\,m^3$

storage at the end of April = $273392\,m^3 - (25200 + 34131 + 112845)$
= $101216\,m^3$

Dead storage = $101{,}216\,m^3$

Balance = $1216\,m^3$

Case 1, - If the Total seepage water lost, not used for irrigation purpose :

Area to be irrigated = 80.5ha.

Case 2. ~~of~~ Under this scheme the experience of the beneficieries to use the seepage water for irrigation is good hence,

Assume that about 40% of the seepage water is used for irrigation for irrigation :

Total water lost through seepage = $126{,}000\,m^3$

$40\% \times 126\,000\,m^3 = 50{,}400\,m^3$

$$A = \frac{50{,}400\,m^3}{9838\,m^3/ha} = 5.123\,ha. \simeq 5\,ha.$$

∴ Under this condition Total Area = 85.5ha.

PE = 45 %

crops	Area %	Area ha	D	J	F	M	A
maize	55	45	1.72 51600	3.2 9600	4.7 131600	4.2 126000	1.4 28000
Onion	34.8	28	2.52 46992	3.4 63403	3.85 67008	4.35 81119	4.36 81305
Tomato	3.7	3	2.48 4960	3.3 6600	4.22 8400	4.7 9400	3.54 3540
Chickpea	5.5	4.5	2.1 6300	3.9 11700	4.2 12600	1.82 5460	
Total	100	80.5	109852	127703	219608	221979	112845

Bibliography

Adams, William M. and David M. Anderson (1988) 'Irrigation Before Development: Indigenous and Induced Change in Agricultural Water Management in East Africa'. *African Affairs*. Vol. 87. No: 349

Alemayehu Lirenso (1990) 'Villagization: Polices and Prospects', in Siegfried, Pausewang, Fantu Cheru and Stefan Brune and Eshetu Chole (Eds.) *Ethiopia: Options for Rural Development.* London: Zed books Ltd.

Alukonya, S.N. (1993) 'MWEA Irrigation Agricultural Development Project, Kenya' in *Poverty in Irrigated Settlements. A discussion paper and replies from Network members.ODI Irrigation Management Network*. Network Paper 27

Anderson, Ian McA and Bryan Flynn (1989) 'Small Scale Irrigation in Ethiopia', in J.R. Rydzewski and C.F. Ward (Eds.) *Irrigation Theory and Practice. Proceedings of the International Conference held at the University of Southampton 12-15 September 1989*. Pentech Press Limited

Arce, A., M.Villarreal and P. de Vries (1994) 'The social construction of rural development: discourses, practices and power', in David Booth (ed.) *Rethinking social development. Theory, Research and Practice.* Longman Group Limited

Assefa Bequle and Eshetu Chole (1969) *A Profile of the Ethiopian Economy*. Addis Ababa

Asmelash Woldemariam (1995) *The Effects of Land Reform on Peasant Social Organisation: A Study of Village-Level Dynamics in Central Tigray, 1974-1994.* MA Thesis, Addis Ababa University

Association of Ethiopian Microfinance Institutions (AEMFI) (2000) *Microfinance Development Review*. Volume 1, No. 2

Barghouti, Shawki and Subramanian, Ashok (1990) 'Policy and Management Problems' in Shawki Barghouti and Guy Le Moigne *Irrigation in Sub-Saharan Africa. The Development of Public and Private Systems.* Washington, D.C.: World Bank Technical Paper Number 123

Barnes, Barry (1986) 'On Authority and its Relationship to Power', in John Law (ed.) *Power, Action and Belief. A New Sociology of Knowledge*? Sociological Review Monograph 32. London: Routledge & Kegan Paul

Barnes, Barry (1988) *The Nature of Power*. Cambridge, Polity Press.

Beccar Lily, Rutgerd Boelens and Paul Hoogendam (2002) 'Water Rights and Collective action in Community Irrigation', in Rutgerd Boelens and Paul Hoogendam (eds.) *Water Rights and Empowerment*. Assen: Van Gorcum

Bedini, Fabio, Zenebe Gebregziaber, Hagos Fitsum, Nick Harvey, Nick Morris, Vincent Langdon and Gebresemayat Woldu (1996) 'Land Allocation Guidelines for Gum Selassa and Adeha Irrigation Projects'. Final Report

BoANR (1999) Livestock Census Analysis Result. Mekelle

Boelens, Rutgerd (1998) 'Design as an organization process' (Lecture Notes)

Bolin, Inge (1993) 'Levels of Autonomy in the Organisation of Irrigation in the Highlands of Peru', in P. William Mitchell and David Guillet (eds.) *Irrigation at High Altitudes: The Social Organisation of Water Control Systems in the Andes.* Volume 12. Society for Latin American Anthropology Publication Series

Bradbear, Nicola (2002) 'Bee keeping and Sustainable Livelihoods', in Nicola Bradbear, Eleanor Fisher and Helen Jackson (eds.) *Strengthening Livelihoods: Exploring the Role of Bee Keeping in Development.* Monmouth: Bees for Development.

Braun, Joachim von, Tesfaye Teklu and Patrick Webb (1991) *Labour-Intensive Public Works for Food Security: Experience in Africa.* International Food Policy Research Institute. Working Paper on Food Subsidies, No: 6

Bruns, Bryan and Ruth S. Meinzen-Dick (2000) 'Negotiating Water Rights: Introduction' in Bryan Randolph Bruns and Ruth S. Meinzen-Dick (eds.) *Negotiating Water Rights*. New Delhi: International Food Policy Research Institute Intermediate Technology Publications.

Burke, Jacob (2002) 'Implementation of national irrigation strategies: fuzzy vision, harsh realties and strange bedfellows'

Bush, Jennifer (2002) Baseline Report. Household Food Economy Assessment. Bosos Sore Woreda, Wolayita Zone, SNNPR. The Food Economy Group

Butcher, Catherine (2002) 'Sustainable Livelihoods and Extension: What Lessons can be Learnt', in Nicola Bradbear, Eleanor Fisher and Helen Jackson (eds.) *Strengthening Livelihoods: Exploring the Role of Bee Keeping in Development.* Monmouth: Bees for Development.

Caldwell, Richard M. (1992) Ethiopia: A Country Profile for Famine Mitigation Planning and Implementation. Prevention, Mitigation and Preparedness Division OFDA/USDA Famine Mitigation Activity PASA

Campbell, D.J. (1990) 'Community-Based Strategies for Coping with Food Scarcity: A Role in African Famine Early-warning Systems'. *GeoJourna*l 20: 231-241

Campell, David J. (1990) 'Strategies for Coping with Severe Food Deficits in Rural Africa: A Review of the literature'. *Food and Foodways*. Vol. 4(2). Harwood Academic Publishers GmbH

Carter, R. (ed.) (1989) NGO *Casebook on Small Scale Irrigation in Africa*. FAO. Rome

Central Statistical Authority (CSA) (1997) Ethiopia Statistical Abstract

Cernea, M.M. (ed.) (1985) *Putting People First: Sociological Variables in Rural Development*, World Bank, Oxford: Oxford University Press

Chambers, Robert (1983) *Rural Development: Putting the Last First*, London: Longman

Chambers, R., N.C. Saxena, and T. Shah (1989) *To the Hands of the Poor: Water and Trees.* London: Intermediate Technology Publications

Chambers, R., A. Pacey and L.A. Thrupp (1989) *Farmer First: Farmer Innovation and Agricultural Research.* London: Intermediate Technology Publications

Chambers, Robert.(1994). 'Irrigation against rural poverty' in Gurjar R.K (ed.) *Socio-economic Dimensions & Irrigation*. Jaipur: Printwell

Clemmens, Alber J. (1987) 'Delivery System Schedules and Required Capacities', in Zimbelman (ed.). *Planning, Operation, Rehabilitation and Automation of Irrigation Delivery Systems*. New York; American Society of Civil Engineers

Cohen, John, M. and Dov Weintraub (1975) *Land and Peasants in Imperial Ethiopia. The Social Background to a Revolution.* Assen: Van Gorcum & Comp. B.V.

Coleman, Brett E. (1999) 'The impact of Group Lending in Northeast Thailand' *Journal of Development Economics*. Vol. 60. Amsterdam: Elsevier B.V.

Co-SAERT (1999) 'Common Problems, Causes and Recommended Solutions'. Mekelle

Cooke, Bill and Uma Kothari (2001) 'The Case of Participation as Tyranny' in Bill Cooke and Uma Kothari (eds.) *Participation: The New Tyranny?* London: Zed Books Ltd.

Coward, Jr. E. Walter (1986) 'State and Locality in Asian Irrigation Development: The Property Factor', in K.Cnobe and R.K. Sampath (eds.) *Irrigation Management in Developing Countries: Current Issues and Approaches*. Studies in Water Policy and Management, No: 8. London: Boulder and Westview Press

Coward, Jr., E.Walter (1984) *Improving Policies and Programs for the Development of Small-Scale Irrigation Systems*. Water Management Synthesis Project Report 27 Cornell University, Ithaca, NY

Dagnew Eshete (1995) 'Differential Socio-economic Impact of Food Shortages and Household Coping Strategies: A Case Study of Wolaita District in Southern Ethiopia'. *African Development*. Vol.XX, No: 1

DECSI (2002) 'Dedebit Credit and Saving Institution 2001 Annual Report'. Mekelle, Ethiopia

De Haan, L. (2000) Globalisation, Localisation and Sustainable Livelihood. *Sociologia Ruralis*, 40, 3, pp.339-365.

Deininger, Klaus, Songquing Jin, Adenew Berhanu, Samuel Gebre-Selasie and Berhanu Nega (2003) Tenure Security and Land-related Investment: Evidence from Ethiopia. World Bank Working Paper

Dejene Abesha, Aragay Waktola and Jens B.Aune (2000) Agricultural Extension in the Drylands of Ethiopia. Report No: 9. Drylands Co-ordination Group

Dessalegn Rahmato (1994) 'Land Tenure and Land Policy in Ethiopia After the Derg'. In Harold G. Marcus (ed.) *New Trends in Ethiopian Studies. Papers of the 12th International Conference of Ethiopian Studies*. Michigan State University 5-10 September, 1994

Dessalegn Rahmato (1999) Water Resource Development in Ethiopia: Issues of Sustainability and Participation. FSS Discussion Paper

Devereux, Stephen (2000) 'Food Insecurity in Ethiopia'. A discussion paper for DFID.

Diemer, Geert (1992) 'Improving Design Processes in Sub-Saharan Africa', in Geert Diemer and Jacques Slabbers (eds.) Irrigators and Engineers. Thesis Publishers, Amsterdam.

Diemer, Geert (1998) 'The Technocratic Vision of Equity in Water Distribution: a Matter of Context' in Rutgerd Boelens and Gloria Davila (eds.) *Searching for Equity. Conceptions of Justice and Equity in Peasant Irrigation*. Assen: Van Gorcum & Comp.

Diemer, G and Huibers , F.P (eds) (1996) *Crops, People and Irrigation. Water allocation practices of farmers and engineers*. Intermediate Technology Publications.

Disaster Prevention and Preparedness Commission (DPPC) (2000) The 2000 Belg Season Crop Production Performance and July to December 2000 Food Supply Prospect in Ethiopia. Early Warning System Report

Eggink, Willem Jan and Jan Ubels (1984) *Irrigation, Peasants and Development. An attempt to analyze the role of irrigation in social change in Third World societies*. MSc Thesis. Agricultural University of Wageningen

Ellis, Frank (1998) 'Household Strategies and Rural Livelihood Diversification' *The Journal of Development Studies*, Vol.35, No: 1, October 1998, pp1-38

EPRDF. 'Abyotawi Democracy' (Amharic version) Leyou Etem Vol. 12 Meskerem 9/1994

Eshetu Chole (1990) 'Agriculture and Surplus Extraction: the Ethiopian Experience' in Siegfried Pausewang, Fantu Cheru, Stefan Brune and Eshetu Chole (Eds.) *Ethiopia: Options for Rural Development*. London: Zed books Ltd.

Eyasu Yazew, Mitiku Haile and Bart Schultz (2002) 'Land and Water Development in Tigray: Lessons that can be learnt from Co-SAERT's Experience'. A Paper presented at the *[Six]* sic Symposium *on Sustainalbe Water Resources Development 8-9 July 2002* Arba Minch Water Technology Institute. Araba Minich

FAO (1979) *Yield Response to Water*. FAO Irrigation and Drainage Paper 33. Rome.

FAO (1994). Ethiopia: Small-scale irrigation consolidation project, Preparation report. FAO/DDC Report 59/94 ADB-ETH 48

FAO (1997) *Irrigation Technology Transfer in Support of Food Security Proceedings of a sub-regional workshop* Harare, Zimbabwe, 14-17 April Water Reports 14

FAO and World Bank (2001) Farming Systems and Poverty. Improving Farmer's Livelihoods in a changing world.

FAO (2002) Special Report. FAO/WFP Crop and Food Supply Assessment Mission to Ethiopia. 30 December 2002

FAO (2002) *The State of Food Insecurity in the World 2002*. Rome, Italy.

FDRE (1995). Proclamation No: 1/95 The Constitution of the Federal Democratic Republic of Ethiopia

Fekade Azeze (1998) *Unheard Voices. Drought, Famine and God in Ethiopian Oral Poetry*. Addis Ababa University Press. Addis Ababa, Ethiopia

Fitsum Hagos, John Pender and Nega Gebreselassie (1999) Land Degradation in the Highlands of Tigray and Strategies for Sustainable. Socio-economic and Policy Research Working Paper. No: 25

Giddens, Anthony (1976) *New rules of sociological method. A positive critique of interpretative sociologies.* London: Hutchinson

Gilkes, Patrick (1975) *The Dying Lion. Feudalism and Modernization in Ethiopia.* London: Julian Friedmann Publishers Ltd.

Guijt, I. and J. Thompson (1994) 'Landscapes and livelihoods. Environmental and socio-economic dimensions of small-scale irrigation'. *Land Use Policy* 11(4)

Hendrie, Barbara (1997) 'Managing Famine Disaster—Popular Participation in Tigray'. *Eritrean Studies Review*. Vol. No: 1

Horst, L (1998) *The Dilemmas of Water Division: Considerations and criteria for irrigation system design.* International Water Management Institute. Colombo, Sri Lanka

Howel, Jude 1995 'Kyrgyszstan Economic Liberalisation in Practice' *Development,* (October 1995)

Hudson, N. (1995) *Soil Conservation*. London: BT Batsfro Limited.

Humphrey, Liz (1999) Food For Work in Ethiopia: Challenging the Scope of Project Evaluations. IDS Working Paper 81

Hunt, Robert C. and Eva Hunt (1976) 'Canal Irrigation and Local Social Organization'. *Current Anthropology* Vol. 17, No: 3

Imperial Ethiopian Government (IEG) (1957) *First Five Year Development Plan* 1957-1961, Addis Ababa

Imperial Ethiopian Government (IEG) (1962) *Second Five Year Development Plan* 1962-1967. Addis Ababa: Brehanena Selam Printing Press

Imperial Ethiopian Government (IEG) (1968) *Third Five Year Development Plan* 1968-1973. Addis Ababa: Brehanena Selam Printing Press

Keller, Edmond J. (1992) 'Drought, War and the Politics of Famine in Ethiopia and Eritrea', *The Journal of Modern African Studies*, 30, Cambridge University Press

Kijne, J.W, S.A. Prathapar and M.C.S. Wopereis (1999) *How to Manage Salinity in Irrigated Lands: a selective review with particular reference to irrigation in developing countries.* Colombo : IIMI

Kissi, Edward (2000) 'The Politics of Famine in U.S. Relations with Eithiopia, 1950-1970'. *The International Journal of African Historical Studies*, Vol. 33, No: 1

Leach Mellissa, Robin Mearns and Ian Scoones 1999. 'Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. *World Development* Vol. 27. No 2

Lemelem Aregu Behailu (2001) *Knowledge, Tehcnology and Rural Livelihood in Ethiopia. The case of Recommended Rate of Chemical Fertilizer and its Adopotion in Ginchi.* MSc. Thesis. Wageningen University and Research Center

Lier, R.A.J. van. (1970) Report concerning the FAO/UNDP Project for Strengthening the Awash Valley Authority (Ethiopia 11)

Long, Norman (2001) *Development Sociology. Actor Perspectives*. London & New York: Routledge

Long, Norman and J.D. van der Ploeg (1989) 'Demythologizing Planned Intervention: An Actor Perspective' *Sociologia Ruralis*. Vol.XXIX - No: 3/4. Assen: Van Gorcum

Long, Norman and J.D. van der Ploeg (1994) 'Heterogeneity, actor and structure: towards a reconstitution of the concept of structure' in David Both (ed.) *Rethinking Social Development. Theory, Research and Practice*. Burnt Hill and Harlow: Longman Scientific and Technical

Long, Norman (1997) 'Agency and constraint, perceptions and practice: a theoretical position, in Haan, H. de and Norman Long (eds.) *Images and realities of rural life. Wageningen perspectives on rural transformations*. Assen: Van Gorcum

Mahetemselasse W. Meskel (1942) (E.C) *Zekreneger* (Amharic version)

Makonen Getu (1987) *Socialism, Participation, and Agricultural Development in Post-revolutionary Ethiopia: A study of constraints*. Doctoral Dissertation. University of Stockholm

Markakis, John and Nega Ayele (1978) *Class and Revolution in Ethiopia*. Spokesman

Merrey, J. Douglas (1997) *Expanding the Frontiers of Irrigation Management Research. Results of Research and Development at International Irrigation Management Institute 1984 to 1995*. Colombo, Sri Lanka: IIMI.

Mesfin Wolde Mariam (1986) *Rural Vulnerability to Famine in Ethiopia* 1958-1977. London: Intermediate Technology Publications

Ministry of Land Reform and Administration. (1971) *The Major Features of Prevailing Land Tenure System in Ethiopia* Addis Ababa

Ministry of Water Resources (MoWR) (1999) (1991E.C) *Yewoha Habt Policy* (Amharic version)

Ministry of Water Resources (MoWR) (2001) Irrigation Development Strategy (component of the water sector development strategy)

Ministry of Water Resources (MoWR) (2001) Irrigation Development Strategy (component of the water sector strategy) Draft Report. Addis Ababa

Mintesinot Behailu (2002) *Assessment and Optimisation of Tradition Irrigation of Vertisols in Northern Ethiopia: a Case Study at Gumselasa Microdam using Maize as an Indicator Crop*. PhD Thesis. Universiteit Gent.

Mitiku Haile and Tedros Adhanom Ghebreyesus (2002) 'Water Harvesting in Micro Dams: Its Impact on the Socio-Economic Conditions of the Community and the Salinty of the Irrigated Fields in Tigray', in Mitiku Haile and Sorssa Natea Merga (eds.) *Workshop on the Experience of Water Harvesting in the Drylands of Ethiopia: Principles and Practices* December 28-30, 2001 Mekelle, Ethiopia. Report No: 19

Mitiku Haile, Eyasu Yazew and Girmay Tesfaye (2001) 'Land Tenure and Plot Size Determination Issues in Small-Scale Development in Tigray, Northern Ethiopia' Paper presented for the workshop on ' *Current Issues on Land Tenure in Ethiopia',* Addis Ababa, Ethiopia, April 6-7, 2001

Moigne, Guy Le and Shawki, Barghouti (1990) *Irrigation in Sub-Saharan Africa. The Development of Public and Private Systems.* Washington, D.C.: World Bank Technical Paper Number 123

Mollinga, P. Peter (1998) *On the Waterfront. Water distribution, technology and agrarian change in a South Indian canal irrigation system*. PhD Thesis Wageningen University : Ponsen en Looijen

Moris, Jon (1987) 'Irrigation as a Privileged Solution in African Development'. *Development Policy Review*. Vo.5 London: SAGE

Moris, Jon R and Thom, Derrick J. (1990) 'Introduction' in Jon R.Moris and Derrick J.Thom *Irrigation Development in Africa Lessons of Experience. Studies in Water Policy and Management*, No.14. Boulder, Westview Press.

Nana-Sinkam S.C. (1995) *Land and Environmental Degradation and Desertification in Africa. Issues and Options for Sustainable Economic Development with Transformation.* Joint ECA/FAO Agriculture Division. Monograph No:10.

Neuman, Lawrence W. (1997) *Social Research Methods. Qualitative and Quantitative Approaches* (Third Edition). A Viacom Company

Office of the National Committee for Central Planning (ONCCP) (1984) *Ten Years Perspective Plan 1984/85 – 1993/94*. Addis Ababa

Office of the National Committee For Central Planning (ONCCP) (1990) *National Irrigation Policy and Strategy Workshop*. Addis Ababa, Ethiopia

Ofshe, R. (1992). 'Coercive persuasion and attitude change'. *Encyclopedia of Sociology*. Vol. 1, 212-224. New York: McMillan

Oliver de Sardan, J.P. (1988) 'Peasant Logics and Development Project Logics'. *Socioligia Ruralis*. Vol. XXVII-2/3

Ostrom, Elinor (1992) *Crafting Institutions for Self-Governing Irrigation Systems*. San Francisco: ICS Press

Pankhurst, Alula (1990) 'Resettlement: Policy and Practice' in Siegfried Pausewang, Fantu Cheru, Stefan Brune and Eshetu Chole (Eds.) *Ethiopia: Options for Rural Development.* London: Zed books Ltd.

Pankhurst, Richard (1986) *Social History of Ethiopia*

Pant, Dhruba Raj (2000) *Intervention Processes and Irrigation Institutions. Sustainability of Farmer Managed Irrigation Systems in Nepal.* Wageningen University

Pausewang, Siegfried (1990) ' "*Meret Le Arrashu*" Land Tenure and Access to Land: A socio-historical Overview' in Siegfried Pausewang, Fantu Cheru, Stefan Brune and Eshetu Chole (Eds.) *Ethiopia: Options for Rural Development*. London: Zed books Ltd.

Pender, John (2002) 'Overview of Conference Findings and Discussions' in Samuel Benin, John Pender and Simeon Ehui (eds.) *Policies for Sustainable Land Management in the East African Highlands. Summary of Papers and Proceedings of the Conference held at the United Nations Economic Commission for Africa, Ethiopia* April 24-26

Pender, John and Fafchampsm Marcel (2001) 'Land Lease Markets Efficiency in Ethiopia'

PMAC (Provisional Military Administration Council) (1975) Proclamation No: 31 of 1975 A proclamation to Provide for the Public Ownership of Rural Lands

Pottier, Johan (1999) *Anthropology of Food. The Social Dynamics of Food Security.* Cambridge: Polity Press

Raymakers, Benoit (2002) Review and Consequences of Reduction in Agriculture Input Sales in 2002. A situation analysis. Emergencies Unit for Ethiopia (UN-EUE)

Relief Society of Tigray (REST) (2001) Farming Systems, Resource Management and Household Coping Strategies in Northern Ethiopia. Report of a

Social and Agro-ecological Baseline Survey Study in the Southern and Eastern Zones of Tigray Region (forthcoming)

Rennie, J. Keith and Naresh C. Singh (1996) *Participatory research for Sustainable Livelihoods. A Guidebook for field Projects.* International Institute for Sustainable Development (IISD)

Robert, Nigel (ed.) (1989) *Agricultural Extension in Africa. A World Bank Symposium.* Washington, D.C: World Bank

Schulz, Manfred (1976) *Organising Extension Services in Ethiopia. Before and After Revolution.* Saarbruecken : Breitenbach

Schutz, Alfred and Luckmann, Thomas (1974) *The Structures of the Life-world.* Northewestern University Press

Scoones, Ian. 1996 *Hazards and Opportunities. Farming Livelihoods in Dryland Africa*: lessons from Zimbabwe. London: Zed Books Ltd.

Scott, James C. (1985) *Weapons of the Weak: Everyday Forms of Peasant Resistance*. New Haven and London: Yale University Press

Scott, James C. (1998) *Seeing Like the State. How Certain Schemes to Improve the Human Condition Have Failed.* New Haven Yale University Press

Seckler, David (1990) 'Private Sector Irrigation in Africa', in Shawki Barghouti and Guy Le Moigne *Irrigation in Sub-Saharan Africa. The Development of Public and Private Systems.* Washington, D.C.: World Bank Technical Paper Number 123

Shah, Tushaar, B.van Koppen, D.M. Merrey, M. de Lange and M.Samad (2002) *Institutional Alternatives in African Smallholder Irrigation. Lessons from International Experience with Irrigation Management Transfer*. Research Report 60. Colombo: International Water Management Institute:

Shank, Robert (1996) '1996 Fetilizer Situation: Progress, Problems and Programs' Emergencies Unit for Ethiopia (UNDP-EUE)

Shephered, Jack. (1975) *The Politics of Starvation*. New York: Carnegie Endowment for International Peace

SOS FAIM (2000) 'DECSI – Ethiopia'. Zoom microfinance No: 3

SOS Sahel (Ethiopia), IIED (UK) and LEI-DLO (the Netherlands) (2001) *Beyond Nutrient Balance: The impact of research on processes of change in Africa agricluture. Proceedings of the second international workshop of the EU/INCO-DEV Concerted Action Programme: Enhancing Soil Fertility in Africa: From Field to Policy-Maker.* Addis Ababa, Ethiopia, 12-15 March

Stake, Robert E. (1995) *The Art of Case Study Research.* Thousand Oaks: SAGE Steenbergen, F. van (1996) 'System captives: change and stagnation in farmer-managed water delivery schedules' in *ICID/FAO Irrigation Scheduling: From Theory to Practice. Proceedings of the ICID/FAO Workshop on Irrigation Scheduling.* Rome, Italy 12-13 September 1995

Tadesse H. (1988) 'Socio-economic Aspects of Small-Scale Irrigation in Ethiopia' in P.N.G. Van Steekelenburg (ed.). *Irrigated Agriculture in Africa. CTA seminar proceedings.25-29 April 1988 - Harare, Zimbabwe*. Volume II

Takele Gebre (2001) 'Maize Technology Adoption in Ethiopia: Experiences from the Sasakawa-Global 2000 Agriculture Program' in (eds.) Manderfro Nigussie, Dtanner, and S.Twumasi Afriyie. *Enhancing the Contribution of Maize to Food Security in Ethiopia. Proceedings of the Second National Maize Workshop of Ethiopia 12-16 November 2001, Addis Ababa, Ethiopia*

Tassew Woldehanna (2000) *Economic Analysis and Policy Implications of Farm and Off-farm Employment: A case study in the Tigray Region of Northern Ethiopia*. Mansholt, Wageningen University

Tenkir Bonger, Eleni Gabre-Madhin, Suresh Babu (2002) 'Agriculture Technology Diffusion and Price Policy', *Proceedings of a policy forum in Addis Ababa, March 25.* 2020 Vision Network for East Africa Report 1

Tiffen, M. (1987) *The Dominance of the Internal Rate of Return as a Planning Criterion and the Treatment of O&M Costs in Feasibility Studies*. ODI/IIMI Irrigation Management Network Paper 87/1b

Tigrai Rural Development Study. Annex 8.(1976)

Turner, Beryl (1994) 'Small-scale irrigation in developing countries'. *Land Use Policy,* Volume 11 Number 4.pp. 251-261

Ubels (1989) 'Irrigation Systems as Social Interfaces: Towards an Understanding of Irrigation Development as an Interactional Process', in Normal Long (ed.) *Encounters at the Interface. A perspective on social discontinuities in rural development.* Wageningen University

Underhill, H.W. (1984) *Small-scale Irrigation in Africa. in the context of rural development*. FAO

UNDP, ECA (FAO-ECA), TDA and the Regional Government of Tigray (1994) Project Document "Sustainable Agriculture and Environmental Rehabilitation in Tigray" SAERT vol.1

University of Sussex. Briefing. ET 15 Participatory Paradigms. Institutions for Natural Resource Management

Uphoff, Norman (1986) *Improving International Irrigation Management with Farmer Participation. Getting the Process Right.* Studies in Water Policy and Management, No: 11. Boulder: Westview Press

Uphoff, Norman (1991) *Managing Irrigation: Analysing and improving the performance of bureaucracies.* New Delhi: Sage

Vermillion, Douglas L. (1995) 'Irrigation Management Transfer: Conditions for Success', in J.C.MA. Geijer (ed.). *Irrigation Management Transfer in Asia. Papers from the Expert Consultation on Irrigation Management Transfer in Asia.* Bangkok and Chiang Mai 25-29 September 1995. Bangkok: Food

and Agricultural Organisation and International Irrigation Management Institute

Vermillion, Douglas L. and Juan A. Sagardoy (1999) Transfer of Irrigation Management Services Guidelines. FAO Irrigation and Drainage Paper 58

Villarreal, M. (1994) *Wielding and Yielding: Power, Subordination and Gender Identity in the Context of a Mexican Development Project.* PhD thesis, Wageningen University

Vincent, Linden (1994) "Lost chances and institutions in small-scale irrigation" Land *Use Policy* 1994; 11 (4) 309-322

Vincent, Linden (1995) *Hill Irrigation. Water and Development in Mountain Agriculture*. Intermediate Technology Publications

Vincent, Linden (1997) 'Minor Irrigation and Multi-Sector Water Supply in Drought-Prone Areas of India', in M.G. Kay, T. Franks & L. Smith (Eds.) *Water: Economics, Management and Demand. Proceedings of the 18th European Regional Conference of the ICID, Water as an Economic Good?* London: E&FN Spon

Vincent, Linden (1997) 'Water Scarcity and Irrigation'. Irrigation and Development Lecture. Wageningen University

Vincent, Linden (1997) "Irrigation as Technology, Irrigation as Resource: Hill Irrigation and Natural Resource Systems" in Shivakoti, Ganesh, George Varughese, Elinor Ostrom, Ashutosh Shukla, and Ganesh Thapa (eds.). *People and Participation in Sustainable Development. Understanding the Dynamics of Natural Resource Systems*. Proceedings of an International Conference 17-21 March 1996 Institute of Agriculture and Animal Science Tribhuvan University Rampur, Chitwan. Nepal

Vincent, Linden (1997) *Irrigation as a technology, irrigation as a resource: a sociotechnical approach to irrigation*. Wageningen Agricultural University.

Vincent, Linden (2001) Focus 9. Brief 5

Vincent, Linden (2001) 'Struggles at the social interface: developing sociotechnical research in irrigation and water management', in Paul Hebinck and Gerard Verschoor (Eds.). *Resonances and Dissonances in Development. Actors, networks and cultural repertoires.* Assen: Royal Van Gorcum

Vries, Pieter de (1995) 'A Review of Some Critical Perspectives on Development Bureaucracy and Policy', in Georg E. Frerks and Jan H.B. Den Ouden (eds) *In Search of the Middle Ground. Essays on the Sociology of Planned Development. Liber Amicorum Dirk van Dusseldorp*. Wageningen Agricultural University

Waal, van der Dirk and Mintesinot Behailu (2001) 'Water Quality Deterioration in Micro-dams. Is it becoming a threat for sustainable irrigated

agriculture?' A paper presented on *the 5th symposium on sustainable water resource development 23-24 July 2001 Arba Minch Water Technology*

Walta Information Centre (WIC) Mekelle, December 12, 2001

Walta Information Center (WIC). Addis Ababa, December 10, 2001

Walta Information Centre (WIC). House Approves Establishment of Water Fund, January 31, 2002

Waters, Malcolm (1994) *Modern Sociological Theory*. London, Thousand Oaks, New Delhi: SAGE

Webb, Patrick and Joachim von Braun (1994) Famine *and Food Security in Ethiopia. Lesson for Africa.* Chichester: John Wiley & Sons

Webb, Patrick, Joachim von Braun and Yohannes Yesehac (1992) *Famine in Ethiopia: Policy Implications of Coping Failure at National and Household Levels.* Research Report 92. Washington D.C.: International Food Policy Research Institute

Woldenhanna, T. and A. Oskam (2001) 'Income Diversification and Entry Barriers: Evidence from the Tigray Region of Northern Ethiopia'. *Food Policy* 26. Amsterdam: Elsevier Science Ltd.

Wollersheim, Lawernce (1991) 'Coercive Persuasion A New Coercive Phsycho-Technology'

Woreda Hentalo Wajirat (1993) Woreda Hintalo Wajirat Ab Godana Limat (1988-1992 E.C) Tigrigna version

World Bank (2003) *World Development Report*. World Bank and Oxford University Press

World Water Forum (2000) *A vision of water for food and rural development*. The Hague

Yibabe Tilahun and Esser B.Kjell (1999) 'Soil Conservation in Tigray' Noragric Brief No: 99/2

Yigzaw Hagos (1994) 'Gum Selassa Dam Site Feasibility Report (Engineering Part)'. Southern Zone SAERT Technical Team. Makelle

Yin, Robert (1989) *Case Study Research. Design and Methods. Applied Social Research Methods Series*. Volume 5. Sage Publications. United States of America

Yoder, R. (1994) *Locally managed irrigation systems: Essential tasks and implications for assistance, management transfer and turnover programs.* Colombo, Sri Lanka" International Irrigation Management Institute (IMI). (Monograph No: 3)

Young, John (1997) *The Tigray People's Liberation Front*. Cambridge University Press

Zaag, Pieter van der (1992) *Chicanery at the canal. Changing practice in irrigation management in western Mexico.* Amsterdam : CEDLA

Zewdie Abate (1994) *Water Resources Development in Ethiopia. An evaluation of present experience and future planning concepts*. Ithaca Press. Lebanon

Summary

This study examines irrigation practices, state intervention and the responses of farmers in the Tigray region of Ethiopia. Although governments have been involved in the construction of irrigation infrastructures since the mid-1980s to mitigate drought and famine in many parts of Ethiopia, the responses of irrigators to such interventions have never been studied. The main concern of this study therefore is to document how irrigation intervention interfaces with the life-worlds of small-scale irrigators.

Two theoretical perspectives are combined: a sociotechnical approach to irrigation and an actor-oriented analysis of the dynamics of state intervention. The former helps to explore irrigation management practices and the social effects of the technology used. Irrigation constitutes an arena of struggle where social actors negotiate and make decisions about technology and water management. The latter perspective focuses on the confrontations and interpretations of intervention as defined by the different actors and their contrasting life-worlds. A case study method is employed to investigate Hewane and Gum Selassa irrigation systems located in the drought-prone region of Tigray. The methodology used is largely ethnographic, that is it is concerned with understanding the social lives of local people and discovering how they construct meanings and livelihood practices in the natural, economic and socio-political settings in which they are located.

The thesis consists of eight chapters. The first outlines the conceptual and theoretical approaches used and lays out the main research questions that guide the study and its methodological considerations. Chapter 2 provides an account of the context of the research and an overview of agrarian policies and conditions, drought and famine situations, and irrigation development and technology choices. A brief historical account shows that none of the various government policies pursued over the previous thirty years has enabled Ethiopia to feed its people adequately. In drought-prone regions like Tigray, food-for-work and labor mobilizations for the construction of infrastructure such as roads and dams have been a regular and essential part of farmers' life-worlds since farm production has often failed to meet family needs. In these circumstances, government and international development bodies have looked to irrigation as a solution to the conditions of drought and famine.

Chapter 3 describes irrigation management practices and the struggle to preserve irrigated areas threatened by soil erosion in Hewane. The management of irrigation schemes under contrasting state regimes in Ethiopia has been the responsibility of government bureaucracies, not irrigators' organizations .It has

fallen, that is, to officials of the *tabia* (local) administration and the Agriculture Department to manage water allocation and resolve any disputes that might arise. The control of access to river water has likewise been administered. In short, water access, allocation and scheduling are dictated by government policies aimed at achieving 'food security' through irrigated agriculture at household level. Classifying plots into *hayfo* and *mesno* is the criterion used for allocating water in Hewane. Upon the decision of government, all soil and water conservation works were halted for over five years so that local labor could be mobilized for the construction of the new Shelenat dams, which eventually aggravated the gully erosion and slumping in Hewane. This agro-ecological problem - mediated by political power - threatened the livelihoods of farmers in Hewane, compelling them to take actions that were more in keeping with their existing life-worlds. One such important initiative was bee keeping.

Chapter 4 discusses government-initiated irrigation intervention through the construction of the Gum Selassa irrigation system. Like Hewane, the approach adopted was top-down and entailed the pooling and redistribution of farmers' holdings, despite the widespread skepticism about irrigation expressed by local people. Also like Hewane, the local government bureaucracy became embedded in irrigation management. The end result, however, was poor water control methods that have given rise to water scarcity in the irrigation system which now threaten farmers' livelihoods. Over the past six years there has been a serious scarcity of water, with the percentage of the plot holders not receiving water fluctuating between 21 and 85 percent.

Chapter 5 falls into three sections. The first section is a detailed description of irrigated agriculture in Gum Selassa and Hewane. It covers agricultural tasks and seasons and the crops cultivated in the irrigated fields and their yields. In both Hewane and Gum Selassa irrigation production has increased by taking advantage of modern agricultural inputs such as fertilizers and improved seeds. Although regional government officials highlight these increases in yield under irrigation, yields remain low for cash crops such as tomatoes and onions, and uncertain for maize as the main food crop. The second and third sections focus on household production dynamics and the practice of Woferit (sharecropping). The government's assumption that the plot holders would cultivate the irrigated plots themselves was not realized. Water users are widely involved in sharecropping: in Gum Selassa, 54 percent of the irrigators and in Hewane, 40 percent leased out their plots, with a higher proportion of female than male plot holders doing so. Due to sharecropping, a large majority of plot holders receive only one-fourth or one-third of the harvest reaped from their leased out plots, and between 70 and 80 percent of households consumed all their grain within four to seven months. Indeed a deficit in household food is a serious problem among these plot holders and

many are forced to seek work as labourers from outside. Hence, the practice of woferit (sharecropping) in both irrigation systems highlights the vulnerabilities of agricultural livelihoods and the differentiated life worlds of different local actors involved in irrigated agriculture.

Chapter 6 discusses the coping strategies commonly adopted during drought and famine situations at household level in Hewane and Gum Selassa. Such strategies span a combination of four types of strategy: a reductive strategy (i.e. an attempt to reduce expenditure and consumption), a depleting strategy (where the household gradually depletes its resources), a maintaining strategy and a regenerative strategy. At times of severe food shortage, the most important maintaining strategy is that of accessing food relief. The study also shows that rainfed farming has been and still remains the main source of livelihood for many local people.

Chapter 7 examines the arena of 'coercive persuasion' pertaining to the widespread diffusion of chemical fertiliser use in rural Tigray. Its aggressive promotion by extension workers and local government officials has led not only to a degree of scepticism and resistance among farmers as to its effectiveness, but also to farmers distancing themselves from the direct cultivation of their irrigable plots, in favour of leasing them out under sharecropping agreements. This takes place in the context of the growing vogue for programmes of 'Participatory Demonstration and Training Extension Systems' in the Hewane and Gum Selassa irrigation schemes. These programmes show how government- induced 'participation' has spearheaded coercive strategies in the implementation of public works such as dam construction and soil and water conservation.

Finally, in chapter 8, I pull together the findings and implications of the research by identifying other measures (besides the development and improvement of irrigation systems) that must be put into place in order to mitigate drought-induced food shortages.

Samenvatting

Dit proefschrift onderzoekt irrigatiepraktijken, staatsinterventie en de reacties van boeren hierop in Tigray, Ethiopië. Hoewel sinds het midden van de jaren tachtig de Ethiopische overheid actief betrokken is geweest bij de aanleg van infrastructuur ten behoeve van irrigatie ter bestrijding van de droogte en honger in grote delen van Ethiopië, zijn de reacties van boeren hierop nooit in detail bestudeerd. Dit proefschrift bestudeerd de wisselwerking tussen irrigatieinterventie en de leefwereld van kleine, irrigerende boeren.

Twee theoretische benaderingen worden hier gecombineerd: een sociaal-technische benadering van irrigatie en een actor benadering om de dynamiek van staatsinterventie te bestuderen. De eerste benadering helpt bij het onderzoeken van irrigatiebeheerpraktijken en de sociale effecten van de gebruikte technologie. Irrigatie vormt een arena van strijd waarbinnen sociale actoren onderhandelen en beslissingen nemen over technologie en waterbeheer. De tweede benadering richt zich op de confrontaties en interpretaties van interventie, zoals ze gedefinieerd worden door verschillende actoren en hun contrasterende leefwerelden. De *case-study* methode wordt toegepast om de irrigatiesystemen, die gelegen zijn in de droogtegevoelige regio van Tigray, te onderzoeken. De gebruikte methodologie is overwegend etnografisch van aard en concentreert zich op het begrijpen van het sociale leven van de lokale bevolking en hoe zij betekenis verlenen aan en de wijze van levensonderhoud construeren binnen de natuurlijke, economische, en sociaal-politieke setting waarin zij leven en werken.

De dissertatie bestaat uit acht hoofdstukken. Het eerste hoofdstuk schetst de conceptuele en theoretische benaderingen en formuleert de voornaamste onderzoeksvragen. Ook worden in dit hoofdstuk de methodologische overwegingen die ten grondslag liggen aan de dissertatie uitgewerkt. Hoofdstuk 2 geeft een uiteenzetting van de context van het onderzoek en een overzicht van het agrarische beleid, de irrigatieontwikkeling en technologiekeuzen, en de omstandigheden van droogte en honger die zich voordoen in het onderzoeksgebied. Een kort historisch overzicht laat zien dat geen van de verschillende beleidsinitiatieven die zijn geformuleerd en uitgevoerd gedurende de afgelopen dertig jaar, Ethiopië in staat heeft gesteld om haar bevolking voldoende te voeden. In droogtegevoelige regio's zoals Tigray zijn voedsel-voor-werk programma's en de mobilisatie van arbeid voor de aanleg van infrastructuur, wegen of dammen, een essentieel onderdeel van de leefwereld van boeren; dit mede daar hun agrarische productie niet voldoende is om in de behoeften van de hun families te voorzien.

Geconfronteerd met deze situatie, wordt door de overheid en de internationale ontwikkelingsorganisaties irrigatie als een oplossing voor het voorkomen van droogte en honger beschouwd.

Hoofdstuk 3 beschrijft irrigatiebeheerpraktijken in Hewane alsmede de strijd voor het behoud van geïrrigeerde gebieden die worden bedreigd door bodemerosie. Het beheer van irrigatie systemen onder verschillende politieke regimes in Ethiopië lag in handen van de staatsbureaucratie, en dus niet van organisaties van irrigerende boeren. Functionarissen van de *tabia* (lokale overheid) en het Departement van Landbouw hebben in deze opzet altijd de waterverdeling beheerd en pogen ook de mogelijke geschillen te beslechten. De controle over toegang tot het water van rivieren is op een zelfde manier geregeld. Met andere woorden: de toegang, verdeling en planning van water(gebruik) wordt gedicteerd door overheidsbeleid dat gericht is op het bewerkstelligen van voedselzekerheid op huishoudniveau door middel van geïrrigeerde landbouw. Het classificeren van percelen van land in Hewane in *hayfo* en *mesno* is het gebruikte criterium voor de waterverdeling. Vanwege een overheidsbesluit werden alle bodem- en waterconserveringswerken stopgezet voor een periode van meer dan vijf jaar, teneinde lokale arbeid in te zetten voor de aanleg van de nieuwe Shelenat dammen. Een van de gevolgen van deze maatregel was dat mede hierdoor de geulerosie en *slumping* sterk toenam in Hewane. Dit agro-ecologische probleem – veroorzaakt door de tussenkomst van politieke macht – bedreigde het levensonderhoud van boeren in Hewane. Dit dwong hen om hun dagelijkse activiteiten meer in overeenstemming te brengen met de eigen leefwereld. Een van dergelijke activiteiten betrof het houden van bijen.

Hoofdstuk 4 bespreekt irrigatie interventie die door de overheid werd geïnitieerd en behelsde de aanleg van het Gum Selassa irrigatiesysteem. Evenals in Hewane was de benadering *top-down*. Ook hier werden boerenpercelen samengevoegd en vervolgens herverdeeld en dit werd gedaan ondanks de wijdverbreide scepsis onder de lokale bevolking over irrigatie. Ook hier werd de lokale overheidsbureaucratie verantwoordelijk gemaakt voor het beheer van het irrigatiestelsel en de verdeling van water ten behoeve van irrigatie. Het eindresultaat was echter teleurstellend: de wijze van waterbeheersing leidde tot schaarste van water en vormde mede hierdoor een bedreiging van het levensonderhoud van de boeren. Gedurende afgelopen zes jaar werden veel boeren getroffen door een ernstig tekort aan water; het percentage landbezitters die geen water ontvingen varieerde gedurende die periode van 21 en 85 procent.

Hoofdstuk 5 bestaat uit drie delen. Het eerste gedeelte is een gedetailleerde beschrijving van de geïrrigeerde landbouw in Gum Selassa en Hewane. Het beschrijft de agrarische taken en seizoenen, de verbouwde geïrrigeerde

gewassen en de opbrengsten. In zowel Hewane als Gum Selassa is mede door het gebruik van moderne agrarische *inputs*, zoals kunstmest en verbeterde zaden de productie van geïrrigeerde gewassen toegenomen Hoewel regionale overheidsfunctionarissen deze toenamen steeds benadrukken, blijven de opbrengsten voor de voor de markt geteelde gewassen, zoals tomaat en ui, aan de lage kant. Verontrustend is ook dat de opbrengst van maïs, het primaire voedselgewas in Tigray, sterk varieert en in veel gevallen uiterst onzeker is.
Het tweede en derde gedeelte van dit hoofstuk richten zich op de dynamiek van de huishoudelijke productie en de praktijk van *Woferit* (deelpacht). De aanname van de overheid dat de landbezitters zelf de geïrrigeerde percelen zouden verbouwen is niet uit gekomen. Watergebruikers zijn op grote schaal betrokken bij deelpacht relaties; in Gum Selassa verhuurde 54 procent van de irrigerende boeren hun percelen en in Hewane is dat 40. Opvallend is dat vrouwen dit meer doen dan mannen. Door middel van deelpachtrelaties ontvangt een meerderheid van de landeigenaren slechts een derde of zelfs een vierde deel van de oogst die op de door hun verhuurde percelen wordt gerealiseerd. Bovendien, consumeerden zo'n zeventig tot tachtig procent van de huishoudens hun voedsel voorraad binnen vier tot zeven maanden. Tekort aan voedsel is voor de huishoudens van deze landeigenaren een probleem en velen zijn gedwongen om werk te zoeken als arbeider. De praktijk van *woferit* in beide irrigatiesystemen illustreert de kwetsbaarheden van een kostwinning gebaseerd op agrarische productie, maar ook de gedifferentieerde leefwerelden van lokale actoren in de geïrrigeerde landbouw.

Hoofdstuk 6 bediscussieert strategieën van redzaamheid van huishoudens in Hewane en Gum Selassa die worden gebruikt ten tijde van droogte en honger. Zulke strategieën omvatten een combinatie van vier verschillende typen: een reductiestrategie (een poging om uitgaven en consumptie te verlagen), een verbruikstrategie (waarbij het huishouden langzaam haar bronnen van bestaan opmaakt), een handhavingstrategie en een oplevingstrategie. Ten tijde van ernstige voedselschaarste is voedselhulp de meest belangrijke component van de strategie die gericht is op handhaving. Het proefschrift laat echter ook zien dat regenafhankelijke landbouw altijd de meest belangrijke bron van levensonderhoud is geweest voor velen en nog steeds zal blijven.

Hoofstuk 8 onderzoekt de arena van 'dwingende overreding' met betrekking tot de wijdverspreide verbreiding van het kunstmestgebruik in Tigray. De agressieve promotie daarvan heeft niet alleen geleid tot een zekere mate van scepsis en weerstand onder boeren ten aanzien van haar effectiviteit, maar ook heeft ook geresulteerd in de eerder geanalyseerde praktijken van deelpacht. Dit alles heeft plaats gevonden in de Hewane en Gum Selassa irrigatiestelsels in het kader van de recentelijk populair geworden benadering

van 'Participatieve Demonstratie en Training Voorlichtingssystemen' (*Participatory Demonstration and Training Extension Systems*). Deze programma's laten zien hoe de door de overheid gegenereerde 'participatie' geleid heeft tot dwang bij de uitvoering van publieke werken, zoals de aanleg van dammen en bodem- en waterconservatie.

Tenslotte, hoofdstuk 8, vertaald de bevindingen en implicaties van het onderzoek door het identificeren van andere maatregelen (naast de ontwikkeling en verbetering van irrigatie systemen) die toegepast moeten zouden worden om de voedseltekorten veroorzaakt door droogte te lenigen.

About the Author

Woldeab Teshome was born on 18 March 1959 in Dessie, Ethiopia, where he completed primary and secondary school. He did his undergraduate studies in sociology at Addis Ababa University. He was employed in the Ministry of Culture and Sports as junior planning officer and served in various capacities for eight years. In 1988, he joined the London School of Economics and Political Sciences, and obtained a MSc. in Social Policy and Planning in 1989. Upon returning from England, he continued his service as head of the planning and research department with the Ministry of Culture until August 1992.

In September 1992, he became a lecturer in sociology in the Department of Sociology and Social Administration of Addis Ababa University. He also conducted consultancy works on the socio-cultural aspects of guinea worm, malaria and sexually transmitted diseases for the World Health Organization and Family Health International.

In May 1999 he moved to Wageningen, and began as a research fellow at the Rural Development Sociology Group of Wageningen University. For his PhD research, he conducted fieldwork in Tigray region, northern Ethiopia. His research interests include health, rural livelihoods and irrigation.

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