AG:UTF/ETH/037/ETH
Final Report, Vol. 1

E T H I O P I A N   F U N D S - I N - T R U S T

ETHIOPIAN HIGHLANDS RECLAMATION STUDY

E T H I O P I A

FINAL REPORT

Volume 1

Report prepared for
the Government of Ethiopia
by
the Food and Agriculture Organization of the United Nations

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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ACKNOWLEDGEMENTS

The compilation of this report, with its coverage of the different sectors and activities relevant to the development of an area as large and diverse as the Ethiopian highlands, would not have been possible within the two-year period since the study became operational without the assistance of many people. Unfortunately it is not possible to name individually the several hundred persons who have contributed to the EHRS, sometimes at much inconvenience to themselves, but the team acknowledges with gratitude its indebtedness to all those persons and institutions who have assisted the project by providing information, advice, suggestions, comments on working papers and logistical support and facilities.

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None of the abovementioned institutions or persons are responsible for the views expressed; this responsibility and that for any errors lies solely with members of the EHRS team.

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ABBREVIATIONS 1/

ADB	African Development Bank
ADD	Agricultural Development Department of the MOA
AEPA	All Ethiopian Peasants Association
AIDB	Agricultural Industrial Development Bank
AIMC	Agricultural Inputs Marketing Corporation
AISCO	Agricultural Inputs Service Corporation
AMC	Agricultural Marketing Corporation
ARDU	Arsi Rural Development Unit of MOA
ASE	Agricultural Service Ethiopia
CADU	Chilalo Agricultural Development Unit of MOA
CBD	Coffee Berry Disease
CBE	Commercial Bank of Ethopia
CDS	Conservation-based Development Strategy
CIMMYT	International Centre for Wheat and Maize Improvement
COPWE	Commission for the Organization of the Party of the Workers of Ethiopia
CPSC	Central Planning Supreme Council
CSO	Central Statistical Office
DA	Development Agent
EDDC	Ethiopian Domestic Distribution Corporation
EELPA	Ethiopian Electric Light and Power Authority
EHRS	Ethiopian Highlands Reclamation Study
ERR	Economic rate of return
ESC	Ethiopian Seed Corporation
ETCA	Ethiopian Transport Construction Authority
FAO	Food and Agriculture Organization of the United Nations
FaWCDA	Forestry and Wildlife Conservation Development Authority
FFHC	Freedom from Hunger Campaign (FAO)
FFW	Food-for-Work
FGAE	Gamily Guidance Association of Ethiopia
FS	Farming System
FTC	Farmers' Training Centre
GDP	Gross Domestic Product
GNP	Gross National Product
GOE	Government of Ethiopia
HASIDA	Handicrafts and small-scale Industries Development Authority
HPC(Z)	High Potential Cereal Crops (Zone)
HPP(Z)	High Potential Perennial Crops (Zone)
HQ	Headquarters

1/ Includes abbreviations used in Parts I, II and III.

IAR	Institute of Agricultural Research
ICIPE	International Centre for Insect Physiology and Ecology
ICRAF	International Centre for Research in Agro-foresty
ICRISAT	International Centre for Research in Semi-Arid Tropics
IDR	Institute of Development Research
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILO	International Labour Organization
IPPA	International Planned Parenthood Association
IUCN	International Union for the Conservation of Nature
IRR	International Rate of Return
IUD	Intra-uterine Device
LPG	Length of Growing Period
LPC(Z)	Low Potential Cereal Crops (Zone)
LSR	Livestock Sub-Sector Review
LUPRD	Land Use Planning and Regulatory Department of the MOA
M&E	Monitoring and Evaluation
MCH	Maternal and Child Health
MCTD	Ministry of Coffee and Tea Development
MOA	Ministry of Agriculture
MOE	Ministry of Education
MPP	Minimum Package Programme
MSFD	Ministry of State Farm Development
NGO	Non-Governmental Organization
NRDC	National Revolutionary Development Campaign
ONCCP	Office of National Committee for Central Palnning
PA	Peasant Association
PADEP	Peasant Agricultural Development Programme
PC	Producer Cooperative
PMAC	Provisional Military Administrative Council
REWA	Revolutionary Ethiopian Women's Association
RRC	Relief and Rehabilitation Centre
SC	Service Cooperative
SCRP	Soil Conservation Research Project
SIDA	Swedish International Development Assistance
SPCRP	Sirinka Pilot Catchment Rehabilitation Project
SRC	Silviculture Research Centre
SWCD	Soil and Water Conservation Department of MOA
T&V	Training and Visit agricultural extension system
TLU	Tropical Livestock Unit
TYPP	Ten Year Perspective Plan of the Government of Ethiopia

UDA	Urban Dwellers Association
UN	United Nations
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNU	United Nations University
USLE	Universal Soil Loss Equation
WADU	Welamo Agricultural Development Unit of MOA
WB	World Bank
WCARRD	World Conference on Agrarian Reform and Rural Development
WFP	World Food Programme
WP	Working Paper
WRDA	Water Resources Development Authority
WWF	World Wildlife Fund

EB	Ethiopian Birr
ha	hectare
kcal	kilo-calorie
kg	kilogramme
km	kilometre
masl	meters above sea level
p.a.	per annum
t	metric tonne

FOREWORD

The highlands of Ethiopia include approximately 88 percent of the total population of the country, over 95 percent of its regularly cropped lands, around two-thirds of its livestock, almost half of its land area and over 90 percent of the national economic activity. The physical resources of the highlands, particularly the land, are seriously threatened by degradation, which in turn threatens economic and social development throughout the country. This threat provided the underlying rationale for undertaking the Ethiopian Highlands Reclamation Study (EHRS), prepared by the joint Government of Ethiopia (GOE) and FAO project UTF/ETH/037/ETH, which was funded through a World Bank loan.

By the year 2010, Ethiopia is likely to have over twice as many inhabitants as today. The growth of Ethiopia's population has far-reaching implications and poses major challenges for development. Most important, the present trends of degradation must not continue, since too much land has already been irreversibly lost from productive use. Ethiopia's development activity must take into account the resource needs of future generations. In this respect, it is of paramount importance to conserve the resource base in order to sustain and improve the livelihood of future generations in Ethiopia. Conservation can no longer be viewed separately from development: a nationwide strategy of conservation based development is needed. This is the underlying theme of the study.

The study was divided into two major substantive phases: the formulation of an overall rural development strategy for the highlands, in which the main thrust was on conserving and improving the productivity of resources, and the preparation of investment projects for implementing the strategy, after its approval by the Government. The first phase culminated in the present report, which presents an indicative rural development strategy for the highlands. The report is divided into three parts:

- Part I provides the context within which the degradation problem is analysed, describes the physical, social and economic resources for rural development and considers how these are organized and used.
- Part II states how and why resources have been degraded and evaluates actions taken to combat such degradation.
- Part III presents a strategy for controlling degradation within the broader context of rural development.

In Part I, the highlands are divided into three broad agroecological zones and nine predominant farming systems are identified, each of which coincides approximately with three altitudinal belts in each zone.

Chapter 1 elaborates on the background, rationale and objectives of the EHRS, describes the project and the planning concepts, methodology and characteristics involved. Chapter 2 defines the study area and explains how it has been divided into zones and sub-zones. The physical resources are then reviewed for each zone as well as for the study area as a whole. The degradation of Ethiopia's resources has been continuing for centuries and the historical and social context of this problem is presented in Chapter 3. This chapter also summarizes the structure of the Ethiopian Government and local administration and gives estimates of the present and projected population to 2010, and both traditional and current land tenure and related peasant institutions are described.

The problems of degradation have some of their roots outside the agricultural sector and the problem cannot be solved exclusively within the sector, as it alone cannot provide all the resources required. Many other linkages and dynamic interactions exist between degradation, solutions to the degradation problem and the non-agricultural sectors of Ethiopian economy and society. Thus Chapter 4 reviews the economy and the economic and social development in Ethiopia and puts both the highlands and the rural sector into their national context. It briefly describes the other major sectors and reviews major constraints, including accessibility, energy, skilled manpower and foreign exchange. It also indicates the priorities attached to different sectors by the Government as evidenced by plans, expenditures and budgetary allocations. The government's taxation system and its progress in social development are briefly described, as these are also linked to the degradation issue. Finally, the overall prospects for development at the macro-level are reviewed, which indicate that much will inevitably depend on the development of the rural sector.

The rural sector is the subject of Chapter 5. Land use and major economic activities in this sector are largely confined to cropping, livestock and forestry. This chapter draws attention to the overall importance of the agricultural sector and describes some of the major constraints which have contributed to the disappointing performance of both peasant and state farm agriculture. Because of the overriding importance of the peasant sector, farming systems and cropping practices are reviewed and a model of each system, together with charts indicating land use in each zone, are presented in Annex 4. Chapter 5 also indicates the importance of livestock to the highland farming systems. Agricultural support services, institutions, markets and marketing are reviwed and the chapter ends by drawing attention to the alarming rate of deforestation and to progress and constraints in forestry development.

The ways in which degradation has occurred are examined in detail in Part II and an evaluation is made of actions taken to deal with this problem.

It is well known that land degradation is widespread and serious in the highlands of Ethiopia, but only general and usually rather qualitative estimates exist of its extent, severity and distribution. The purpose of Chapter 6 is to consolidate the qualitative view of highlands degradation and to supplement it by adding quantitative dimensions. It seeks to identify the most serious and common types of degradation in the highlands, to demarcate their extent and severity and to identify the areas most seriously affected and threatened. Tentative estimates are given of the rate of degradation and both the present distribution and rates of degradation are related to the interaction of socioeconomic factors, land use and physical and ecological conditions.

Chapter 7 reviews the consequences of degradation, in socioeconomic as well as in physical terms. It presents some tentative estimates of the costs of degradation to Ethiopia as a whole, as well as to individual farmers, identifies the areas where degradation is costing most and estimates the numbers of people affected. It presents an appalling scenario of the future, based on the continuation of present trends of degradation.

Chapter 8 describes and evaluates how degradation is being controlled by conservation and reclamation efforts of the people and the Government of Ethiopia, assisted by external agencies,and presents achievements and estimates costs, benefits and impact. It identifies weaknesses and constraints and attempts to use past experience as a basis for relevant future lessons.

Resettlement is discussed in Chapter 9, including a brief outline of resettlement and land administration policy before 1974. The rest of the chapter deals with resettlement after this date and includes information on the institutions involved, the settlement process up to November 1984, settlement models, the manpower involved and new approaches, as well as the emergency programme of November 1984. Costs and benefits, both estimated and recurrent, are reported. The chapter ends with a discussion of resettlement in relation to conservation-based development.

The presentation of the resource base in Part I and the concentration on resource degradation and the evaluation of actions to control it in Part II provide the context within which the final section, Part III, of the report attempts to coordinate strategy for the conservation and development of the highlands.

The degradation of its resource base is the most serious constraint to sustained development in Ethiopia. The threat to national livelihood calls for analyses not only at the national level, but throughout all levels down to farm level, for ultimately it is the rural land users themselves, the peasants, who must attain and sustain the conservation of their lands. At all levels, socioeconomic considerations are blended with physical factors to give the analyses a multidisciplinary character reflecting the wide range of expertise and experience of the EHRS team.

As soil degradation is already so widespread, there is an urgent need to conserve the productive soil still remaining and to prevent the spread of soil degradation to areas not yet affected. The current famine in northern Ethiopia will, like the 1973/74 famine, draw attention to the continuing degradation of resources, for it is this, rather than the drought per se, which accounts for the extent and severity of the famine. If degradation continues as at present, future effects will be appalling.

The basic objectives of the development strategy for Ethiopia and the options available are presented in Chapter 10. Growth with equity is seen as a priority objective and conservation is considered as a prerequisite for sustained development and socialism. Specific objectives and options for conservation-based development are discussed. Strategy proposals are differentiated through farm model analyses and the chapter ends by giving the uses and audience of such proposals.

The various measures utilized for land reclamation and conservation are outlined in Chapter 11, including vegetative and structural measures, conservation, research, extension and training. Motivation for carrying out these measures and the effects of land tenure are also discussed.

The importance of agriculture in development strategy is highlighted in Chapter 12 and priorities are indicated. Cropping, irrigation, livestock, agroforestry, research, training, extension, inputs, credit, marketing, pricing, efficiency, capital accumulation and marketable surpluses are all reviewed in this context.

Chapter 13 deals with rural development in relation to energy, forestry, industry and public works, as well as the role of resettlement, migration, establishment of villages, education and other social services, transport, communications and taxation. A summary of rural development priorities is given at the end of the chapter.

A strategy overview for national development considers the factors of population, famine and poverty and linkages between urban and rural development and beween lowlands and highlands development in Chapter 14. Criteria for selecting national development priorities and some indicators for project priorities are given, as well as views on target incomes and economic growth.

Planning and implementation of the development strategy is the subject of Chapter 15.

The report is based on the work of members of the EHRS team and consultants (listed in Annex 1), their reports (listed in Annex 2) as well as many discussions with peasants and officials of the Government and other agencies and a wide range of other information, analyses and reports (listed in Annex 3).

I conclude by thanking all those who have contributed to the study, and most particularly the study team itself, which has persevered under continuing pressures, sometimes in very difficult and uncertain circumstances.

Ethiopia Tikdem

Ermias Bekele
Head Land Use Planning and Regulatory Dept.
Addis Ababa, 1985

PART I

RESOURCES FOR RURAL DEVELOPMENT

Chapter 1

INTRODUCTION TO THE ETHIOPIAN HIGHLANDS RECLAMATION STUDY

1.1 OBJECTIVES AND STRUCTURE

The care of land and water is essential to the survival of the human race. Land and water are used to provide most of our food, fibres for clothing and industry and wood for fuel and building. This study is concerned with the higher lands of Ethiopia, which are identified in the map in Figure 1.1. These lands with their fertile soils, a climate favourable for farming and relatively protected from malaria, tsetse and foreign aggression, have supported a growing farming population for over two thousand years. 1/ The increase in population has extended farming to increasingly vulnerable lands and reduced fallow period. Feudal and other forms of dependent land tenure, coupled with the day to day preoccupation with survival, have, over the centuries led the growing Highlands population to farming the land in ways inappropriate to its sustained use. This has inevitably led to land degradation, typified by excessive deforestation and soil erosion, and by worsening water storage and flow regimes. These reduce potential productivity of land and so aggravate the situation further: a spiral of degradation has developed.

It is estimated 2/ that over 1900 million tons of soil are lost from the Highlands of Ethiopia annually. These losses are of productive top soil and for all practical purposes are irreversible for it takes many years to generate a ton of top soil. Thus the Highlands of Ethiopia contain one of the largest areas of ecological degradation in Africa, if not in the world. Environmental conditions have worsened to such an extent that in some parts of the Highlands millions are now scarcely able to subsist even in years of good rainfall. Years of poor rainfall threaten famine, with increasing severity and extent. Other Highland areas are not yet threatened by famine; nevertheless they are being gradually degraded, and it is only a question of time before the degradation spiral threatens livelihood in these areas too. Thus, a recent review of Ethiopian agriculture states: "Underlying these concerns is a serious problem of soil erosion which is

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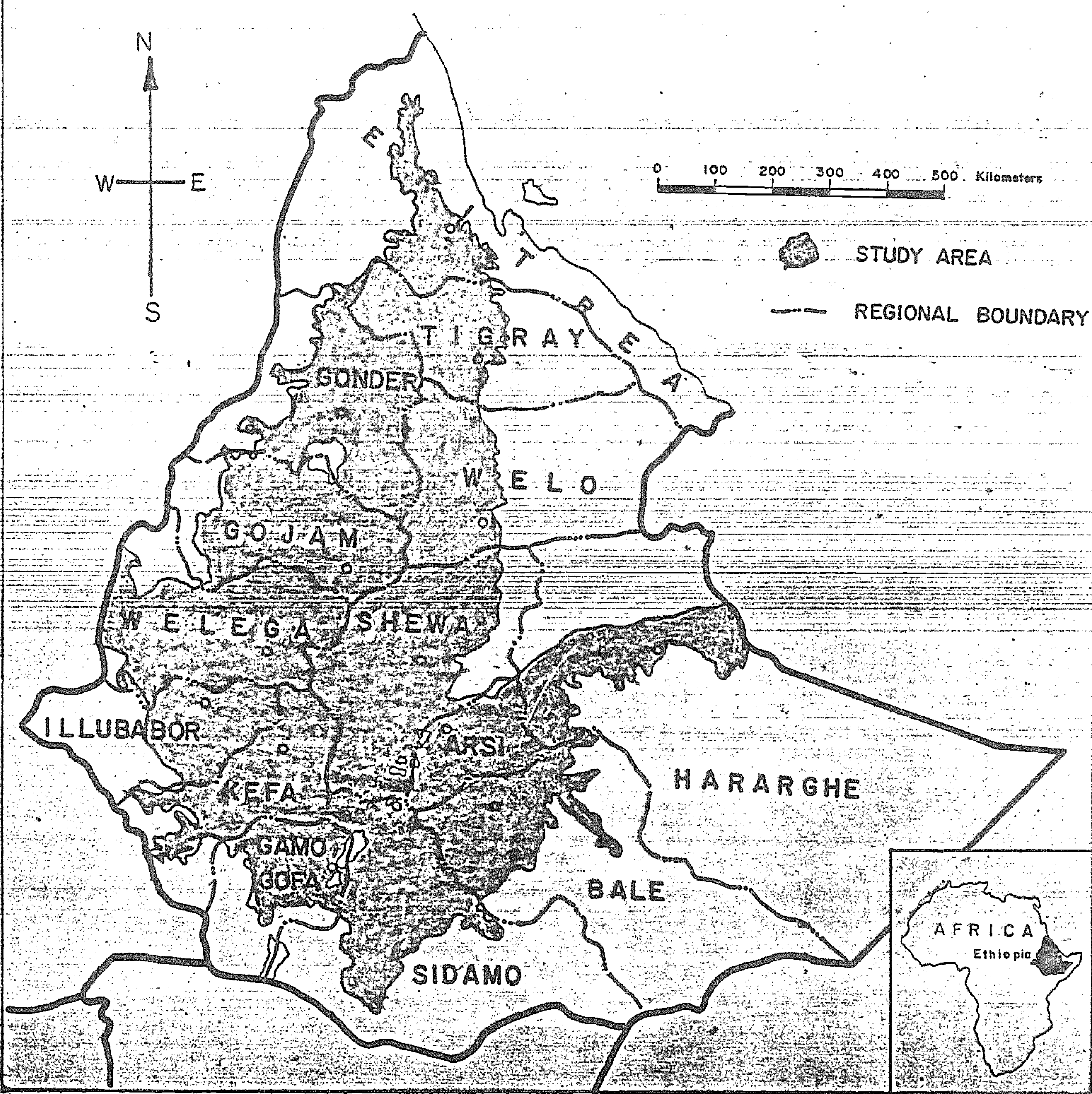
1/ Though irregularly, because of famines, wars, etc.

2/ The details of these estimates are given in Chapter 6 (Part II) section 6.4.2.

THE STUDY AREA

Fig. 1.1



gradually undermining the natural agricultural heritage of the country." (World Bank, 1983a, p.1) 1/

This process of degradation threatens both millions of Ethiopians today and even more tomorrow. It poses the greatest long-term threat to human survival in Ethiopia. It poses one of the greatest challenges facing the Ethiopian people and Government. Both people and Government are already responding to this challenge. Among other responses, the Government has initiated this Ethiopian Highlands Reclamation Study (EHRS).

The EHRS is intended to analyse and explain the processes, causes, extent and types of degradation in the Highlands; identify the areas and peoples most critically affected and threatened; estimate the rates and costs of degradation in different areas, both now and in the future; assess the need to tackle degradation (in terms of alternative development options); and evaluate what is already being done to combat or avoid degradation. These specific assessments and analyses are presented in Part II of the report; Part I is a more general review of the physical, social and economic resources of the Highlands and of how these are being used in agriculture, livestock and forestry. This initial chapter provides the background and rationale for the EHRS, summarizes the nature and timing of its preparation, describes the nature and characteristics of the Conservation-based Development Strategy to be presented in Part III and discusses the planning concepts and methods used. Together, Parts I and II put the degradation problem into proper perspective in the Ethiopian context, both quantitatively and qualitatively, and present a dynamic picture of why and how degradation is occuring, how serious it is, and how effective are current actions to combat it. They assess both the current "benchmark" situation and present the scenario embodying continuation of present trends.

Within the context of the above assessments, the EHRS is intended to systematically review the options for improving what is already being done to combat degradation, and to formulate a coherent strategy both for reclaiming already degraded lands and for conserving lands threatened by degradation. This is presented in Part III, which includes at its outset a summary statement of major GOE objectives relevant to the proposed strategy. Part III is intended to show how the use of land in the Highlands can be influenced - through policies and projects - to become more consistent with the longer term improvement of productivity. The product of the Study is the Conservation-based Development Strategy (CDS).

1/ All non-EHRS references are listed in the bibliography presented in Annex 3. All EHRS reports are listed in Annex 2.

1.2 BACKGROUND AND RATIONALE

1.2.1 Drought, degradation and conservation

Even before the most recent devastating drought it was recognized that vulnerability to drought and the severity of consequent famine are largely attributable to misuse of the land.

The exceptionally severe drought of 1972-73 probably killed over 250 000 people in northeast Ethiopia. A joint GOE/WB mission surveying the effects of that drought concluded that:

> "The disaster could not be entirely blamed upon natural causes, notably an exceptionally severe drought, but was largely brought about by a combination of bad land use and increasing human and animal populations. It is, and has been for many years, apparent that practically all land that can be cultivated is cultivated; that hillsides are almost entirely denuded of their original forest or woodland cover ... soil conservation is either ineffective or totally lacking ... livestock are normally depastured on steep slopes without any attempt to control their movements or numbers, with the result that many such areas are bare soil and rock infested with unpalatable weed shrubs... The combination of all these adverse factors, which together add up to long-continued bad land use, is the main primary cause cause of the disaster." (GOE/WB, 1974)

The 1972-73 drought, and the subsequently less severe but more frequent droughts in the intervening years to 1984 1/, together with the high costs of providing emergency food, medical and other relief against the effects of drought 2/, focused increasing attention of all concerned on the need for preventive and preparatory actions to reduce the effects of droughts, both in terms of their severity and their coverage of people affected. There are agricultural approaches, methods and practices which make sustained production possible, even in low rainfall years, through a better understanding of the

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1/ Some indications of the possibly increasing frequency of drought is presented in GOE 1984a. From analyses covering recent decades, the paper concludes that "it appears from documented information that drought or lean rainfall years in Ethiopia have about seven to ten years recurrence."

2/ The 1974 GOE/WB mission estimated that internationally financed relief cost some US$38 million while GOE relief cost at least another US$5 million.

productive capacity of natural resources under various ecosystems. There are well-known techniques both for preventing further degradation and for combating existing degradation: people may move from areas considered to be irreversibly degraded or excessively vulnerable to the effects of drought; irrigation may also be developed to reduce reliance on rainfed agriculture.

In light of such considerations the GOE, sometimes assisted by different external assistance agencies, has, in the last decade, been implementing various programmes, policies and projects aimed at rehabilitating degraded lands, soil and water conservation, and resettlement of particularly vulnerable populations. The costs of these measures have been considerable - probably more than US$50 million by the GOE alone 1/ - but their total impact, as assessed by various observers (e.g. Bolt, 1981) and as verified in Part II of this Study, has been small compared to the massive extent and continuing rate of degradation, and also small compared to the costs of degradation. For example, it is estimated (see Part II) that the area in the Highlands suitable for cropping is being reduced by around 60 000 ha p.a. as a result of degradation. Over a decade, cereal production valued at over US$500 million may have been lost because of this, and the losses accruing through the effects of degradation on yields may be even greater (see Chapter 7).

1.2.2 The need for a more planned approach

Although much valuable conservation work has already been undertaken, the GOE recognizes that the approach has necessarily been simplified (for example, conservation engineering has not been differentiated for the various ecosystems; too little attention has been paid to vegetative techniques of conservation, etc.). Priority areas and projects have not been selected very systematically. It is also recognized that allocation of many resources has been only partially successful (for example, in some areas newly built conservation works have not been maintained, and from some settlements many settlers have returned).

Both the amount of resources allocated to tackling degradation and their impact have to be increased. The nature and direction of resource allocation and policies to tackle degradation and its effects have to be decided upon, as well as the priority and amount of resources to be allocated to this challenge. The strategy and policy decisions which have to be made concerning the future of the Highlands may be among the most difficult and far-reaching in implication of any which the GOE has faced. At one extreme, the decision might be to gradually abandon the severly degraded areas and resettle population

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1/ See Chapters 8 and 9 for details.

elsewhere. At the other extreme, it might be decided to reclaim the populated catchments at a rate which would make long distance resettlement unnecessary. In view of the scale of these decisions, the GOE initiated the EHRS to provide information, analyses and advice to assist decision-making in this context. By implication the GOE accepts that the previous project approach which has characterized conservation, rehabilitation and resettlement efforts over the past decade, though understandable, is no longer sufficient to guide its decision making and its allocation of resources to tackling degradation. The separate activities and individual projects of the past decade have been useful, but they do not add up to a coherent plan.

Degradation is inherently a long-term process. This and the continuing need for conservation imply that projects should be formulated and viewed within a longer-term perspective, so that they can be seen to be consistent with progress by stages toward the solution of the long-term problems. This is especially important because the GOE clearly wants to undertake widespread activities to conserve its valuable lands. Without such a perspective, project activities on the scale foreseen would be attempted without reference to important macro-economic criteria. Individual projects frequently imply certain irreversible choices about matters such as settlement, cropping patterns, land and water use and the structure of rural organization. These need to be consistent with each other and with longer-term progress as perceived in an overall development plan. Thus the feasibility and priority of individual conservation projects cannot be adequately assessed without reference to a wider planning framework.

> "Projects are rarely conceived and implemented in isolation. For the purpose of assessing their performance and impact, they should be linked to the development programme of the sector or sub-sector in which they fall as well as to the overall development plan. The limitation of resources, especially scarce resources, necessitate such a linkage of projects, programme and the overall development plan. However, the affinity between them does not mean that projects must always be derived from an established programme or plan. Such a condition, though desirable, is not absolutely essential. In fact, there may be circumstances in which sound projects are conceived either from simple notions about development prospects or on the basis of a very preliminary survey of the economy and its sectors. The likelihood of this approach is even greater in the early stages of development when the general lines of priorities in each sector are not yet sharply defined. However, when the development process gains momentum (as it has after a decade of conservation and resettlement activity), the opportunities for investment become wider, and the task of allocating resources among competing claims tends to become more and more complex. At this stage (in Ethiopia in 1984) simple notions and <u>ad hoc</u> ideas are no longer sufficient for project selection, and it is necessary to adopt a more refined framework for selecting specific investment proposals."
> (FAO, 1971)

In the light of such considerations, the GOE indicated that the EHRS should provide the degradation assessments presented in Part II of this report in order to provide a rational basis for the formulation of a longer term planning framework and strategy to include an internally consistent combination of policies and projects, which together would aim to guide rural development toward uses of the Highlands natural resources which are more consistent with their increased productivity in the longer term. 1/ It is only then that priorities, in terms of policies, projects and areas, can be rationally identified.

This rationale for the EHRS has been accepted by the FAO, in its agreement to undertake the EHRS, and by the World Bank, both in its agreement to fund the EHRS through an IDA credit and in its most recent review of the Ethiopian Agricultural sector:

> "A number of studies of a policy nature designed to accelerate Bank support to Ethiopia have been recently proposed including ... Highland rehabilitation ...(p.2)... The results of this study (the EHRS) will be of crucial importance to guide the preservation of natural resources in the face of increasing population pressure."
> (World Bank 1983a, p.38)

Other international organizations concerned with the degradation problem have generally called for a study such as the EHRS. Thus, the World Food Programme (WFP), (the external agency which has given most support to Ethiopia's conservation activities) has called for a "national soil erosion master plan" (WFP, 1982); also one of the key priorities identified in the World Conservation Strategy, launched in March 1980, is the need for the preparation of national conservation strategies:

> "Analyses of conservation/development interaction is one of the most important elements in the formulation of a national conservation strategy. The analyses should consider all measures necessary to achieve conservation .....and consider basic human needs; it should assess the effects of conservation on all activities planned for the future or underway. When these aspects have been analysed, priority action to ensure conservation can be defined. The development of a national conservation strategy is seen as a vital part of the planning process of any country - a process for guiding the country in achieving sustainable development and maintaining the essential life-support systems." 2/

1/ These requirements are also reflected in the GOE/FAO Project agreement (1983).

2/ IUCN Bulletin, Vol. 14, April/May/June 1983, as reported in FAO Environment and Energy Information - No. 7, August 1983.

Another rationale for the EHRS is, quite simply, that by drawing attention in a rational and systematic manner to the extent and gravity of the degradation problem in Ethiopia, it is hoped that substantially more resources, both from within and outside Ethiopia, will be mobilized in efforts to overcome the problem. 1/

1.3 WORLD BANK FUNDING AND FAO EXECUTION: PROJECT UTF/ETH/037/ETH

At the request of the GOE, a World Bank staff member prepared a proposal for the EHRS in mid-1981 (Bolt, 1981). In 1982, IDA credit funds from the Ethiopian Rangelands Project were used to employ consultants to compile a preparatory report intended to further justify and estimate costs of the EHRS (Falconer and Thung, 1982). With subsequent GOE modifications this formed the basis of GOE's request to FAO in December 1982 that it form a team to undertake the EHRS, with funds from the same IDA credit totalling US$1 652 320. FAO agreed and a formal agreement was signed in April 1983 (GOE/FAO 1983) to set up the GOE/FAO project UTF/ETH/037/ETH, funded by the GOE through the abovementioned WB loan. The project has four major objectives:

(a) the formulation of proposals for a strategy for reclaiming the Highlands, in the light of an assessment of the extent and rate of degradation and an evaluation of experience in combating degradation;

(b) the identification of priority areas, policies and projects for implementing the proposed strategy;

(c) the detailed preparation of at least two investment projects; and

(d) training Ethiopian officers in (a), (b) and (c).

From mid-1983, FAO assembled a core team comprising a team leader, a soil and water conservation engineer, an agronomist, an agro-forestry and rangelands specialist, an agricultural economist and two associate experts.

1/ Because of its systematic analyses and longer-term time horizon, this report complements other reports which might be used for this purpose: for example, the GOE Ten Year Perspective Plan, the World Bank Agricultural Sector Review (1983a) and the FAO Country Programming Mission Report (FAO 1982b). The complementary relation of this report to the Ten Year Perspective Plan is described in section 1.4.2.

The GOE also assembled, between August and November 1983, a team of six counterpart officers, trained in similar disciplines, to take advantage of the in-service training opportunities and to assist in the preparation of the EHRS. A list of all GOE and FAO personnel, including short-term specialist consultants, is presented in Annex 1.

Implementation of the project was discussed by representatives of GOE and FAO during September-November 1983, with the result that the project's Inception Report was finalized in December 1983. This presented an agreed interpretation of the project's objectives, a revised duration and budget, a programme of work and a schedule of activities. Project progress reports have documented the reasons for delays in the project.

Three major project output reports were envisaged: the strategy report 1/ and two project preparation reports. In accepting the programme of work, the Ministry of Agriculture (MOA) stressed the overriding importance which the GOE attached to the strategy proposals as opposed to the project preparation. This reflected the value of the strategy in identifying not just the two projects to be prepared by the EHRS team itself, but also in indicating further projects and, even more importantly, in providing a planning framework in which the GOE could formulate and adjust policies for rural development in the Highlands, thus valuably complementing the GOE's Ten Year Perspective Plan. Accordingly, over two-thirds of the man-months of professional services available through UTF/ETH/037/ETH were spent on the Strategy phase. Over half the total man-months of professionals have been provided by Ethiopians.

In addition to the in-service training (six GOE officers worked full time with the FAO team), efforts were made to strengthen Ethiopia's capacity in this kind of planning by a deliberate policy to fill the needs for short-term professional inputs from within Ethiopia whenever possible. A deliberate attempt is also being made to institutionalize the planning procedures followed in order to encourage their continued use in policy planning.

The project's progress is described at six monthly intervals in EHRS Progress Reports (see Annex 2).

1.4 STRATEGY CHARACTERISTICS AND TIME HORIZON

1.4.1 Rural development scope and multi-disciplinary character

Proposals for conservation and reclamation cannot be justified, or even adequately formulated, without reference to the benefits from

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1/ (of which this is Part I)

use of the conserved or reclaimed resources. This involves analyses of how, why, where and when resources have been, could or should be used, and necessarily takes the EHRS into the wider realm of rural development. Furthermore, the reclamation/conservation of resources is not an end in itself, but a means to development, and the broader issues of rural development necessarily provide the context within which reclamation strategy can be logically formulated and justified. It was for these reasons that the Plan of Operation (GOE/FAO, 1983 Annex 1, p.8) defined major objectives by reference to overall planning strategy for rural development:

"i) to identify and to evaluate the various factors and conditions hindering agricultural and rural development in the Ethiopian Highlands;

ii) to provide Government with information, projections and recommendations for an overall planning strategy that will enable decisions to be made on the reclamation and development of the various sub-regions of Ethiopia and including, where necessary, the resettlement of people to other areas;

iii) to recommend, in order of priority, areas for rehabilitation and development ....."

Accordingly, the EHRS relates to development of the rural sector of the Highlands and not just to the agricultural sector. By focussing too narrowly on agriculture, the EHRS would risk overlooking non-agricultural and potentially complementary activities in the rural sector as well as the important side effects of policy proposals outside the agricultural sector. 1/ This emphasis on an integrated rural development approach does not, of course, imply that development actions need to be taken on several fronts simultaneously. While it is considered necessary to present an understanding of the interrelated facets of rural poverty and development in Ethiopia, the EHRS is oriented to the use and development of land for the population's advancement.

The analyses of the Study, reflecting its rural development scope, are multi-disciplinary, combining contributions from physical sciences (agronomy, engineering, etc.) with those from social sciences (economics, demography, etc.), as illustrated by the wide range of working papers (Annex 2).

1/ A well presented case that non-agricultural factors are essential to self-sustaining rural development, but have been neglected in traditional approaches, is made by B. Woods: "Altering the present paradigm: a different path to sustainable development in the rural sector". (World Bank, May 1983)

1.4.2 Time horizon and relation with the GOE Ten Year Perspective Plan

The GOE's Ten Year Perspective Plan (TYPP) 1/, covers the period 1984/85 to 1994/95. The Plan is divided into 3 parts:

(1) immediate priorities for the period 1984/85 to 1986/87;

(2) action plan for the period up to 1989/1990; and

(3) perspective plan for the whole period up to 1993/94.

During preparation of the TYPP, it was known that the EHRS would be prepared during 1984/85. Accordingly, the GOE Perspective Plan provides 2/ that the EHRS would be incorporated as appropriate, in the preparation of the subsequent detailed GOE plans and, in particular, in the subsequent elaboration of parts (2) and (3) above. Thus, whereas the TYPP presents indicative national targets and budgetary allocations, the EHRS goes into more detail for the rural sector.

After discussion with GOE authorities concerned with the project, it was considered that the EHRS strategy should have a longer time reference than the TYPP in order both to highlight the consequences of degradation and to draw up a longer-term strategy for combating degradation. The time horizon should also be sufficient to permit adequate economic analyses of costs and benefits. In light of these considerations, a planning time horizon of 25 years was taken, i.e., up to the year 2010. The method is to unfold and analyze the implications of two alternative scenarios for this period:

(a) the situation that is expected to evolve if present trends continue (presented in Part II); and

(b) the situation that is expected to result if the strategy proposals are implemented (presented in Part III).

1.5 PLANNING CONCEPTS AND METHODOLOGY

1.5.1. Data base, quantitative and qualitative analyses

Understanding of and planning for the rural sector in Ethiopia is abnormally handicapped by important gaps and anomalies in statistics.

1/ An official presentation of the TYPP was not available at the time of completing this Part, although the EHRS team has had access to some drafts of certain sections. (See section 4.6.)

2/ Statement recorded in minutes for 7-8 February 1984 meeting of GOE Co-ordinating Committee for the EHRS, as well as in the TYPP itself.

Such basic statistics as population numbers 1/ have been lacking, while access to detailed official statistics from the agricultural sample surveys has been slow and incomplete. The basic gaps in know ledge about the rural sector and the diversity within the Highlands makes it particularly difficult to arrive at confident judgements on the basis of aggregate data. Hence, broad assumptions and/or "guess-timates", suitably qualified, have to be made on the basis of the evidence available. Such assumptions/guess-timates may be checked where possible by interviews at various levels, by first-hand observations and by analyses, while sensitivity testing establishes the extent to which findings depend on critical values of data guesses/assumptions. This approach, of necessity, has often been pursued in the course of the EHRS.

> "In developing countries, planning can be viewed as a pragmatic problem-solving activity and so really no apology needs to be made for inadequate data or for making broad assumptions about agricultural resources. More precise statistics would be useful but the importance of precise data can be overrated. A planner might do well to bear in mind that some action based on sound judgement even though not too polished or ideal is in most cases better than endless delays waiting for proper statistics, or no action. In fact the educated guesses of seasoned agricultural specialists and community officials can fill in many of the gaps in a vague statistical pattern. One important objective in the actual formulation of a plan is not to develop such a rigid framework that everything must happen in the way the plan foretells; that is clearly impossible. Even an accurate plan is no good if it lacks flexibility. Often it can fairly be said that inadequacy of the statistical base imposes the much-needed flexibility on the plan." (FAO, 1970.)

The inadequacy of the statistical base also limits the extent to which reliance can be placed on quantitative analyses. Nevertheless, quantitative analyses, if viewed in terms of supplementing rather than replacing more qualitative analyses by approximately indicating broad orders of magnitude, do have a useful role in planning rural development, even in Ethiopia with its particularly weak data base. Furthermore, the methods of quantitative analyses are often more explicit, rigorous and systematic and for these reasons alone application of such methods is often worthwhile. Thus, some efforts have been made to pursue a quantitative cost-benefit type of approach in the EHRS, but as a means of supplementing and sharpening the more qualitative and often broader analyses.

1/ Project time was not available to adjust the study to the information later available in the first Census, volume one of which was released in mid-December 1984. A revision reflecting the Census data will be required but will have to be done as an exercise separate from the Study Project.

The latter qualitative analyses are inherently more subjective and intuitive but (to the extent possible within the time and resources at the disposal of the EHRS team) reflect group consensus, "common sense", and professional/technical judgements. It is partly to minimize obvious shortcomings of the sometimes necessary qualitative analyses that findings have been written up in EHRS working papers circulated to GOE, FAO, WB and others for the purposes of generating feed-back comments. No apology is made to the extent that this approach presents "more of what we already know", for a major task of the EHRS is to inter-relate existing knowledge, data, studies, etc. and it is this interrelation that so far has been particularly lacking in Ethiopian planning (except possibly within narrow subsector surveys), but which is needed on a multi-disciplinary, multi-sector basis to produce the cohesive strategy required for rural development in Ethiopia.

1.5.2. Rolling and indicative planning vs. blueprint planning 1/

The formulation of a longer-term rural development strategy should not be regarded as a definitive and inflexible blue-print for development planning and priorities over the next 25 years.

> "Rural development projects are not like construction works, with engineering blue-prints which precisely predetermine what will be done, but rather like voyages into unchartered seas, where directions and steering will change with new soundings and sightings." 2/

There is a trade-off between the "detail" embodied in a plan and the flexibility needed to make corrective changes during the plan's implementation to achieve meaningful popular participation and improve development impact.

In view of the limited duration of the EHRS, the importance of using rapid rural appraisal techniques has been stressed, rather than more exhaustive approaches to data collection. 3/ This reflects the emphasis, in the overall planning framework, on a continuous or cybernated approach where learning by doing and feedback information substitute for much of the *ex ante* information required for blue-print or end-phase planning. The rapid rural appraisal approach relies substantially on the accumulated

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1/ The reiterative planning approach described in this section has been developed by D. Belshaw, R. Chambers and others and has been developed to advantage in similar limited-data, rural planning environments (for example, in Tanzania). See FAO 1983c, from which much of this sub-section is taken.

2/ R. Chambers. "Short-cut methods in information gathering for rural development projects". Paper of World Bank Agricultural Sector Symposium, January 1980.

3/ Nevertheless, the EHRS has fortunately been able to draw on much of the physical data collected (but so far under-utilized) by the Land Use Planning and Regulatory Department of the MOA.

local wisdom of the people themselves, common sense and satisfactory practical solutions, as opposed to methodologically rigorous and theoretically optimal solutions. Actual conditions rarely approximate theoretical concepts and the conditions, limitations and constraints under which the EHRS has been prepared preclude any pretension to optimal solutions. The rapid rural appraisal approach attempts to be practicable by being quick and cheap, by being problem-oriented and by producing more timely reports. Furthermore, simplicity and flexibility in formulation are more likely to maintain the relevance of the strategy and expedite its execution.

It is therefore assumed that the strategy proposals presented in this report, even after they have been accepted by the Government, will be revised periodically to take into account new information, progress achieved, changing circumstances and opportunities, improved analyses and changes in the objectives, priorities and preferences of participants and government. Such changes will require reiterations to fully integrate them in the strategy. This is particularly relevant for reclamation because it is a slow and long process, during which improvements and revisions to strategy proposals will be both possible and necessary. For this reason the strategy serves only as a guide or indicator to development directions and policies: "strategy" is inherently "indicative". Therefore only broad lines of strategy can be specified for each of the sub-zones, for the proposals cannot possibly cover the huge diversity of existing and future situations in the Highlands. The indicative planning approach recommended by EHRS leaves scope for filling in strategy details as well as planning detailed tactics (policies and projects) with and by the participation of people at the Peasant Association and other levels (section 1.5.3).

This approach will be used in the subsequent project preparation phase of the EHRS. This should result in feedback from micro-project implementors to macro-plan formulators and also reduce the risks of total project failure by preparing the projects so that they consist of a series of independent stages, each with its own objectives so that, if funds are suddenly cut off, earlier investments are not totally wasted. 1/ Phased planning is all the more important for conservation projects, with their long gestation periods.

The need for "rolling" planning, as emphasized in this section, and the rolling character of this strategy plan, underscore the importance of institutionalizing the planning procedure and the training of Ethiopians to continue the development of strategic planning in the future (section 1.3). Institutionalization of the planning procedure encourages both development of indigenous planning capability and, if used properly, development of effective dialogue between planning analysts and policy makers.

1/ Elements of this approach are described by the World Bank, 1980.

1.5.3 The intended "bottom-up" and participatory character

Experience has drawn attention to the need for people at the grassroots to participate in the various development processes, from planning through implementation to monitoring and evaluation. Participation can help to mobilize popular resources and improve project functioning. This was a major theme of the 1979 World Conference on Agrarian Reform and Rural Development (FAO 1979) of which the GOE was a party. The GOE is committed to promoting the fuller participation of Ethiopians in their development (see Chapter 11) and provisions are underway to support the development of planning at zonal and regional levels and below. It is realized that "top-down" planning, by its nature, cannot accurately take into account the objectives, aspirations and preferences of local people or even appreciate properly the development potential of local resources.

Accordingly, in preparing the EHRS the GOE/FAO project team has sought to further this "bottom-up" and participatory approach by:

(a) conducting a small sample survey (1 000 randomly selected farmers were interviewed in ten purposively selected representative areas) in order to indicate rural peoples' perceptions, priorities, preferences, problems and views on degradation and conservation activities and rural development (EHRS WP 4);

(b) organizing similar grassroots level surveys in the three areas selected by the GOE for detailed project preparation in order to identify the development needs, priorities and preferences of those living in these areas and to identify ways to foster their incorporation and participation in the projects;

(c) discussion with groups of individual farmers by team members in the course of field trips, to ascertain characteristic problems, methods, views on potential, and requirements of different land use systems in the Highlands;

(d) disaggregation of the Highlands into zones and sub-zones so that identification of constraints and problems and formulation of strategy proposals are brought closer and relate more directly to specific systems of land use and to requirements as seen at levels nearer to the grassroots;

(e) circulating the working papers on which the strategy proposals are based to GOE and other persons in varying levels of contact with rural people for review and comments; and

(f) requesting the GOE to prepare an Amharic summary of the draft strategy proposals to facilitate discussion at grassroots levels before finalization of the proposals.

Inevitably more could and perhaps should have been done to achieve greater grassroots participation in the planning work undertaken thus far by the project team, but resources and time available have restricted the team's efforts in this respect. However, bearing in mind the indicative character, flexible approach, and rolling nature of the kind of planning counselled by EHRS, as well as the substance of the resulting proposals, the strategy can claim to be an expression of the participatory principle.

Participation of the Government has also been continuously sought by:

(a) the FAO team working closely and continuously with the Government officers attached to the core team;

(b) seeking to recruit consultants from Government institutions whenever possible;

(c) seeking counterpart Government officers for every internationally-recruited consultant;

(d) arranging both formal and informal meetings with Government officers at the beginning and end of each consultancy as well as continuing liaison during each consultancy;

(e) regular formal reporting to the GOE on project progress; and

(f) submitting all working papers, on which the strategy proposals are based, to an especially established GOE Coordinating Committee, for review and feedback comment.

1.5.4 Some guiding principles

In preparing this strategy the EHRS project team has sought:

(a) to undertake its assignment at the highest technical and professional standards available to the project within the resources allocated to it and deliberately building into the work programme a number of external review processes to ensure that high quality standards are met;

(b) consistency with the stated ultimate objectives of the GOE (summarized explicitly in Chapter 11);

(c) effective participation at both grassroots and governmental levels, reflecting the declaration of principles, objectives and strategies agreed to by Ethiopia as well as by over 140 other countries at the WCARRD in 1979;

(d) to maximize involvement of Ethiopian institutions and Ethiopian professionals in EHRS planning processes for reasons mentioned in sections 1.3 and 1.5.2; and

(e) to focus specific attention on the poorest sections of rural society.

1.5.5 Review and evaluation of proposals prior to finalization

Before team members finalize their working papers concerned with particular components of the strategy, a review meeting is convened to which the whole team, GOE officers concerned, other FAO and UN personnel, and others are invited to comment on the findings and recommendations being presented. The working paper is subsequently completed and submitted for review and comment to:

(a) the GOE Co-ordinating Committee for the EHRS;

(b) the MOA Representatives in each region of Ethiopia;

(c) FAO Headquarters;

(d) the World Bank; and

(e) other institutions/persons concerned with the subject, including other FAO and non-FAO projects in Ethiopia and agencies such as UNDP, WFP, ILCA, etc.

This report is based not only on EHRS working papers, but also on feedback generated by those working papers as a result of review procedures, further reading, development and analyses by the project team. In order to further check the quality and acceptability of the strategy proposals, the Strategy Report has been evaluated by the GOE Coordinating Committee, by an especially assembled mission of senior FAO specialists, and by a representative of the World Bank.

All the abovementioned review and evaluation procedures were designed to ensure that the final Strategy Report complies with the highest professional quality standards and is acceptable to the GOE.

Chapter 2

PHYSICAL RESOURCES

2.1 DEFINITION, SIZE AND IMPORTANCE OF THE STUDY AREA

Ethiopia stretches south and west from the Red Sea coast to form the hinterland of the Horn of Africa. The country extends from latitude 3^{o}N to 18^{o}N and from longitude 33^{o}E to 48^{o}E, and its east-west north-south dimensions are therefore approximately equal, enclosing an area of about 1 223 600 sq km. Ethiopia's western neighbour is Sudan; to the south it shares a border with Kenya; and to the east and south-east lie the Republics of Djibouti and of Somalia.

The Highlands of Ethiopia have been defined for the purpose of this study as those areas over 1 500 metres above sea level (masl), and the study area includes the associated valleys. The location of the study area is shown in Fig. 1.1. The choice of the 1 500 metre contour as the lower limit is justified on four important grounds. These are:

(a) within Ethiopia the 1 500 metre contour approximates the boundary between the settled mixed agriculture of the Highlands and the nomadic livestock areas of the lowlands. Below 1 500 metres little cropping is undertaken - in terms of cropped area, probably less than five percent. This contour generally marks the upper limit of the semi-arid savannah rangelands;

(b) 1 500 metres is the altitude in Ethiopia at which the mean daily temperature is approximately 20^{o}C, which is near the maximum mean temperature at which temperate crop and forage species will grow satisfactorily; 1/

1/ Examination of temperature data from 155 suitably distributed meteorological stations throughout Ethiopia (Goebel, 1983) indicates a very strong correlation (R=0.95) between temperature and elevation for all the country except the southeast lowlands and the Ogaden area. On this data the 20^{o}C isotherm conforms roughly with 1 700 metres during the growing season, and the temperature at 1 500 metres is 21.3^{o}C. However, temperatures at the same altitude vary: locations closer to the equator are generally warmer and wetter than those further away. The available data, however, are not considered sufficient to make adjustments to the generalized use of the 1 500m contour.

(c) areas below 1 500 masl generally fall within the traditional Ethiopian "kolla" or hot zone, while those above 1 500 masl are traditionally classified as "woina-dega" and "dega" (see Section 2.2);

(d) other studies undertaken in Ethiopia have adopted the 1 500 metre contour as the dividing line between Highlands and lowlands and this has been used by the GOE, the World Bank and others.

The inclusion of valleys adjoining the Highlands, even though they may be below the 1 500 metre contour, is desirable to facilitate comprehensive planning on a watershed basis. Though these valleys are not strictly part of the Highlands, they are the drainage network and thus are directly influenced by activities and events on the Highlands. By this definition the study area comprises some 536 000 square kilometres, or 44 percent of the total area of Ethiopia. Some 88 percent of the population of Ethiopia live in the study area. The study area also contains over 95 percent of the regularly cropped areas of Ethiopia and around two-thirds of Ethiopia's livestock. It is estimated that over 90 percent of Gross Domestic Product is generated within the study area.

2.2 ZONING THE STUDY AREA

2.2.1 <u>The need</u>

The Highlands of Ethiopia, as will be seen in the rest of Part I of this report, have enormous environmental, ethnic, economic and agricultural diversity. This diversity forbids attempts to formulate a development strategy regarding the Highlands as a homogenous whole. Thus there is a need to disaggregate the study area on the basis of observed similarities and differences within it. Important differences - even within fairly confined areas - makes zonation difficult, and the task was governed by the time, resources and data available to the EHRS team. Consequently, the system of zonation developed in this section reflects a compromise between the requirements of diversity and what practicably can be managed by the team. The resulting zones are necessarily both generalized and simplified. It is emphasized that the resulting zonation is intended to facilitate planning within the study area as a whole; it is <u>not</u> intended to demarcate possible project areas nor necessarily to serve as a basis for implementing plans or projects. The zoning serves to indicate the possible extent of replicability of the various proposals made in Part III of this report, and for this reason both analyses and strategy proposals are differentiated by zone and sub-zone wherever appropriate and possible within the time, resources and data available to the EHRS team. Fundamentally, the zones and sub-zones are considered suitable and adequate for the purpose of the study, to help determine the main lines and components of a development policy appropriate to the problem - the Conservation-based Development Strategy.

2.2.2 Refining traditional zonation

For centuries livelihood in Ethiopia has depended overwhelmingly on cropping and livestock. Crop and livestock production systems within traditional agriculture are dependent on climate, and this (both rainfall and temperature) is determined primarily by altitude. On this basis Ethiopian farmers have traditionally recognized three broad agro-climatic/altitudinal zones, namely kolla (hot zone), woina dega ("wine highland" or intermediate zone) and dega (cold zone).

There is no precise agreement on the altitudes and/or temperatures or rainfall that correspond to these zones, but the kolla is most often cited as being below 1 500/1 800 masl, the dega is usually cited as being above 2 500 masl and the woina dega as being between these limits. Although it is nowhere explicitly defined, the basis of the traditional zonation appears also to be related to ambient conditions, with the woina dega having the climate most favourable for human comfort - being temperate and free of malaria-carrying mosquitoes. It is also suitable for growth of many plants, i.e., the grapevine - considered from very ancient times to be an appropriate indicator.

This traditional zonation is not considered entirely satisfactory; it lacks precise definition, making transfer to maps and subsequent quantification difficult. Nevertheless, the rough altitudinal base of the traditional zonation is of undoubted validity. Altitude (through its effects on both temperature and rainfall) is the prime determinant of the types of vegetation and crops that will grow. Therefore the traditional zonation has been refined by reference to more objective altitudinal limits demarcated by the following contours:

- 1 500 masl: for reasons given in section 2.1;

- 2 000 masl: the approximate frost line, the altitude above which frosts seasonally occur. This contour in Ethiopia marks the approximate growth limit of frost-sensitive plants (including, very importantly, coffee), and precludes year-round growth of such crops as maize, sorghum and millet. Below 2 000 masl savannah grasslands are the prevalent vegetation types; above, woodlands are more important;

- 2 500 masl: the approximate altitude at which frost becomes the major constraint for certain crops. Only temperate species will perform satisfactorily. Maize, sorghum, millet, teff and chick peas are almost wholly absent, whereas temperate cereals such as wheat and barley are dominant. Temperate pasture species take over from the savannah grasslands;

- 3 000 masl: above this there are very limited cropping opportunities and vegetation becomes sub-alpine. Only about four percent of the Highlands is above 3 000 masl.

On this basis, altitudinal zones within the study area are broadly defined in table 2.1, together with their area.

Table 2.1

DEFINITION AND AREA COVERAGE OF ALTITUDINAL ZONES

Altitudinal zone	Contour (masl)	Area Km^2 000	Area %
Tropical/sub-tropical Highland valleys	below 1 500	89	17
Frost-free tropical/sub-tropical	1 500-2 000	176	33
Sub-tropical/temperate	2 000-2 500	183	34
Cool temperate	2 500-3 000	68	13
High-altitude cold sub-alpine	above 3 000	20	4
Total study area		536	100

Source: Estimated by EHRS project.

2.2.3 Relating zonation to farming systems and potential

While altitude, temperature and rainfall (to the extent that it is affected by altitude) determine the range limits of vegetation and cropping possibilities, as indicated in the previous section, the actual patterns of both vegetation and cropping that predominate within these limits are determined primarily by the lengths of growing periods 1/ and by socio-economic considerations. Cropping potential is similarly affected. For example, areas with a short growing period generally have sparser vegetation and the potential to grow only a single crop under rainfed conditions. Conversely, areas with a long growing period have much more lush vegetation and the potential for more intensified cropping. Other physical conditions such as soils are also important in influencing potential for plant growth, but soils are much more amenable to change (by the addition of fertilizers) than climatic factors. In the light of such considerations, three broad agro-ecological zones may be distinguished as follows:

1/ The growing period concept has been developed by FAO to take into account the influences on plant growth not only of precipitation and evapotranspiration, but also temperature and stored soil moisture. It is here broadly defined as the number of days in a year in which plants can grow without irrigation.

Table 2.2

DISTINGUISHING CHARACTERISTICS OF AGRO-ECOLOGICAL ZONES

High potential perennial crop zone (HPPZ)	
Soils:	Volcanic parent materials
Degradation:	Limited
Climate:	Warmer and more humid
Growing period (days):	Mainly >240
Major natural vegetation:	Forests
Major farming systems:	Perennial crops (e.g. coffee/enset)
Tillage:	Hand hoe and ox plough
High potential cereal zone (HPCZ)	
Soils:	Volcanic parent materials
Degradation:	Moderate to severe
Climate:	Intermediate
Growing period (days):	Usually >180
Major natural vegetation:	Temperate savannah grasslands and forests (largely depleted)
Major farming systems:	Cereals; livestock
Tillage:	Ox plough
Low potential cereal zone (LPCZ)	
Soils:	Sedimentary or metamorphic parent materials
Degradation:	Widespread, severe
Climate:	High rainfall variability; occasional drought
Growing period (days):	Mainly 90 to 150
Major natural vegetation:	Savannah grasslands; woodlands (depleted)
Major farming systems:	Cereals; livestock
Tillage:	Ox plough

Source: Compiled by EHRS project, UTF/ETH/037

The zonation indicated in table 2.2 closely resembles, and indeed was developed from, the zonation of the Highlands compiled by Amare (1978a, b and 1980). 1/

2.2.4 Superimposing zones and sub-zones based on crop potential and farming patterns on the traditional zonation

Section 2.2.2 accepted the validity of the altitude-based zones recognized traditionally by most rural people in Ethiopia, and refined these to make them more easily identifiable on maps.

Section 2.2.3 indicates the clear physical and socio-economic distinctions between different areas of the Highlands. Superimposition of the two notions of zoning concepts results in some 15 zones (i.e., five altitudinal ranges in each of the three broad zones of crop potential and farming patterns). Farming patterns and cropping potential over the whole high-altitude sub-alpine range do not differ markedly, and this altitudinal range accounts for only about four percent of the total area and population of the study area. The tropical/sub-tropical valleys within the study area are not as easily distinguished by farming patterns or cropping potential, and they account for only two percent of the population of the study area. The mountainous areas over 3 000m and the valleys/gorges below 1 500m are more inaccessible and isolated, and much less densely populated than the rest of the study area. The study area and population (1983) is thus broadly disaggregated into three major zones with three sub-zones each, plus the sub-valley and sub-alpine zones. Table 2.3 also shows the approximate location of each zone with reference to Ethiopia's 14 Regions.

This zonation is indicated in Figure 2.1. The "overlap", in terms of area percentages, between each Administrative Region or Awraja on the one hand, and each zone or sub-zone on the other, is presented in Annex 5, Table A2.1. 2/ Annex 4 lists the major physical, social and economic characteristics of each zone. The physical characteristics are also listed and/or referred to where appropriate in later sections of this chapter, while social and economic charateristics

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1/ There are some differences in the zonation criteria used by Amare with the result that his zonal boundaries differ in some places from those presented here. Amare's basis for sub-zoning is also more geographical, whereas the EHRS sub-zones are based on traditional altitudinal zoning as defined in section 2.2.2.

2/ All supporting tables are presented in Annex 5. The letter A before the table number indicates that the table is placed in Annex 5, while the first digit of the table number indicates the chapter to which the table primarily relates.

(differentiating by zone where appropriate) are reviewed in Chapters 3 and 4, respectively. Chapter 5 describes land use, agriculture, livestock and forestry (again differentiating by zone where appropriate).

Table 2.3

DISAGGREGATION OF THE STUDY AREA AND POPULATION (1985) BY ZONE AND SUB-ZONE

Zone	Sub-zone altitude (masl)	Area 000 km^2	Area %	Population mill.	Population %	Approximate zonal locations: Regions
High-potential perennial crop zone (HPP)	1500-2000	63.0	11.8	6.1	17.5	Sidamo, Gamo Gofa, Kefa, Illubabor, Welega (except east) and SW Shewa
	2000-2500	59.0	11.0	3.4	9.9	
	2500-3000	17.5	3.3	1.4	4.1	
	Sub-total	139.5	26.1	10.9	31.5	
High-potential cereal zone (HPC)	1500-2000	33.8	6.3	2.5	7.1	Gojam, south Gondar, central Shewa, east Welega, Arsi, and NW Bale, Welo escarpment, and central Hararghe highlands
	2000-2500	65.2	12.2	5.6	16.0	
	2500-3000	35.0	6.6	2.3	6.6	
	Sub-total	134.0	25.1	10.3	29.7	
Low-potential cereal zone (LPC)	1500-2000	74.8	14.0	6.1	17.6	Eritrea, Tigray, Gondar (except south) Welo (except escarpment), NE Shewa and Shewa Rift Valley and the lower highlands of Hararghe, Arsi and Bale.
	2000-2500	58.0	10.8	4.1	11.7	
	2500-3000	17.1	3.2	1.1	3.3	
	Sub-total	149.9	28.0	11.3	32.6	
Other areas:						
Valleys, gorges	below 1500	91.1	17.0	0.6	1.8	Valleys throughout, but over half are in HPP. Sub-alpine mainly in HPC and LPC.
Sub-alpine	above 3000	21.4	4.0	1.5	4.3	
	Sub-total	112.5	21.0	2.1	6.1	
Total Study Area		536.0	100.0	34.6*	100.0	

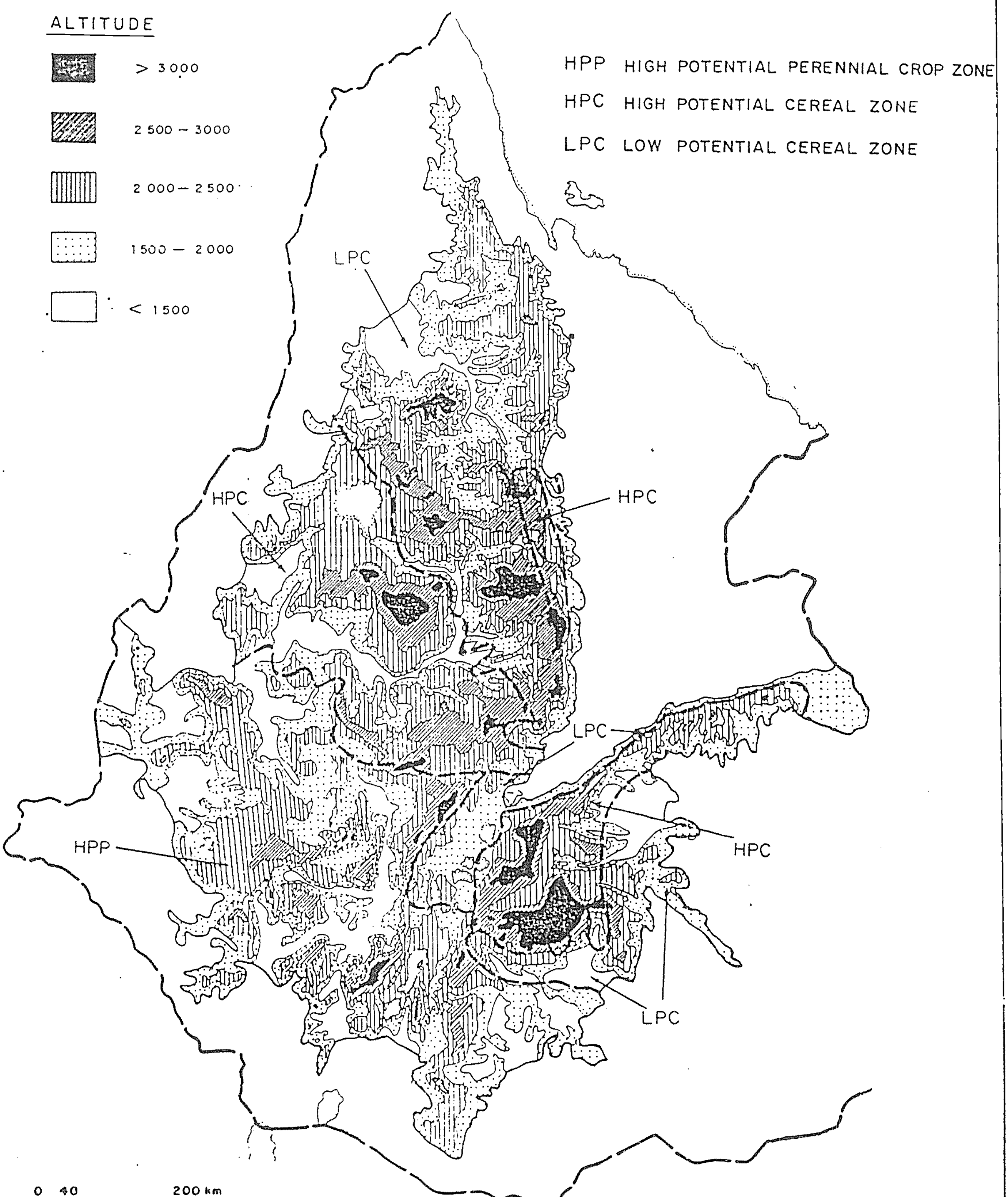
* of which, 28.3 million are rural.

Source: Estimated by EHRS project.

Figure 2.1

ZONATION OF THE STUDY AREA

(based on altitude and agro-ecology)



2.3 GEOLOGY 1/

Ethiopia is based on the Precambrian (before 600 million years ago) crystalline basement underlying most of Africa. This basement is dominated by various schists, gneisses, granites, and slates which are exposed in areas where geological erosion has been great, particularly along plateau fringes in the northern, western and southern parts of the country (see Fig. 2.2). Sedimentary limestones and sandstones, several hundreds of metres thick, were deposited over this basement foundation when the sea engulfed the country from the southeast some 100 to 200 million years ago. These are capped, over almost half of the country's land, by successive flows of lava (composed mainly of basalts), which have accumulated to a thickness of several thousand metres in some areas. The period of intense volcanic activity coincided with the formation of the Rift System. Evidence of volcanic activity is still to be found in the form of a few live volcanoes and numerous hot springs, suggesting that large segments of the land mass are still geologically unstable. As can be seen from Fig. 2.2, geology differs more within zones than between zones.

2.4 PHYSIOGRAPHY

Ethiopian physiography is characterized by the Highlands complex of mountains and plateaus contrasting with the lowlands of the Ogaden and around the country's periphery (see Fig. 2.3). The Highlands, and in particular the HPP zone, are bisected by the Rift Valley, which ranges in width from 40 to 60 km and whose floor is occupied by a succession of lakes (within the study area). This Rift Valley is part of the East African Rift System caused by the continental drift in which Africa and the block of the Arabian peninsula are gradually pivoting away from each other. In the latitude of Addis Ababa (within the HPC zone), the western wall of the rift turns north and runs parallel to the Red Sea, leaving a wide plain between the escarpment and the Red Sea coast, which gradually narrows until, north of Massawa, the foothills of the escarpment are almost on the coastline. The eastern wall of the rift turns to the east in the latitude of Addis Ababa, forming an escarpment looking north over the Afar plains. The escarpments are nearly always abrupt, commanding extensive views over the lowlands some 1 000m below and are broken at only one point near Addis Ababa where the Awash River descends from the rim of the plateau. It is at this point that the railway from Djibouti reaches the Highlands. It is only from this point to the end of the lakes area that the Rift Valley lies within the study area, as shown in Figure 2.1.

1/ For further information on both geology and soils, see Berhanu (1980) and FAO 1983(e).

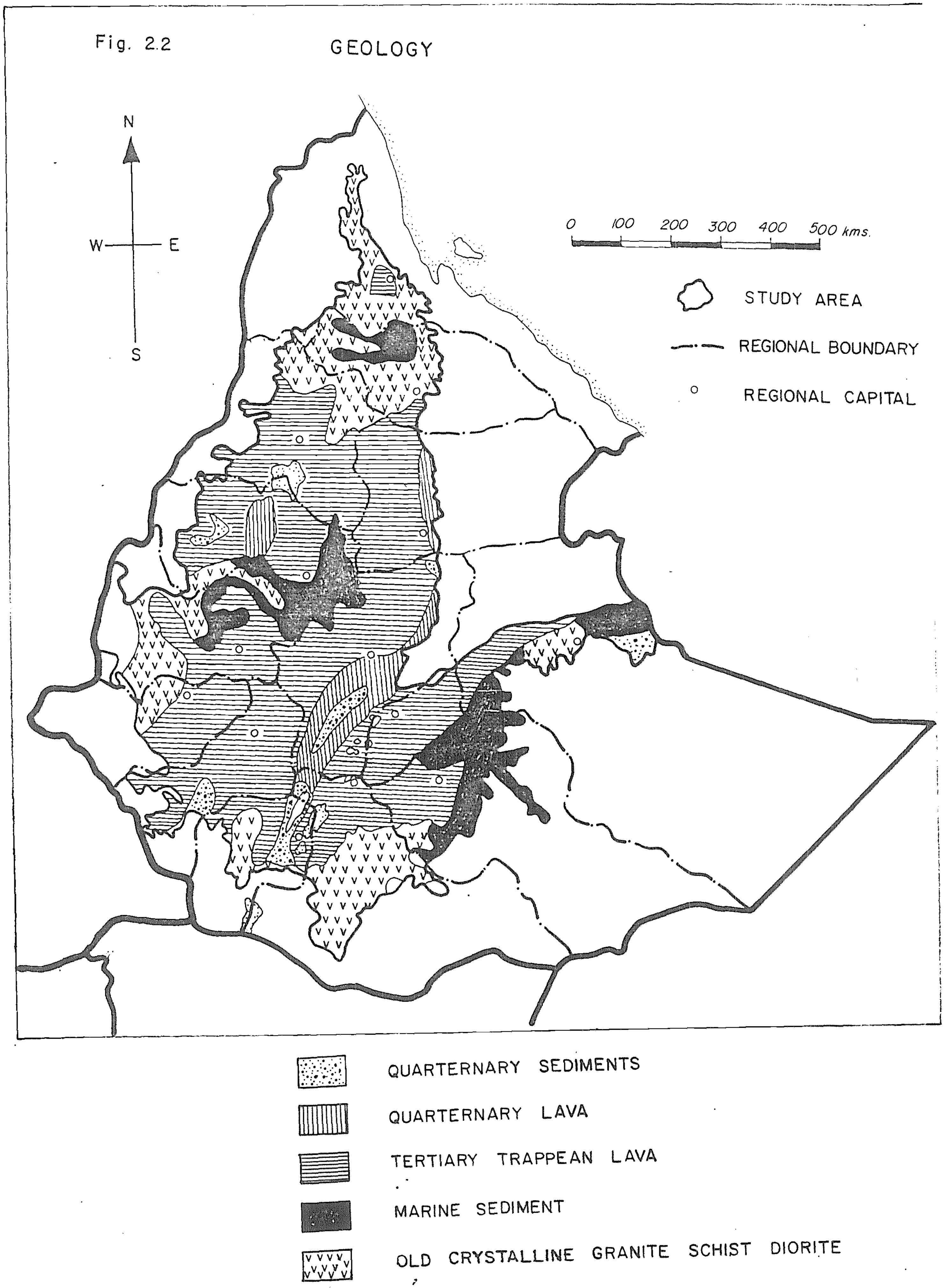
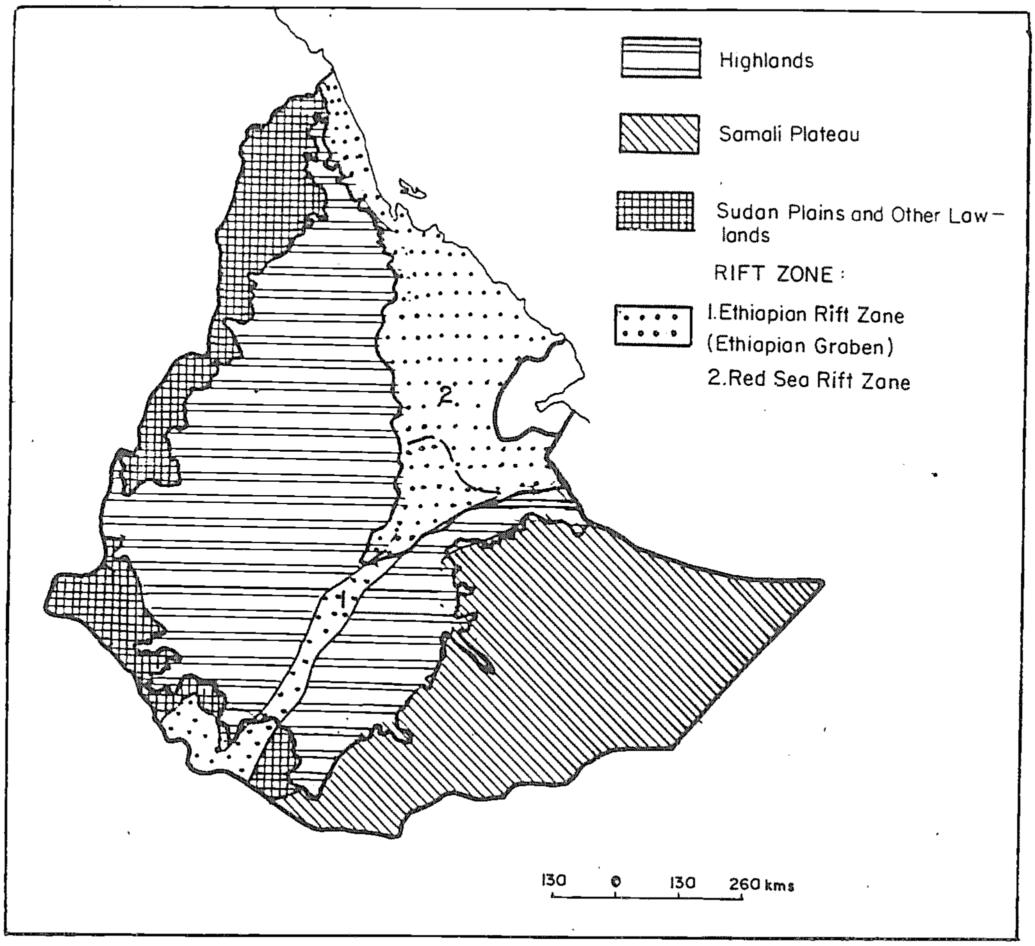


Fig. 2.2 GEOLOGY

Fig. 2.3

PHYSIOGRAPHY



Over half of the study area lies above 2 000 masl and about 4 percent lies above 3 000 masl. The northern Highlands (LPC zone) contain the Semien Mountains - with the highest peak in Ethiopia, Ras Dejen (4 620 masl), while further south, in the HPC zone lies Lake Tana (3 070 sq km). The basalt plateaus of both these zones are dissected by deep gorges and canyons protected from widening by the hard lava cap. The Highlands are generally of lower elevations toward the southwest in the HPP zone, where only one percent of the land area is above 3 000 masl (compared to four percent in the LPC zone, and seven percent in the HPC zone). Conversely, a much larger proportion (27 percent) of the HPP zone is below 1 500 masl, compared to 10 and 13 percent in the HPC and LPC zones, respectively (see table 2.4). The eastern Highlands are far less extensive, with a sharply defined northern boundary and a gradual downward slope to the southeast.

Table 2.4

DISTRIBUTION OF LAND AREA IN EACH ZONE BY ALTITUDE

Altitude Zone (masl)	HPP		HPC		LPC		Total	
	km^2	%	km^2	%	km^2	%	km^2	%
<1500	50	26	15	10	23	13	89	17
1500-2000	66	33	36	22	74	41	176	33
2000-2500	60	30	64	40	59	33	183	34
2500-3000	18	9	33	20	17	9	68	13
>3000	2	1	12	7	7	4	20	4
Total	195	100	161	100	180	100	536	100

Source: Estimated by EHRS project.

Despite the heights and many deep gorges, there are substantial land areas of little or moderate slope. Twenty one percent of the study area has a slope of less than eight percent. On the other hand, 60 percent of the study area has slopes in excess of 30 percent.

The HPC zone has the greatest area of land with gentle slopes, while the HPP zone has the least area below eight percent slope and the largest area with slopes above 30 percent.

Table 2.5

DISTRIBUTION OF LAND IN HIGHLAND ZONES BY SLOPE
(percent of total land area)

Slope Percentages	HPP	HPC	LPC	Total
0-8	11	31	24	21
9-16	25	17	15	19
17-30	27	22	29	27
30 or more	37	30	32	33
Total	100	100	100	100

Source: estimated by EHRS project.

2.5 CLIMATE 1/

The generalizations which follow, even when zone-specific, should be qualified to the extent that micro-climates often vary significantly, even over relatively small areas, largely reflecting micro-relief. The major factors influencing rainfall in Ethiopia are the Inter-tropical Convergence Zone (ITCZ), the northeast trade winds and the southeast monsoon.

The northern movement of the Inter-tropical Convergence Zone in the period March to June brings moisture-laden air masses from the southwest. When the prevailing warm and moist winds reach the western Highlands, they are forced to rise, thereby cooling and losing their capacity to hold moisture, so that by July, most of the Highlands experiences the main rainy season known locally as "krempt", which generally lasts to around mid-September. The amount of rainfall varies widely, being determined principally by the direction of moisture-bearing seasonal air currents and elevation. Rainfall is generally greatest (around 2200 mm p.a.) in the southwest Highlands and decreases to around 600 mm p.a. in parts of the northeastern Highlands (see Fig. 2.4). Annual rainfall averages between 1 000 and 1 800 mm, and much of this falls between June and September. Only in the southern and eastern Highlands are there pronounced biomodal rains (see Fig. 2.5) with the first peak occurring around April and the second around September. This generally shorter rainy season results from the movement of a high pressure system over the Arabian peninsula

1/ For further information see Goebel (1983), Gamachu (1977), Kebede Tatoo (1984).

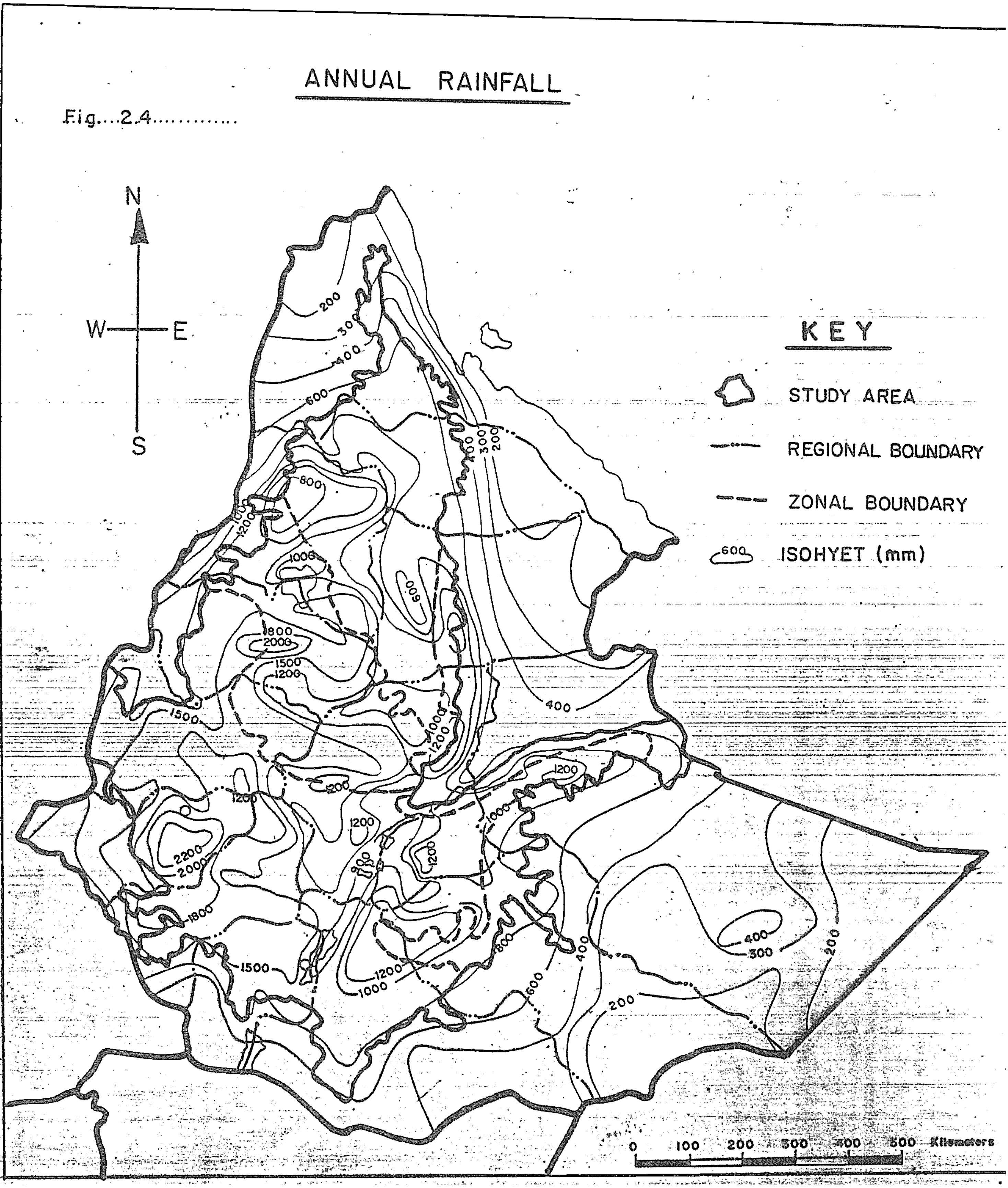
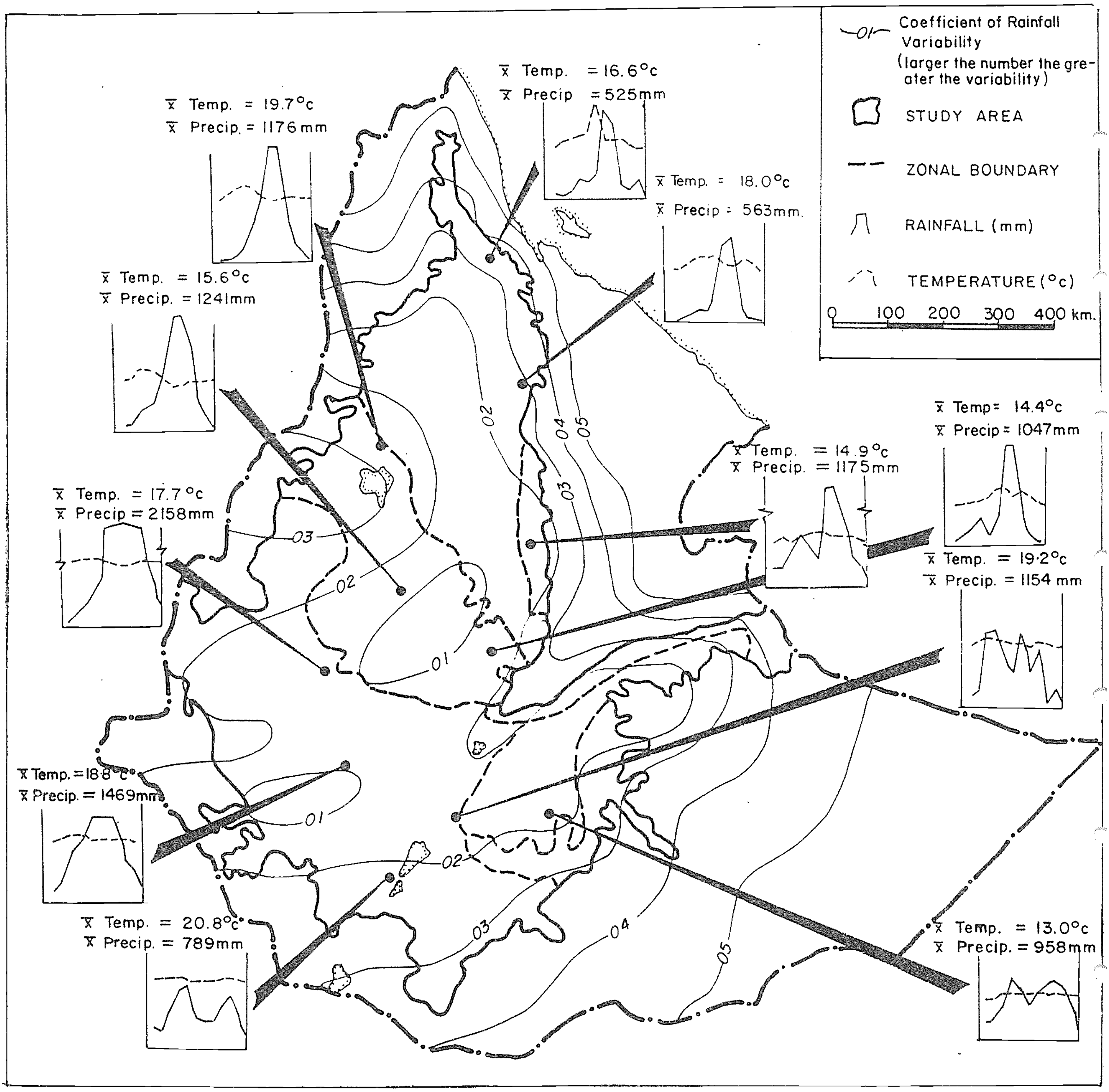

ANNUAL RAINFALL
Fig. 2.4
N
W
E
S
KEY
STUDY AREA
REGIONAL BOUNDARY
ZONAL BOUNDARY
ISOHYET (mm)
0 100 200 300 400 500 Kilometers

Fig. 2.5 RAINFALL VARIABILITY, DISTRIBUTION AND TEMPERATURE



and southwest winds from the Indian Ocean and is known locally as the "Belg" rains, important especially for Welo and much of northern Shewa. The main dry season is between October and February, being longer and drier in the northern Highlands.

Rainfall variability generally increases as rainfall itself decreases and is thus generally greatest in the lower rainfall areas of the north and northeast Highlands (see Fig. 2.5). Rainfall intensity records are not generally available but it is widely accepted that rainfall intensities are high, with most rains falling as heavy showers lasting only a few hours at most (GOE, 1984).

Although Ethiopia is completely within tropical latitudes, it enjoys a generally temperate climate in the Highlands, but this varies significantly according to altitude. The annual range of temperature is relatively small because of proximity to the equator, but the average daily range is wide because of the intense daily insolation at higher altitudes. In much of the Highlands the main rainy season has the effect of lowering the temperature. The mean daily temperature during the Highlands growing season (from May to December) is 21.3^{o}C, and drops by 0.6^{o}C for each 100 metres' increase in altitude (Goebel 1983).

Table 2.6

DISTRIBUTION OF ZONAL AND SUB-ZONAL AREAS
BY LENGTH OF GROWING PERIOD
(percent of land area)

Growing Period (days)	Zones			Altitude (masl)					Study Area Total
	HPP	HPC	LPC	<1500	1500 to 2000	2000 to 2500	2500 to 3000	>3000	
<90	0	0	6	0	5	1	0	0	2
90-150	1	0	33	10	14	14	8	4	12
150-180	2	7	22	9	13	9	13	8	11
180-240	26	51	30 1/	49	33	34	30	20	35
>240	71	42	9 1/	33	35	42	50	67	40

1/ Most of the areas in the LPC zone with long growing periods are located at high altitudes such as the Semien Mountains.

Source: Compiled by EHRS project, UTF/ETH/037.

Frost also occurs in sheltered places at about 1 800 metres, but generally is not severe below 2 000 metres (Westphal, 1975).

Ethiopia is outside the area where severe cyclonic winds occur, although some strong winds occur along the eastern escarpment of the Highlands. At high altitudes there are cold, dry winds from November to January.

Growing periods vary substantially, from around 100 to 150 days in the northeast, to over 240 days in the south and southwest. Thus 71 percent of the HPP zone has a growing period of over 240 days while more than 60 percent of the LPC zone has a growing period of less than 180 days. The HPC zone is intermediate, as can be seen from table 2.6. The table also shows that growing periods in the study area generally increase with altitude. Growing periods are demarcated in Fig. 5.1.

2.6 HYDROLOGY

The physiography of the Highlands and its exposure to seasonally abundant rainfall has created an extensive network of rivers and streams. Many rivers starting in the Highlands are also the source of major water resources in neighbouring countries. Major rivers include the Abay (the Blue Nile), Tekeze, Mereb, Baro, Barka, Awash, Omo, Woito, Bilate, Dawa, Genale and the Wabi Shebele. Figure 2.6 indicates the basins of these rivers.

The north, central and western Highlands are tilted westwards so that most rivers rising from these Highlands flow toward or into Sudan. The most well known of these rivers is the Blue Nile (Abay) with its immense system of tributaries which include the Muger, Jemma, Guder, Didessa, Dabus and Beles. It rises in the central Highlands, in the vicinity of Lake Tana, and flows through hundreds of kilometers of dissected canyons and gorges. The major exception to the westward flow of these rivers is the Awash river, important for its agricultural irrigation, which rises in the Highlands west of Addis Ababa, but flows east from the plateau through the northern half of the Rift Valley. It is also served by tributaries from both the western and eastern borders of the Rift Valley. Other smaller rivers of the central, southern and eastern Highlands flow into the closed lake basins within the Rift Valley. The southern Highlands are also drained by the River Omo which flows southward into the Lake Turkana basin, shared with Kenya. River drainage on the eastern plateau is noticeably influenced by the southeasterly surface tilt of the geological strata, with most rivers flowing toward or into Somalia. The upper reaches of the Wabi Shebelle, the main river system on this plateau, rise in the Chercher Highlands on the east side of the Rift Valley and partly in the Chilalo mountains of Arsi.

The hydrology of the Highlands is dominated by a variable rainy season with corresponding large variations in surface water flows, relatively few rivers being perennial. Ethiopia's inland waters cover a sizeable proportion of the territory. Most rivers are typical mountain streams over much of their length and form numerous waterfalls and rapids. During floods, which in some areas continue for

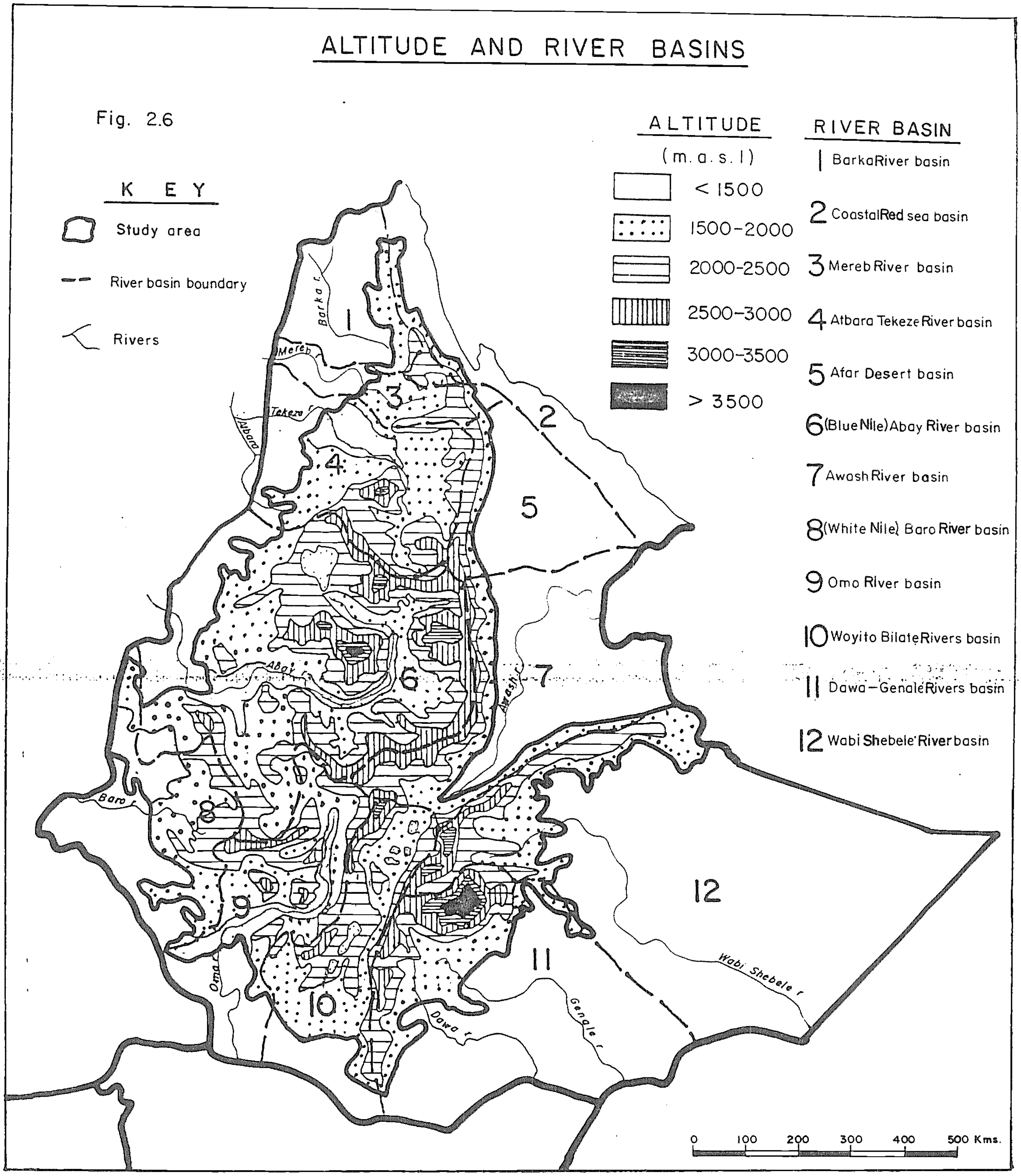

ALTITUDE AND RIVER BASINS
Fig. 2.6
KEY
Study area
River basin boundary
Rivers
ALTITUDE
(m.a.s.l)
< 1500
1500-2000
2000-2500
2500-3000
3000-3500
> 3500
RIVER BASIN
1 Barka River basin
2 Coastal Red sea basin
3 Mereb River basin
4 Atbara Tekeze River basin
5 Afar Desert basin
6 (Blue Nile) Abay River basin
7 Awash River basin
8 (White Nile) Baro River basin
9 Omo River basin
10 Woyito Bilate Rivers basin
11 Dawa-Genale Rivers basin
12 Wabi Shebele River basin
Barka r.
Mereb r.
Tekeze r.
Atbara
Abay r.
Awash
Baro r.
Omo r.
Dawa r.
Genale r.
Wabi Shebele r.
0 100 200 300 400 500 Kms.

Table 2.7

DOMINANT SOILS IN THE HIGHLANDS BY ZONE

Soil Type	Total 000 km²	%	000 km² LPC	HPC	HPP	Colour	Parent Material	Chemical pH	CEC	OM	P	K	Physical Depth 1/	Drainage	Workability	Erodibility
Nitosol	106	20	7	24	76	Red/ Brown	Volcanic	5.5-6.7	High	Variable	Low		VD	Good	Very good	0.15
Cambisol	91	17	57	22	11	Brown	Metamorphic or Volcanic	5.5-7.5	Moderate	Low	Low-very low	Medium	S to MD	Good Excessive	Depends on stoniness	0.2-0.3
Acrisol	81	15	7	5	69	Red	Volcanic or Metamorphic	Less than 5.5	Moderate	Variable	Very low	High	MD to D	Good Excessive	Good	0.11
Vertisol	62	12	14	32	15	Black	Volcanic or Alluvial	5.5-8.2	Very high	Moderate	Low	High	MD to VD	Poor	Difficult	0.16
Luvisol	58	11	23	25	10	Brown	Volcanic	6.3-7.3	High	Variable	Low	High	MD to VD	Good	Good	N.A.
Lithosol	37	7	26	7	5	Variable	Variable	N.A.	N.A.	N.A.	N.A.	N.A.	V.S.	Excessive	Unworkable due to degradation	0.2
Phaeosem	34	6	17	15	1	Brown/ Black	Volcanic ash	6.3-7.5	High	High	Low	Medium	S to MD	Good Excessive	Depends on stoniness	0.06-0.2
Other	67	12	29	32	7	-	-	-	-	-	-	-	-	-	-	-
TOTAL	536	100	180	162	194	-	-	-		-	-	-	-	-	-	-

1/ VS=very shallow (<10cm); S=shallow (10-50cm); MD=moderately deep (50-100cm); D=deep (100-150cm); VD=very deep (>150cm).

several months, they are virtually impassable. The volume of water in Ethiopian rivers depends largely on the amount of precipitation, and the uneven distribution of rainfall explains the marked variations in the abundance of water in respective river basins at different times of the year. Heavy rainfall and intense cultivation of steep slopes result in excessive runoff which causes much seasonal flooding in the Highlands. This is particularly apparent in the north. Conversely, as a result of topography and soil texture, large tracts of relatively flat land in the central Highlands are affected by seasonal drainage deficiencies causing water logging.

Little quantifiable information is available on Ethiopian ground water, although geological and climatic conditions imply that reserves of subterranean waters, including some near the surface, may well be considerable. This implication is supported by the abundance of springs: there are numerous thermal and mineral springs, especially in the Rift zone.

2.7 SOILS

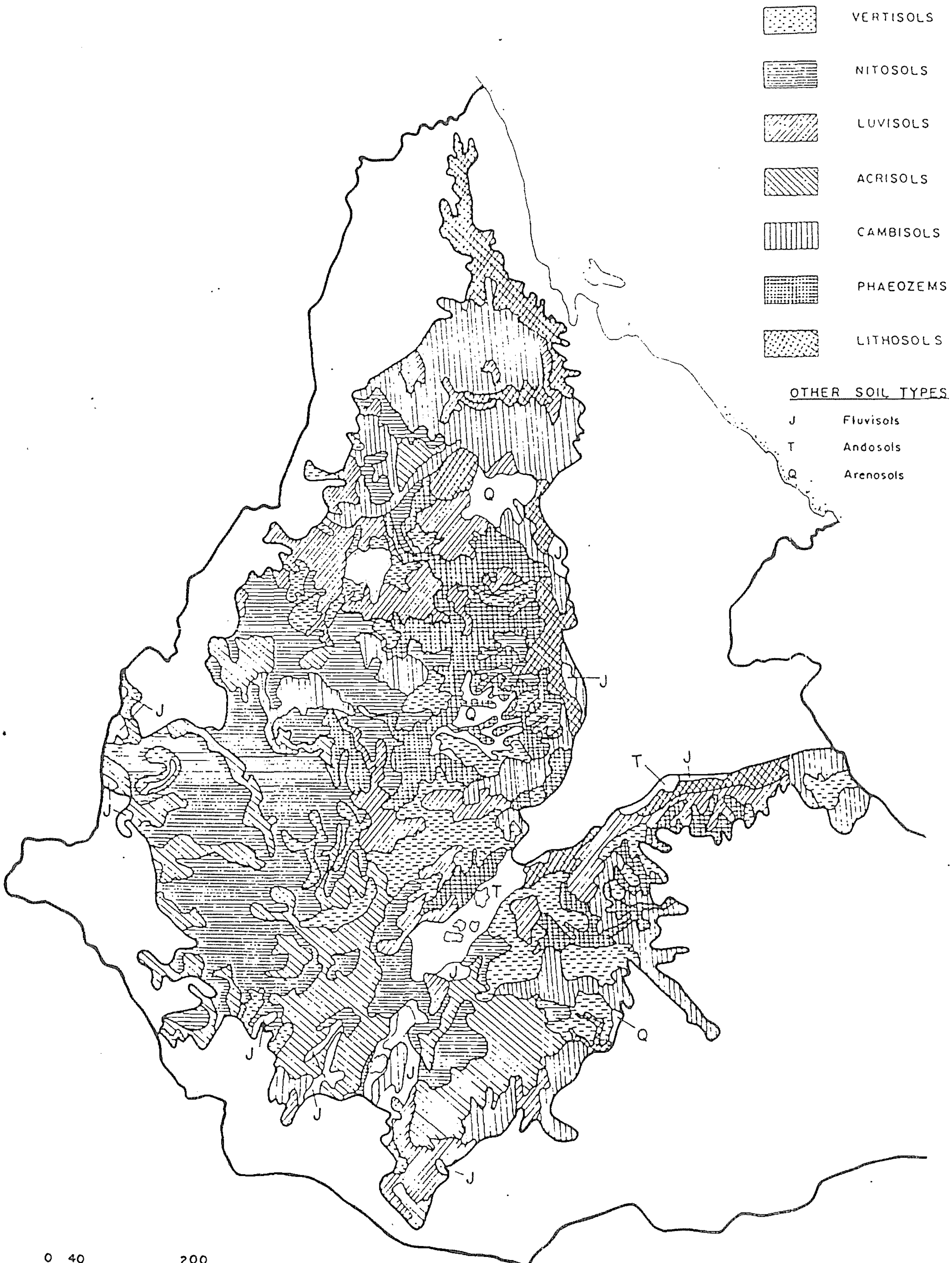
The soil resources of Ethiopia have been studied in detail only in recent years, with a draft provisional soil association map becoming available only in March 1984. Although the level of field verification of the soil associations is not intensive, this map does permit broad characterization and quantification of the soil resources of the Highlands. Table 2.7 shows the areas of major soils in each zone and lists some of the important physical and chemical characteristics of these major soil types, while Figure 2.7 shows the geographical distribution of dominant soil types. Seven soil types comprise 88 percent of the Highland soils. With the exception of the cambisols and lithosols, all the main soils are derived from volcanic parent materials.

By international standards, potassium, nitrogen, cation exchange capacity and organic matter are generally high, phosphorus is low, and calcium and magnesium at international average levels. It should be noted that even though all soil types are noted as having low to very low phosphorus levels, field responses are not as universal as would be indicated by these chemical extraction results. The reason for this is unclear, but could be due to fixation of phosphorus onto clays, or a hitherto unrecognized nutrient deficiency (perhaps sulphur). There has been little investigation of minor elements. With the exception of the lithosols and the vertisols all the major soils have good workability, good drainage, and adequate soil depth. The lithosols are, by definition, already degraded. The vertisols on the other hand, pose different problems. They are inherently fairly fertile with good moisture-holding characteristics, and a well developed structure when dry. However, they have a narrow range of moisture outside of which they are hard when too dry and very sticky when too wet.

The HPP zone is dominated by nitosols (39%) and acrisols (36%). The HPC zone is much more varied, with vertisols covering 20 percent

Figure 2.7

MAJOR SOILS IN THE HIGHLANDS



of its area, followed by luvisols, nitosols and cambisols. The LPC zone is also varied, with cambisols (32%) being most widespread, followed by lithosols (indicating more widespread degradation), luvisols and others. Generally most of the cambisols and lithosols are in the LPC zone while most of the nitosols and acrisols are in the HPP zone. Around half the vertisols are in the HPC zone and practically all the phaeozems are in the HPC and the LPC zones. The distribution of major soils by altitudinal sub-zone is given in table A2.3.

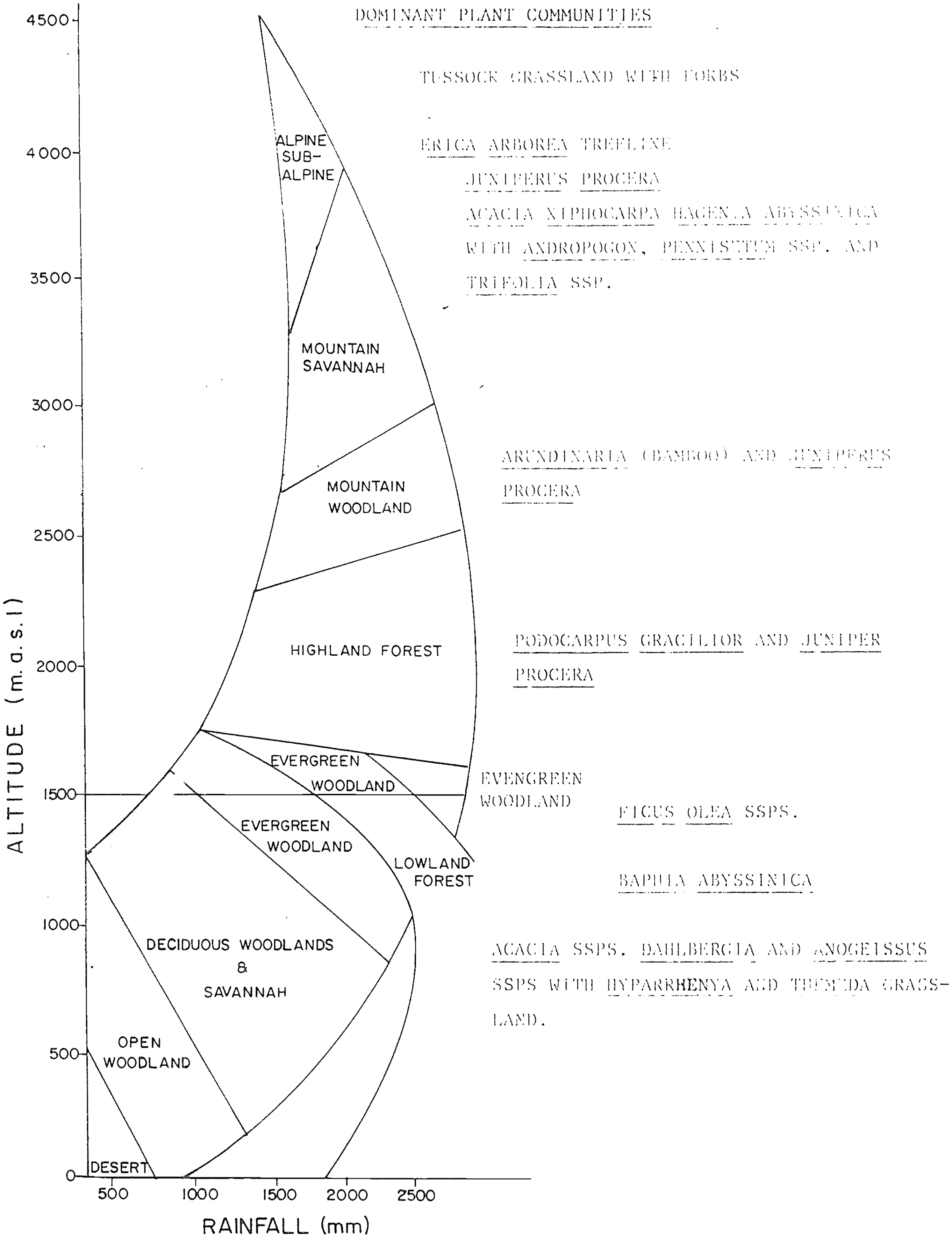
2.8 VEGETATION

Little of the natural vegetation of the Highlands remains today. The influence of man and his domestic animals has profoundly altered both the vegetation and the landscape. Ecological degradation, including deforestation and erosion, is widespread - particularly in the northern and central Highlands. Though not as severely degraded, the southern parts of the Highlands are being increasingly affected. In the northern Highlands the human influence on the landscape has been going on for so long, and is so uniform, that it resembles a natural climax - which it is not. This section describes the original vegetation and indicates how this has changed in response to the impact of man.

Because of the diversities in climate, topography and soils, Ethiopia is one of the few countries in Africa where virtually all major types of natural vegetation are represented, ranging from deserts to tropical forests to alpine grasslands. The number of wild flora species has been estimated at over 10 000 (Mooney 1961), while more than 50 different botanical plant communities exist.

Despite its diversity, Ethiopia's natural vegetation has a broad pattern related primarily to altitude and rainfall, which is shown summarily in Figure 2.8. In general, the height of the dominant natural vegetation and its density increases in proportion to humidity. Desert steppe vegetation of scattered low shrubs is found in the arid lowlands. As humidity increases, desert vegetation passes into open arid woodland steppe vegetation of short shrubs and scattered small trees among annual grasses. Savannah vegetation varies, with increasing humidity, from tall grass and shrubs to true savannah of dense, tall grasses with scattered short trees. With even more humidity, savannah vegetation passes into deciduous woodlands of small trees (5-12m) with a lower strata of high shrubs (2-3m). Parts of the woodland region also consist of bamboo forests. Evergreen woodland consists of transitional forest between deciduous woodland and Highland forests (above 1 500m). The Highland forests consist of an upper canopy of tall trees (30 to 50m), an intermediate layer of medium-sized trees and lower layer of tall shrub and low trees. With increasing humidity trees become taller (40-60m). With decreasing humidity and elevations over 2 400m the Highland forests give way to mountain woodland. At still higher elevations (over 2 700m), and with ever-decreasing humidity, there appears mountain savannah of shrubs, small trees and grasses, and from 3 400m upwards sub-alpine and alpine vegetation consists only of short grasses.

Fig. 2.8 **VEGETATION BY ALTITUDE AND RAINFALL**



SOURCE: MODIFIED FROM BREITENBACH 1963, PLANT COMMUNITIES BASED ON MARKLUND AND ODENYO, 1982

Many plant species are typical of certain altitudinal/rainfall ranges (Fig. 2.8 lists dominant species), while others, e.g., acacias, are virtually ubiquitous although their vegetative profusion changes with altitude. The presence between 1 500 and 2 500 masl of the richest and most diverse plant regime is due to the fact that this altitudinal zone is characterized by the most favourable combination of climatic and soil conditions. The distribution of major natural vegetation types is given in Figure 2.9, whilr table 2.8 indicates the relative importance of these natural vegetation types in terms of coverage of the Highlands area.

Table 2.8

CLIMAX NATURAL VEGETATION TYPES IN THE HIGHLANDS
(percent of land area)

Afro-alpine Sub-alpine	Forest	Woodlands	Grasslands	Wetlands and Riverine Forests
1	41 1/	37	20	1

1/ Consisting of forests of Juniper (6%), Podecarp (8%), Arindinaria (3%), Aririgeria (4%), Olea (10%), Baphia (3%) and others (7%).

Source: Marklund and Odenyo, 1982.

Most important among the natural forests are the broad-leaved moist forests and the coniferous forests. The former are found mainly in the moist humid parts of the southwest Highlands where rainfall is distributed more uniformly and in other higher rainfall areas of the southern Highlands. These forests are characterized by their high density and great variety of species. In the southwest, they include the wild coffee bush, Coffea arabica, from which is picked about a tenth of Ethiopia's coffee. The coniferous forests, much of it Junipero procera, once generally dominated the central and northern Highlands above 1 800m. Remnants of these forests can still be found today in the inaccessible areas of the eastern escarpment and the Arsi-Bale massif and around old churches.

Fig. 2.9 MAJOR NATURAL VEGETATION TYPES

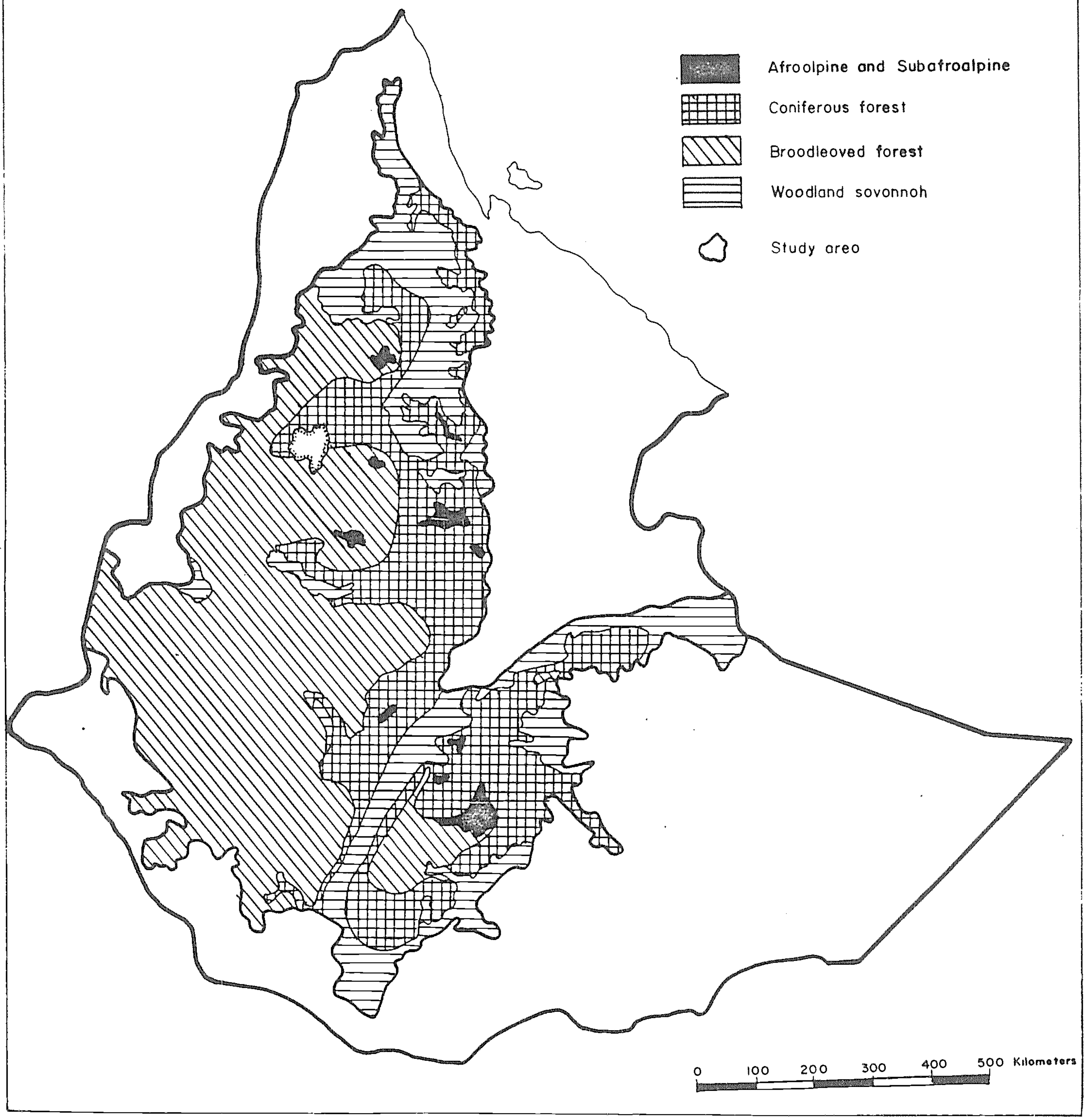


Table 2.9

MAJOR VEGETATION TYPES BY ZONE, 1983

	HPP		HPC		LPC		TOTAL	
	000 km^2	(%)	000 km^2	(%)	000 km^2	(%)	000 km^2	(%)
Forests	12	(8)	2	(1.5)	1	(0.7)	15	(3.5)
Woodland	4	(3)	5	(4)	1	(0.7)	10	(2.3)
Shrubland	15	(10)	4	(3)	8	(5)	27	(6)
Wooded grassland	38	(26)	25	(19)	37	(25)	100	(24)
Open grassland, fallow, 1/ failed crops	39	(27)	61	(46)	64	(43)	164	(39)
Harvested 2/	19	(13)	21	(16)	21	(14)	64 3/	(16)
Total	140	(100)	134	(100)	150	(100)	424	(100)

Note: Includes only the areas between 1.5 and 3.0 thousand masl. See Annex 4, tables 1-4 for detail. About 12 percent has been estimated as "waste" in each sub-zone.

1/ It has not been possible to estimate or define fallow land for Ethiopia, and there are no consistent estimates in past studies or surveys. Because of the difficulty of distinguishing in aerial photographs or satellite imagery, fallow land is included here with "open grassland".

2/ Includes about 7 000 km^2 of perennial crops (mostly coffee and enset).

3/ Includes about 3 000 km^2 of state farms, unallocated.

Source: EHRS Team estimates.

The study area between 1 500 and 3 000 masl under forest has declined rapidly to less than 4 percent today (see table 2.9), as the human population increased and more land was required for cropping - initially by shifting cultivation. This encouraged the spread of grasslands on areas cleared of forest. Thus it is estimated that grasslands (including both temperate pastures and rangelands) now cover some 65 percent of the study area land (1 500-3 000 masl) while a further 9 percent is covered by woodlands and shrub. The croplands account for around 16 percent of the study area. 1/

Table 2.9 clearly shows the much smaller forest areas of the HPC and LPC zones (only about one percent, compared to 8 percent in the HPP zone). Conversely, harvested lands account for only 13 percent of the HPP zone compared to 16 percent of the HPCZ and 14 percent of the LPCZ. Vegetation types by altitudinal sub-zone are presented in Annex 4, Tables 1-4.

The grasslands consist of both temperate and savannah grasslands. Temperate grasslands total about 4 million ha - usually above 2 000m and mainly in the HPP and HPC zones and characterized by genera of *Andropogon*, *Pennisetun* and *Festuca* with temperate herbaceous legumes belonging to the genus *Trifolium*. Much more extensive are the sub-tropical savannah grasslands (about 20 million ha), which stretch southward and eastward into the semi-arid rangelands which cover most of eastern Ethiopia and vast areas of the African continent. Dominant grass species change from *Hyparrhenia themeda* to *Chemchrus* and to *Aristida chrysopogon* as rainfall decreases.

2.9 WILDLIFE

Wildlife and national parks form an important part of the natural resources of Ethiopia, particularly in the Highlands. Wildlife includes over 100 species of animals and over 800 species of birds. Many wild species are endemic to the country. Some 37 wildlife areas are officially designated: nine national parks; 14 sanctuaries or reserves and 14 controlled hunting areas. These areas comprise about 64 790 km^2 (4 percent) of the total land area of Ethiopia. Major wildlife areas in the Highlands include: the Semien Mountains, Rift Valley Lakes, the Bale Mountains, Nech Sar and the Awash Park. These resources, coupled with the rich cultural heritage and spectacular landscapes, form a potentially valuable resource base for tourism (see section 4.3).

Prior to 1965 wildlife conservation in Ethiopia was primarily limited to regulatory measures and the granting of licenses for hunting. In that year, a Wildlife Conservation Department was established in the MOA. The Provisional Military Government, in an early policy statement concerning wildlife conservation indicated:

> "... it should, however, be emphasized that the conservation of wildlife, birdlife, etc., ... will be viewed primarily as national objectives in their own right and not only as a matter of attracting foreign visitors. This task of preservation will be actively pursued by the State."

1/ The estimate of harvested area is based on those of the annual CSO sample surveys, but these are considered by the team to be significantly underestimated.

The 1978 "Plan for the conservation and development of the wildlife resources of Socialist Ethiopia" lists six major problems in wildlife conservation:

(a) lack of awareness of the value of conservation of natural resources;

(b) failure of existing legislation and enforcement, with open encroachment of national parks;

(c) lack of integration with the people around the conservation areas;

(d) human interference through settlement, grazing, etc. and the resultant degradation of wildlife range;

(e) lack of trained personnel; and

(f) absence of a planned programme for land use, including wildlife.

Chapter 3

SOCIAL RESOURCES AND ORGANIZATION

3.1 SOCIAL ORIGINS AND COMPOSITION

Ethiopia has had a continuous existence as a nation, though with highly variable frontiers, for some 3 000 years. People within Ethiopia are today more easily grouped socially by reference to language, religion or other aspects of culture than by differences in physical features or appearance. There are over 70 distinct languages in Ethiopia and even more dialects and regional variations, but the most commonly accepted broad grouping distinguishes between people who speak Ethio-semitic, Cushitic and Nilotic languages. Figure 3.1 shows the distribution of these broad groups.

In terms of the historical, political and cultural influence on its speakers, the most dominant of these language groups has been the Semitic, which includes Amharic (19-32%), Tigray (11-15%), and Gurage (2%). 1/ Apart from the Gurage-speaking people, who are relatively separated in southwestern Shewa, the main homelands of Semitic-speaking people are in the northern Highlands and the northern coastal lowlands. Amharic is the official national language and is probably the most widely spoken.

Cushitic-speaking people occupy most of the rest of Ethiopia; the Nilotic speakers (1%) living almost totally in the lowlands bordering Sudan. By far the most important of the Cushitic languages is Oromigna (28-40%), which with Sidamo (9%) and other Cushitic-Omotic languages are the main languages in the remaining Highlands (central, western, southern, eastern). The rest of the lowlands are also occupied by Cushitic-speaking people: Somalis in the Ogaden and Afars in the northeast. Oromigna is almost certainly the most common mother-tongue, but taking into account knowledge of a second language, more Ethiopians today probably speak Amharic.

The same factors giving rise to this linguistic variety, namely Ethiopia's bridge position with respect to Africa and Asia and the dissected landscape causing many groups to live in comparative isolation, have also contributed to rich and varied cultural differences. For the purpose of this study the most important differences for agriculture are those between the plough farming culture of the

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1/ Figures in parenthesis indicate estimated percentages of the population speaking the mother tongue concerned.

Fig. 3·1

DISTRIBUTION OF MOTHER-TONGUES

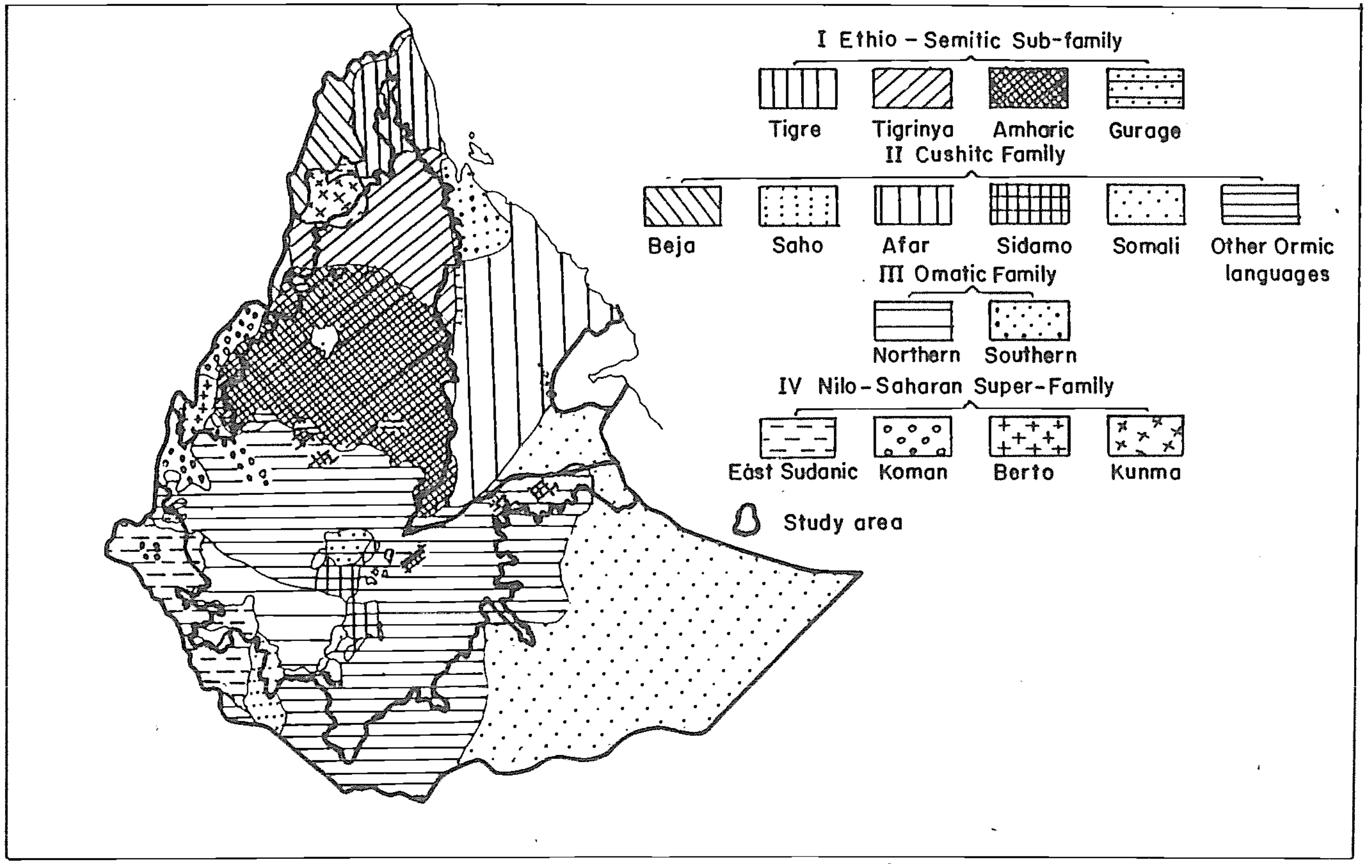


Fig. 3.1

northern Highlands (now widespread, however) and the hoe cultures generally of the south (although those which are still predominantly hoe cultures are theoretically limited to the southwest, virtually all ethnic groups now use the plough for some cultivation of cereals). The migration of people from Arabia brought to Ethiopia not only the Semitic languages, but plough cultivation, stone construction (especially to northern Ethiopia), and arable cropping, long before the plough appeared in Africa further to the south. As will be seen in the course of this report, the Semitic influence and extensive plough cultivation of cereals has an important bearing on the origins of degradation in Highlands.

3.2 HISTORY, POLITICS AND RELIGION

3.2.1 Beginnings of a culture

Ethiopia's historic continuity is largely the result of geography. Its high plateau, both fertile and temperate, was fairly defensible and thus Ethiopia has been able to preserve its unique culture born of the ancient encounter and slow fusion with the Cushitic and Semitic-speaking peoples. It is likely that forms of shifting cultivation were introduced as early as the first millenium B.C. by the migrants from Arabia, taking advantage of the relatively well-watered and temperate climate of the Highlands. Further agricultural development resulted from continuing in-migration. In the period from the 2nd to 9th centuries A.D. the distinctive Aksumite Empire, centred at Aksum on the Tigray plateau, grew to include a large part of present-day Ethiopia.

3.2.2 Religion

Christianity spread from its establishment in the fourth century but the Aksumite Empire came under increasing challenge from the seventh century with the spread of Islam. The major centres of Moslem influence today in the Highlands are around Harar and Jimma. Apart from the traditional religions of parts of the southern Highlands, most of the remaining Highlands are inhabited today by people who are significantly attached to the Ethiopian Orthodox Church, especially in the northern areas.

Statistics on religious (as on ethnic) affiliation, are not precise. A large part of the Amhara and Tigray peoples, and perhaps 40 to 50 percent of the national population, are orthodox Christians. Muslims are commonly estimated at between 30 and 40 percent.

A number of holy days require prolonged church services and feasting. The most important of the Ethiopian Orthodox Church's requirements, however, is the keeping of fast days. While only the clergy and very devout maintain the full schedule of fasts comprising

250 days, the laity is expected to fast 165 days in the year, including Wednesday and Friday of every week, the two months comprising the Lenten season and Easter, and 20 days preceding the Feast of the Assumption. On fast days milk, meat, and their by-products may not be eaten, and some may completely abstain from eating in the days immediately preceding Easter Sunday. However, on fast days pulses and, to a lesser extent, vegetables may be consumed. Strict Church observances also forbid manual labour on 86 days of the year and partially forbid it for a further 107 days.

Although the secular power of the Church has diminished, it is still an officially recognized institution - with the presence of high priests at secular public ceremonies - and remains (for reasons given in this section) a major influence on people's lives, especially in rural areas. Today, however, Peasants Associations have become an adjacent and possibly more important focus of activity in the life of rural communities (section 3.6).

3.2.3 Modernization with continuing feudal characteristic

The decline of the Aksumite Empire in the early Middle Ages was followed by several centuries of internal rivalry and fighting against external invasions. By the eighteenth century, the powers of the monarch had been usurped by the nobles, and the empire had largely disintegrated into several semi-independent provinces, whose rulers often fought among themselves. Emperor Tewodros II (1855-68), the first protagonist of modern Ethiopia, succeeded in bringing much of Ethiopia under single control. The southern regions of Hararghe, Kefa, etc. were subsequently brought into the empire by Emperor Menelik (1889-1913). Italy, however, took the area of Eritrea as a protectorate in 1890, but by defeating the Italians at the battle of Adowa in 1896, Menelik stopped Italy's advance, until its invasion and occupation 1935-61. It was under Menelik that Ethiopia's first national currency was introduced (1894), the capital was moved to Addis Ababa (1880s), the railway from Djibouti was built, telegraph lines were introduced to link major Regional centres and the first eucalyptus trees were introduced from Australia and planted widely over the Highlands for fuel and polewood.

The processes of modernization were continued by Emperor Haile Selassie (1930 to 1974), but most of the population received few benefits from the developments, as their lives continued to be governed by their total dependence on the vagaries of the weather and, in the southern and central areas, on powerful landlords. In any event there was little development impact in most of the rural areas.

The feudal lords had traditionally been the Amharic and to a lesser extent the Tigray-speaking aristocrats, but members of other ethno-linguistic groups, particularly among the Oromo, in exceptional cases were elevated to the aristocracy by the Emperor and given large areas of land (Gilkes, 1975). Generally the ruling groups made few concessions to other interests. About half of the peasant cultivators were tenants (usually sharecroppers) and were forced to pay other forms of tribute (section 3.5). Despite owning most of the best land, the landlords viewed themselves more as power wielders and status bearers rather than as agricultural entrepreneurs. Few engaged actively in commercial agriculture, relying instead on the heavy rents in kind surrendered by their tenants. If such landlords managed to accumulate capital beyond that considered necessary for their derived lifestyle, it was usually invested in urban property and services such as hotels and restaurants. The tenants, on the other hand, had very little interest/motivation in trying to conserve the productivity of their plots (see section 3.5).

> "The Government's pattern of agricultural and rural development barely touched the peasant agricultural sector, which constituted more than 90 percent of the country's population. The development strategies of the three Five-Year Development Plans from 1957-1973, focussed mainly on commercial and export agriculture. Investment was mainly in the urban areas, with monetary investment in agriculture averaging only about six percent of total investment, in the period 1960-1970. Approaches to peasant agriculture were piecemeal, seeking the increased production of a few crops in a few areas along existing roads, thus by-passing 90 percent of the rural population. The same approaches were used in meeting the basic needs of the population. Health services were poor. Drinking water supplies, particularly in the rural areas, were almost non-existent. Education and literacy were at very low levels, with 97 percent of Ethiopia's rural population considered illiterate. Food security and nutrition were low, with people in many rural regions subject to the ravages of drought and famine". (FAO 1982c.)

3.2.4 Colonial influences and separatism

Immediate strategic interests as well as long-term economic considerations caused the Italians to devote great efforts to road-building, and this was, of course, of long-lasting benefit to Ethiopia. The Italian armies were defeated by Allied troops and the Italian occupation ended in 1941.

The immediate postwar years witnessed protracted discussions over the future of the ex-Italian colony of Eritrea. In 1950, the United Nations agreed that Eritrea should be federated with Ethiopia, and the federation came into existence in 1952, with a semi-independent elected Eritrean Assembly (the elections were supervised by Britain). In 1962 the Assembly voted for Eritrea's full union with Ethiopia and this took place in that year, but this has been opposed by a separatist guerrilla movement.

3.2.5 The revolution and political aftermath

The failure of Haile Selassie's government to effect significant economic and political reforms which would enable the mass of the people to gain from the nation's development, resulted in increasing peasant disturbances, especially in the south. The growth of an educated urban middle class (which increasingly resented the autocracy of the emperor and rule of the aristocrats), rising inflation, pervasive corruption, attempts to conceal the catastrophic 1972-1974 famine, growing student, teacher, worker and army discontent, led to uprisings which eventually developed, during 1974, into the Ethiopian revolution, headed by the "Derg" or "council", a Coordinating Committee of the Armed Forces.

The Derg replaced the imperial regime by a Provisional Military Government. The declaration of a socialist state in December 1974 was followed in 1975 by the nationalization of large private companies and all land (see sections 4.4, 4.5) and the establishment of Peasant Associations in rural areas (section 3.6) and urban dwellers' associations (Kebeles) in urban areas. By 1976 the socialistic aims of the Revolution had thus been manifested in terms of these fundamental changes affecting most of Ethiopia's population. In December 1979 a Commission for Organizing the Party of the Working People of Ethiopia (COPWE) was established. The objectives and political creed of the Party are described in Chapter 11. The Party was proclaimed in September 1984.

3.2.6 Internal security

Despite GOE efforts, centuries-old centrifugal problems are expressed to varying degree in separatist opposition. This has led to security problems in some areas in the northern Highlands (parts of Tigray, Eritrea, Welo and Gondar Regions), which at times are partially inaccessible through fears of security incidents. This restricts travel by GOE personnel and, even more particularly, expatriates. This inevitably has some effect on the extent to which development projects can be prepared, implemented and monitored in these areas. For example, projects have had to be curtailed in Welo and Tigray Regions in recent years (e.g., the Kobo Alamata and Colina Hormat projects of the RRC).

3.3 GOVERNMENT AND LOCAL ADMINISTRATION

The circumstances leading to the establishment of the Provisional Military Government of Socialist Ethiopia (GOE) were described in the previous section. Figure 3.2 shows how the GOE is organized, with Ministries and (ministerial level) Commissions reporting to the Council of Ministers, which liaises closely with the National Revolutionary Development Council (NRDC) and the Office of the National Committee of Central Planning (ONCCP) in reporting to the General Assembly under the Chairman, who is the Head of State.

Fig. 3·1

DISTRIBUTION OF MOTHER-TONGUES

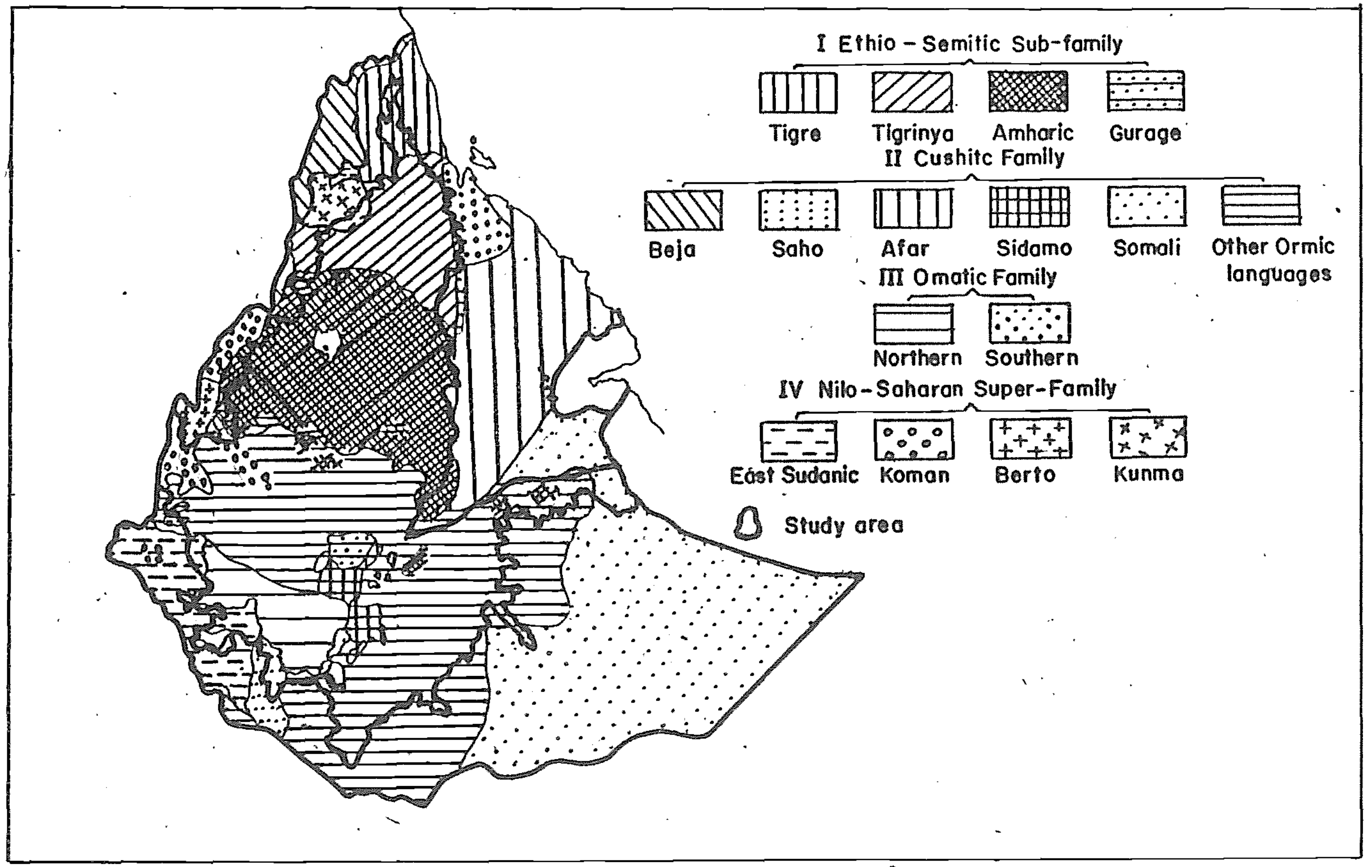
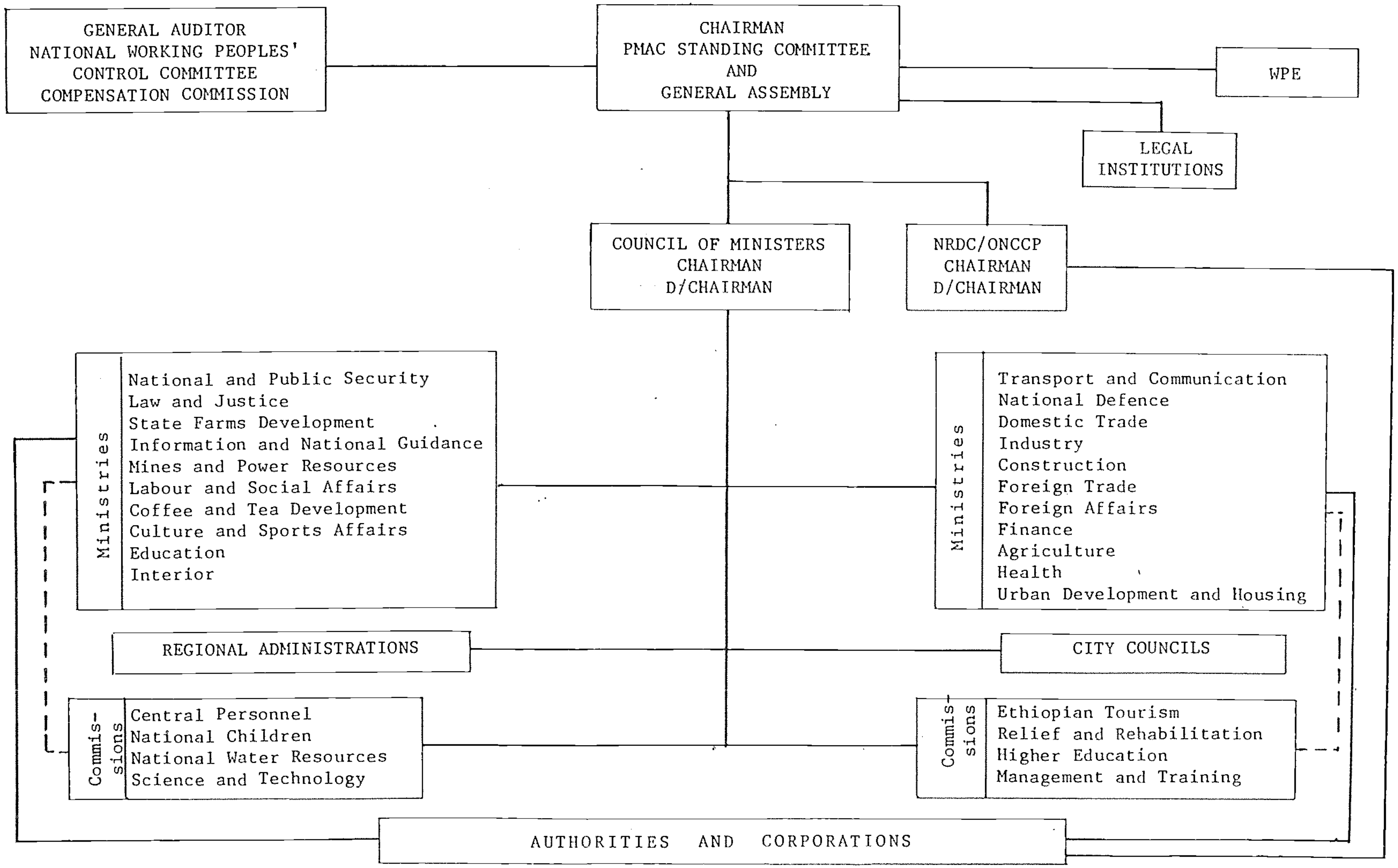


Fig. 3.1

Figure 3.2 GOVERNMENT OF ETHIOPIA: ORGANIZATION



Because of the predominantly rural nature of Ethiopia, most of the Ministries and Commissions are concerned directly or indirectly with rural development. Those concerned with agricultural development include: the Ministry of Agriculture, the Ministry of State Farms, the Ministry of Coffee and Tea Development, the Ministry of Domestic Trade (with some responsibilities in agricultural marketing), the Ministry of Foreign Trade (agricultural exports and imports) as well as the Ministry of Transport and Communications, and of Finance. Ministerial level commissions with responsibilities in agriculture include the Relief and Rehabilitation Commission (responsible for settlements, but it is understood that this responsibility should pass back to the MOA), the National Water Resources Commission (responsible for large-scale irrigation) and the Science and Technology Commission, under which is the Institute of Agricultural Research. The Board of the IAR is chaired by the Minister of Agriculture.

Coordination of these entities is the responsibility of the ONCCP. For this purpose the ONCCP has an Agricultural Division which is the central advisory/decision-making body for all key matters affecting the agricultural sector. Other Divisions in the ONCCP play a similar coordinating role with respect to critical decision-making and overlap between various Ministries and Commissions in the other sectors. Thus the Ministries and Commissions are essentially operating agencies with coordinating decisions being made at a higher level.

For administrative purposes, Ethiopia is divided into 14 Regions (see Fig. 1.1). Each Region is divided into Awrajas: there are 102 in all Ethiopia; 89 in the Highlands. Awrajas are further sub-divided into Weredas. Under the Weredas, but not reporting directly to them, are the Peasant Associations which, as will be seen in section 3.6, have certain governmental and administrative functions, as have also the Producer and Service Cooperatives which are formed by PA members and PA's respectively. These latter organizations are described in detail in Section 3.6. The abovementioned local administrative structure is illustrated in Figure 3.3. The numbers of each of the abovementioned units in Ethiopia and the study area, together with estimates of the population covered by each, are presented in table 3.1. Table 3.2 summarizes the average areas covered by each unit.

Each Region is under a Chief Administrator, responsible to the Ministry of the Interior for administration of that Region. Awraja and Wereda Administrators and municipal authorities within each Region are responsible to the regional Chief Administrator.

A pertinent weakness of the organizational structure is the difficulty of ensuring co-ordination between the interrelated ministries in the field of rural development. The apparent overlap between the many ministries and commissions concerned with agricultural development raises risks of unnecessary duplication, waste and competition for the nation's scarce resources (e.g., manpower, land, seed, fertilizers etc.) while activities in the field may be adversely affected as a results (for example, the Sirinka project - see Chapter 8). It is presumably in light of such considerations that the GOE is giving attention to the reorganization of various ministries.

STRUCTURE OF LOCAL ADMINISTRATION

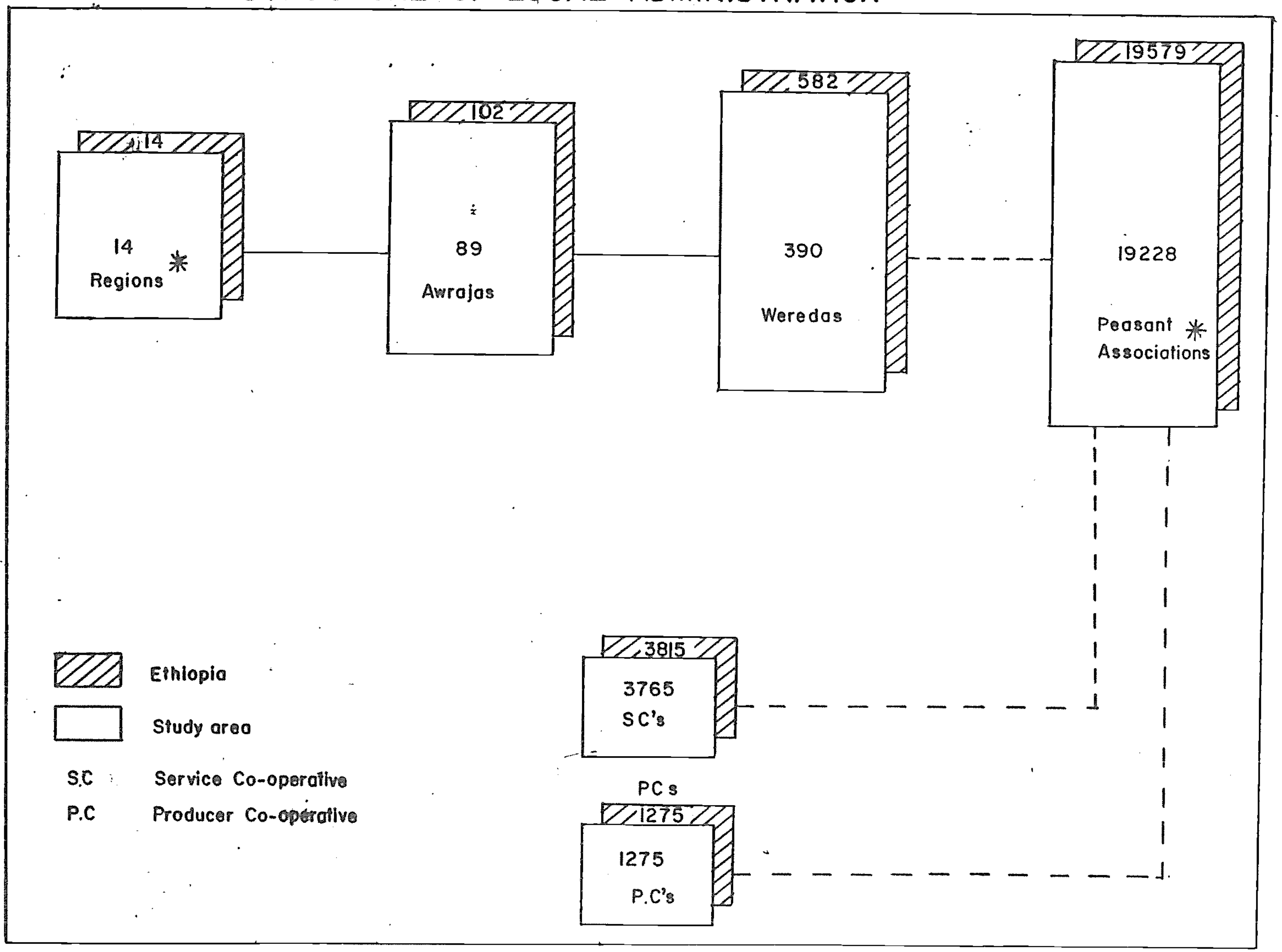


Fig. 3.3

Table 3.1

STUDY AREA POPULATION BY ADMINISTRATIVE UNIT IN 1983

	Total Ethiopia Number	Total Study Area Number	Study Area: Population per Unit		
			Range		
			Low	High	Average
Administrative Regions	14	14	772 100	7 473 000	2 346 100
Awrajas	102	89	177 100	1 069 800	369 000
Weredas	582	390	4 500	286 600	84 200
Peasant Associations	19 579	19 228	352*	6 600*	1 560*
Service Cooperatives	3 815	3 765	704*	30 800*	7 500*
Producer Cooperatives	1 275	1 275	44*	4 400*	240*

* Rural population only.

Source: EHRS Team calculations and EHRS WP No.8. The CSO national average of 4.5 members per farm family is assumed.

Table 3.2

AREAS COVERED BY ADMINISTRATIVE UNITS IN THE STUDY AREA IN 1983

	Study Area: Area per unit			
		Range		
	No.	Low	High Km^2	Average
Administrative Regions	14	21 900	73 400	41 500
Awrajas	89	1 100	25 900	6 500
Weredas	390	130	11 900	1 500
Service Cooperatives	3 765	12	52	32
Peasant Associations	19 228	6	10	8
Producer Cooperatives	1 275	3	10	5

Source: EHRS team calculations.

3.4 POPULATION

3.4.1 Numbers and Growth

The first population census of Ethiopia was undertaken while this Study was being prepared. The main results 1/ were made known only in December 1984, far too late for use in the analyses of the EHRS. The basic assumptions on population used in this Study are described as follows.

The official population estimate for mid-1983 was 33.7 million, based on regional sample surveys conducted by the Central Statistical Office (CSO) in 1970. Long before the Census these figures were widely known to be serious underestimates, and for the planning purposes of the EHRS it was considered desirable to obtain additional estimates. For this reason the EHRS commissioned a study (WP 8) by staff of the Economics Department of the University of Addis Ababa, to estimate the population in the Highlands, its distribution and growth and to project future population. At the time, the latest (1980) Ministry of Agriculture figures on membership of the Peasant Associations (see section 3.6), multiplied by regional average household sizes (as estimated by CSO), were compared with the CSO 1980 rural population estimates for a sample of 45 Awrajas in the Highlands. The former estimates were some 13 percent higher in aggregate than those of the CSO. This average "correction factor" was used to adjust upwards the CSO estimates of rural population. The CSO estimates of urban population at that time were considered more reliable (being updated by frequent surveys) and were used in this study.

On this basis, the 1983 population of Ethiopia was estimated at 37 429 000, of whom about 89 percent (or 32.8 million) live in the study area. 2/ The Highlands rural population was estimated to be growing at the rate of 2.8 percent p.a., reflecting crude birth rates of between 43 and 50, and crude death rates of around 19 or 20 per 1 000. (This coincides with the average for Africa as a whole, according to UNECA, and is supported by the Census.) 3/ The average size of the rural family in the Highlands is generally estimated at 4.5. (The EHRS Sociological Survey (WP 8), however, indicated a mode of 5 and a mean of 5.6).

1/ Total population, 42.0 million as of 9 May, 1984; of which 37.3 million rural and 4.7 million urban. The annual growth rate is put at 2.9 percent.

2/ Including about 2.1 million in the areas below 1 500m and above 3 000 masl.

3/ Hadgu Bariagaver, "Demographic Characteristic of the Rural Population of Ethiopia, "Ethiopian Journal of Development Research, III, 2 (October 1979) p.85.

3.4.2 Geographical Distribution and Settlement Patterns

Generally, the distribution of Ethiopia's population reflects the pattern of physical relief. The Highlands, having more plentiful rainfall, are the home of settled agriculture. Land over 2 000m is free of the malarial mosquito, a factor contributing to the more sparse occupation of those lowlands which are suitable for farming. It is thus not surprising that 88 percent of Ethiopia's population reside in the 44 percent of its land area which comprises the Highlands and associated valleys. Accordingly, the average population density in the Highlands, at about 61 persons per sq km, is double the national average and eight times that of the lowlands (7 persons per sq km). But there are significant variations from these averages by location. Population density is generally highest in the north and central Highlands, stretching down to the Rift Valley Lakes (see Figure 3.4 showing the distribution of population in 1983). Highlands population densities are lowest in the western and eastern Highlands.

Table 3.3

PERCENT OF TOTAL ZONAL AREA WITH
LOW POPULATION DENSITY IN 1983

Rural population	Zone		
	HPP	HPC	LPC
Density per km^2	%	%	%
0 to 9	19	13	5
10 to 19	12	15	9
Below 20	31	28	14

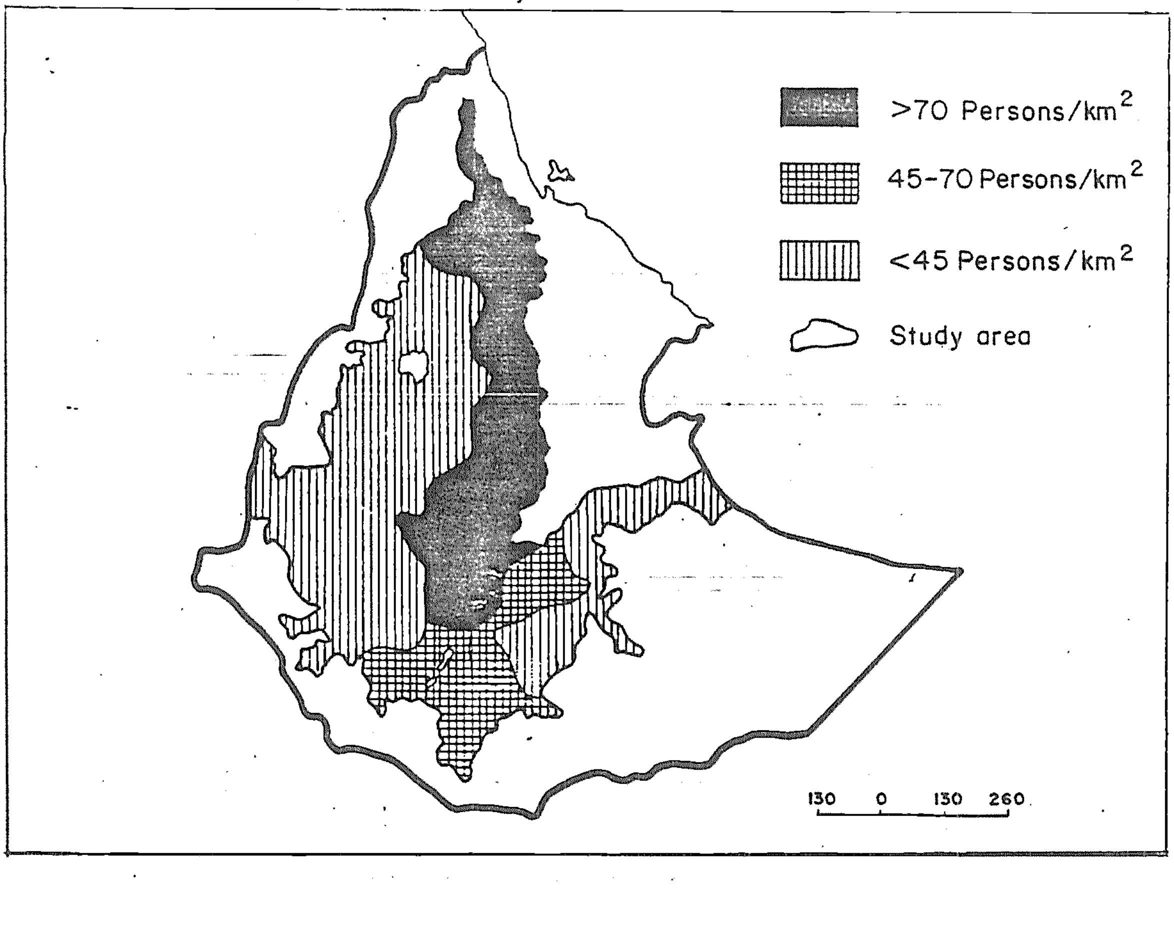
Source: EHRS calculations.

Population is very unevenly distributed in each zone, rendering the arithmetic mean densities unreliable. Thus the HPP zone contains areas of the highest rural population density (to the southwest of Addis Ababa) and yet has the largest areas of relatively low population density.

Table 3.3 draws attention to the relatively small proportion of the LPC zone having lower population densities compared to the high potential zones. Indeed, population pressure is one of the factors that has contributed to extensive degradation in the LPC zone (see Chapter 6).

Fig. 3.4

Population Density In 1983



If urban localities are defined as those with 2 000 or more inhabitants 1/, there are some 222 urban localities in the Highlands, with 4 580 100 residents - 14 percent of the Highlands population. Sixty-five towns with more than 10 000 residents account for 81 percent of the urban population; 19 percent live in small towns with less than 10 000 inhabitants. Only ten towns with population of more than 50 000 account for 56 percent, and the cities of Addis Ababa and Asmara cover 43 percent of the total. 2/ Urbanization is lowest in the HPP zone: about 9 percent, compared to 13 percent in the LPC zone and 24 percent in the HPC zone.

In rural areas, settlements generally are not concentrated around a village centre, but are usually dispersed over a large area, each nuclear or "extended family" preferring to live adjacent to its cultivated fields. The typical "parish" may contain a core of some 20 to 30 household heads, possibly descended from a common ancestor. The largest rural settlements have generally developed local markets and also serve as administrative centres (e.g. Wereda "towns"), some formed recently along all-weather raods. In the less densely populated areas of the southeast (especially in Bale Region), in RRC resettlement areas, and in the nomadic lowlands, the GOE is pursuing a policy of villagisation, as a major step toward the provision of services and cooperative development (see Chapter 9 and section 13.4). The initial houses and stores are constructed by the newly settled villagers themselves, with material supplied on credit to the corresponding Producer Cooperative. (In this respect, efforts should be made to learn from experiences of other countries, such as Tanzania 3/.) However, most families continue to live in widely scattered family compounds. Homesteads are generally fenced but fields are not - with the major exception of the most densely populated areas in the south, where bamboo fencing is common.

3.4.3 Migration

Human settlement on a large scale apparently started in the northern Highlands (the Aksumite Empire) and has gradually extended to Highlands in the south, west and east (section 3.1). The EHRS Sociological Survey (WP 4) indicated significant numbers of Amhara in such

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1/ This is the CSO definition; the Ministry of Interior's definition additionally relates to certain infrastructures; while the definition of the Ministry of Urban Development and Housing also relates to non-agricultural sources of income.

2/ The most important towns in 1980 were Addis Ababa (1 177 159); Asmara (424 532); Dire Dawa (82 624); Gonder (76 932); Desie (75 616); Nazareth (69 865); Harar (62 921); Bahr Dar (52 188) and Debre Zeit (49 570).

3/ Many lessons to be gained from Tanzanian experience in villagisation are summarized in FAO 1983c.

traditional Oromo areas as Arsi, Bale and Kefa. This directional movement was what one would expect: as fertile land became unavailable in the north, people moved to other fertile areas further south, and to the east and west. The EHRS Sociological Survey indicates that by far the most important reason for migration has been to find land suitable for cropping (36 percent of respondents), while a further 25 percent of respondents migrated to be with other members of their family. From other data, 1/ the EHRS Working Paper No. 8 on population concludes that it is not so much the search for employment opportunities that is the "pull" of migration, but rather the "push" of the lack of fertile land in the areas of origin. Nevertheless, seasonal migration in search of employment has been important in the past, and also appears to have followed the same direction. Thus Sahle Mariam (1982) estimates numbers of annual seasonal migrants from Tigray and Welo in search of employment in the early 1970s at: 50 000 to Kefa for coffee picking; 30 000 to the lower Awash for cotton picking; and 20 000 to Setit Humera for sesame harvesting.

Through the RRC, GOE-supported migration or resettlement has been pursued since the 1972/74 drought. In seven years approximately 105 000 persons were resettled (mainly from Welo) to both the southwest and southeast Highlands (see Chapter 9). Furthermore, the Ten Year Plan target of 85 000 to be resettled in the next ren years implies that resettlement will remain relatively insignificant in relieving zonal population pressures, though its significance will be greater in small localities. The 1975 Land Reform Proclamation forbids the rural employment of labour on privately farmed holdings and the private renting of land. This - and the fact that a peasant has to obtain authorization from the PA before he leaves an area and can be allocated a new plot by the PA in the new area where he intends to settle - tends to discourage migration, especially as such authorizations are difficult to get. Accordingly, rates of migration have fallen substantially since the mid-1970s. The EHRS Sociological Survey (WP 4) indicated that only two percent of the farmers interviewed had moved into their present residence area in the past ten years, compared to 20 percent in the past 40 years. A recent review of the economy (World Bank 1983d, p.37) draws attention to the serious shortage of seasonal labour for coffee picking in Kefa and Illubabor.

Potential permanent migrants from northern areas (where there is surplus labour) are discouraged by fear of losing their land use rights at home, and seasonal migration is discouraged by movement restrictions.

Similar reasoning suggests that the rate of rural-urban migration has also decreased in the past decade, and the EHRS population study presents some data to support this (WP 8). This may also be attributed to growing urban unemployment. Urban population apparently was

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1/ CSO: Population, Labour Force and Housing Characteristics of Seventeen Major Towns. August, 1980, pp. 68-97.

growing at around 6.6 percent p.a. in the 1960s and 1970s (4.1 percent of which was attributed to rural-urban migration), but it appears to have fallen to about 5.5 percent p.a. since the mid-1970s (3 percent of which is attributed to rural-urban migration). 1/

3.4.4 Projections

Using age- and sex-specific mortality and fertility rates (i.e., the cohort-component projection method as opposed to mathematical extrapolation of past trends), the EHRS population study (WP 8) projects the annual growth of the Highlands population at between 2.4 and 3 percent. With the medium variant, the Highlands population would reach 65 million by the year 2010, around 90 percent of the total population of Ethiopia (see Figure 3.5). These projections are based on a gradual reduction of mortality rates and on constant birth rates until the early 1990's. Reluctance to accept any form of birth control reflects continued dependence on rural child labour and the need for support in old age. 2/ Any declines in birth rates (for example, associated with urban drift 3/) are likely to be offset by increases in fertility associated with improved nutrition and health among mothers and children.

Urban population is projected to reach around 20 percent of the Highlands population by the year 2010, compared to the present 11 percent, even assuming a further fall in the rate of rural-urban migration for the reasons given in the previous section. The economically-active population in the Highlands (defined as all persons between the ages of 10 and 59 years) is projected to increase from 41 percent at present to around 44 percent by the year 2010.

Population density is projected, based on the medium variants, to more than double, thus reaching around 108 persons per sq km for the Highlands as a whole by the year 2010. Thus where each family now has access, on average, to around eight ha, this would decline to less than 5 ha by 2010.

1/ With the announcements of the May 1984 Census results in December 1984, it was found that urban population had been growing recently by about four percent p.a.

2/ Examples of aversion to birth control are cited in Fassil G. Kiros, "A Critical Evaluation of Family Planning Prescriptions for Rural Welo and Tigray", Ethiopian Journal of Development Research, III, 1, April 1979.

3/ The economic benefit-cost ratio of children is less attractive in urban than in rural areas, and contraception is more common in urban areas. (EHRS Working Paper 8.)

POPULATION TRENDS AND PROJECTIONS

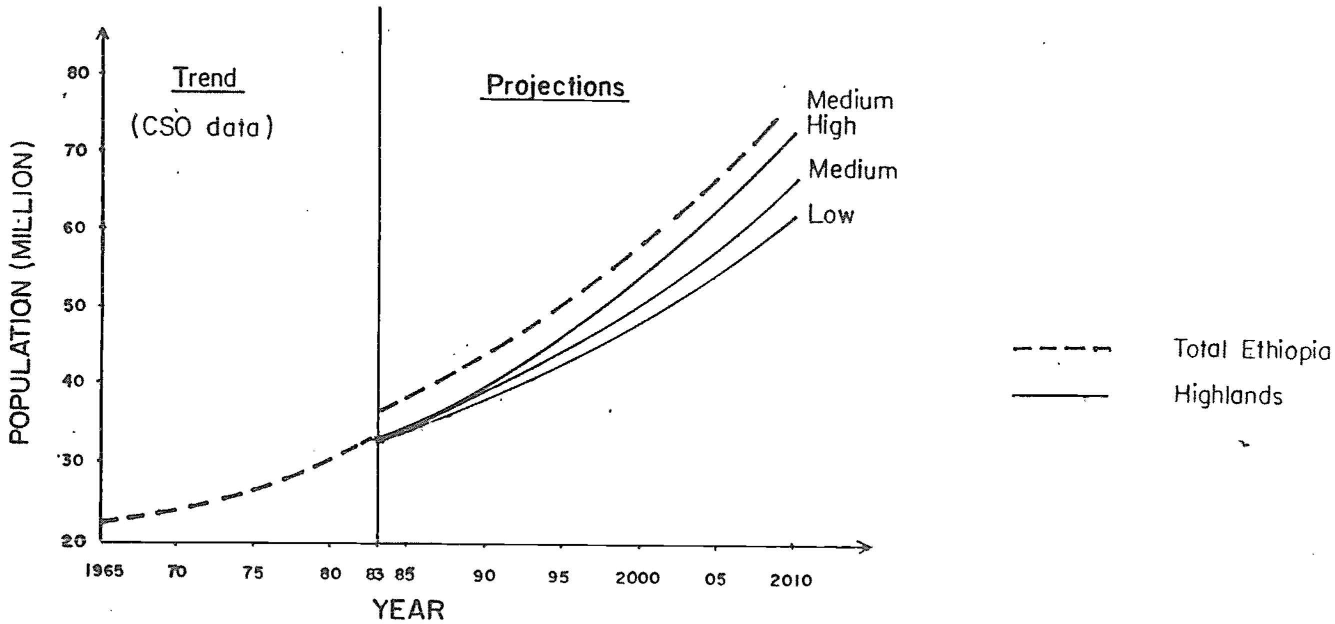

Fig. 3.5

3.5 LAND TENURE

3.5.1 Before the Revolution

Figure 3.6 shows the distribution of land ownership before 1975. Prior to the Revolution, an estimated 46 percent of farmers were tenants. 1/ Fundamentally different systems of land tenure co-existed in the north and south, respectively. These systems have been described as "some of the most intricate, and at times most difficult to understand, in the world" and the following descriptions are necessarily over-simplified. Much fuller descriptions are given by Mulugetta (1978).

In the north, there were various systems of communal or kinship land tenure, known as "Rist" in Amhara areas and "Gult" in Tigray. Rist was the right to claim a share of land held in common with others, all of whose claims were based on kinship to a common ancestor. In practice this led to increasing fragmentation of individually used family plots and substantial deforestation and overgrazing on more communally-held tracts of land (Sahle Mariam, 1982). Substantial disputes arose over rights to use the land. Under "Gult", rights were given to a share of the tax levied by the state on an area of kinship land. Such taxes were analogous to crop shares paid by tenants in the south.

In the south a private "freehold" system prevailed, in which most of the land was owned (as a result of grants from the Emperor - see section 3.2) by absentee landlords who allowed local people to cultivate it under a feudal system. Tenants were basically share croppers who, on the average, paid about a third of their major crops as rent - in some cases as high as 75 percent. Tenancy was insecure, and this severely inhibited their investment in these lands.

The Ethiopian Orthodox Church also held a great deal of land, up to 20 percent of the total cultivated land in some areas (Mulugetta, 1978). Most of the lowlands were categorized as government land, and these were held under customary land tenure by pastoralists.

During the 1950s and 1960s some landlords became more interested in farming, prompted both by the growing possibilities of mechanization and the encouragement from the Imperial government (section 3.2). As a result, tenant evictions became more frequent and redistribution of land was largely confined to government employees. A 1973 World Bank mission concluded that "a major constraint on agricultural growth

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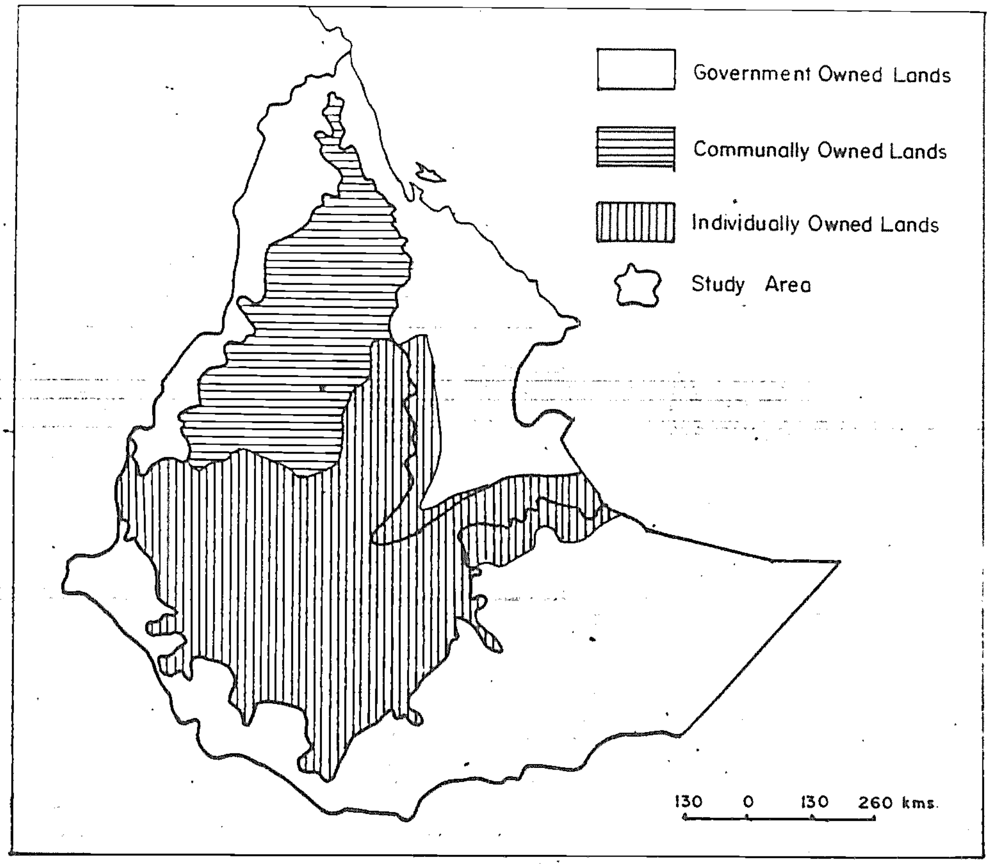
1/ Sahle Mariam (1982). The national average estimate conceals important differences. In the south sharecropping tenancies on the free holdings of the large landlords was dominant: about two-thirds of the peasants were tenants. In the north somewhat more than a quarter of the peasants were tenants.

Fig. 3.6

Land Ownership Before 1975



in Ethiopia was the highly distorted land ownership and high tenancy rates in the southern regions, and the prevalence of communal land tenure in the northern region" (WB 1973). With more specific reference to conservation a 1974 USAID report concludes:

> "The land tenure system helps assure that the peasantry will follow and perpetuate - because he has no incentive not to - those defective agricultural practices - lack of soil and water conservation, lack of afforestation and deforestation, lack of crop rotation, lack of fodder and stock control, etc. - which encourage and abet the ecological deficiencies which eventuate drought."

3.5.2 Land Reform

The Rural Lands Proclamation of March 1975 declared "all rural lands to be the collection property of the Ethiopian people" (Art. 3.1), and that "no person or any other organization shall hold land in private ownership" (Art. 3.2). The Proclamation further specified that the right to use land (but not ownership) was to be distributed as equally as possible among all rural families actually living from the land. No family was to have a plot larger than 10 ha and no part of this land was to be sold, exchanged, mortgaged, rented or leased. Landuse rights could be inherited by children. The Proclamation prohibited the use of hired labour except by women disabled or old or very young persons with no other means of livelihood. The Proclamation also nationalized (sometimes with some compensation) large-scale commercial farms (section 5.7).

Much of the responsibility for implementing the land reform was given to the peasantry itself. For this the Government initiated a special campaign (Zemecha) to mobilize some 50 000 university and high school students to help the peasants establish associations to implement the land reform. The organization of Peasant Associations (section 3.6.1) ensured the participation of the beneficiaries in the process of redistribution. Land is usually allocated to individual PA members in proportion to their family size. Sometimes, where soil or other physical conditions obviously differ, the allocations take this into account. On average, the holding consists of three separate plots of land (EHRS WP 4). Although efforts are made to make the allocations long-term, in practice boundaries have been frequently revised to accommodate new members joining the PA both from inside (i.e., those reaching the age of 18), or migrants from outside who have successfully requested such rights. In the second place, where a Producer Cooperative (PC) is formed (section 3.6.2) within a PA, the PA is obliged to arrange for the PC members to be reallocated land that is contiguous, which inevitably means displacing PA members not joining the PC and adjusting the boundaries of others to accommodate them. PC members receive the same holding sizes as allocated to other PA members, both in the case of cultivated and of grazing land. Adjucation is carried out by the Wereda PA in collaboration with MOA staff. The EHRS Sociological Survey found that 37 percent of the farmers had their holdings partly or wholly changed in the last ten years.

In 1982 an FAO mission concluded that while no systematic review of the process of land redistribution had taken place, most tenants and landless workers had obtained increased access to land with greater equity in its distribution (FAO 1982c). However, while equity in land holdings has been achieved within each PA, there is often considerable inequality between the holdings of land available to different PAs and therefore the size of average holdings of their respective members. The allocation of land to PAs nationally is around 800 hectares (see table 3.2) and this may be a good estimate of the average. PAs vary greatly in membership, from around 100 families to over 1000 families (see table 3.1). Thus in some of the larger PAs, families are allocated less than one hectare to cultivate. Statistics on holding size are disorderly and are of little use in analysis of the ratio of cropped areas to the total holdings. While the Government has encouraged some reallocationn of land between PAs, there is a very real danger in some PAs that population growth will reduce the size of individual holdings to uneconomic levels. Uncertainty about the possible communalisation of land through Producer Cooperatives (see section 3.6.2), and the frequent and continuing land redistributions discourage peasant efforts to invest in the permanent conservation and improvement of their holdings. 1/ There are no guarantees that peasants joining a Producer Cooperative will be compensated for trees they have planted or bunds they have built or other improvements they have made to their holdings. There is thus little incentive to use the land in such a way as to conserve or increase its productivity in the longer term. These problems of insecurity of land tenure and growing fragmentation of holdings are addressed in Part III, section 11.6 in particular.

While the land reform programme has provided a more equitable distribution of the use of land, further impact of land reform depends on the extent to which the peasants are able to translate their tenurial gains into gains in income, productivity and welfare. This will depend on their ability and willingness to increase production. These aspects are considered in Chapter 5.

1/ Partly because of insecurity of land tenure, the peasants continue to regard livestock as the main investment opportunity rather than the land they cultivate (see section 5.6). By definition there should be no insecurity of tenure for members of a Producer Cooperative. Uncertainties relate to the period until all members of a PA have also become members of the cooperative. There have been isolated examples of coercion, and these can too easily bring disrepute to the PC movement and discourage individual investment in land improvement. The EHRS Sociological Survey (WP 4) found re-allocation frequent (see section 11.6).

3.6 PEASANT INSTITUTIONS

3.6.1 Peasant Associations

The Public Ownership of Rural Lands Proclamation of March 1975 provided for the establishment of Peasant Associations (PAs) to carry out the required land redistribution. Each PA was to have a minimum land area (including grazing lands) of 800 ha, although in practice some PAs have less. In the Highlands the range is from 600 to 1000 ha (see table 3.2). Membership in PAs is voluntary, and members come from former tenants, previous landowners who owned less than ten hectares, landless and pensioned persons. In practice, most rural household heads are members of their PA, the coverage being weakest in the nomadic areas and in the northern Highlands. Leaders of PAs are elected by all the members.

The principal functions of Peasant Associations are as follows:

"1. To distribute, with the solicited assistance of the Government when necessary, land forming the area mentioned in Article 8 (i.e. land within the PA boundary) as much as possible equally, and in the following order:

   (a) to former tenants and former landowners residing within the area;

   (b) to evicted tenants;

   (c) to persons who reside within the area but do not have work or sufficient means of livelihood;

   (d) to organizations needing land for their upkeep.

2. To follow land-use directives to be issued by the Government.

3. To administer and conserve any public property within the area - especially the soil, water and forest.

4. To establish judicial tribunals to hear land disputes arising within the area.

5. To establish marketing and credit cooperatives and other associations like the debo which would help farmers to cooperate in manual and other works.

6. To build, with the cooperation of the Government, schools, clinics and similar institutions necessary for the area.

7. To cultivate the holdings of persons who by reason of old age, youth or illness, or in the case of a woman, by reason of her husband's death, cannot cultivate their holdings.

8. To undertake villagisation programmes.

9. To exclude from distribution mining and forest lands and places of historical and antiquarian significance." 1/

The PAs were given legal status and their duties and powers further strengthened, particularly in their jurisidiction over peasants living within their boundaries (e.g., resolution of local conflicts, issuing regulations, defence and security) and in the establishment of cooperatives, by the Peasant Association Organization and Consolidation Proclamation of December 1975. Through representation at the Wereda, Awraja and Regional levels, the PAs are linked with the All-Ethiopia Peasants' Association (AEPA). The AEPA has a permanent secretariat in Addis Ababa and a wide range of duties, including: the full implementation of the Public Ownership of Rural Lands Proclamation; the explanation off Government policies to the peasantry; the development of cooperatives; encouragement of collectivisation; and the promotion of production.

Each PA member pays an annual tax of Birr 20. Income tax is only levied on annual incomes of Birr 600 and over, but the average peasant does not pay income tax, either because his income is less than this or because a collection system has not yet been organized (see section 4.9). Eash PA member also pays an annual subscription of Birr 3 to his local PA, which retains half and sends the rest to the Wereda PA, from which it passes through the PA structure, each level retaining 50 percent of receipts, the residual being received by the AEPA. In addition, each member is expected to pay occasional special contributions for development of local infrastructure, for the literacy campaign and for other local activities in the area. Members are also expected to supply their labour (or labour of their household) free of charge for local PA and area works.

As of 1984, there were some 19 579 Peasant Associations in existence (of which 90 percent are in the Highlands), with a total membership of some 6.67 million farm families. The average membership is about 346 farm families, but this varies from less than 80 to about 1500 families (see table 3.1). The PAs have in effect become the basic social, economic and developmental unit in the rural Highlands, and in practice the administrative and law and order units in their specified areas. The PAs are without doubt the most prominent social institutions in rural Ethiopia. Above all, they have emerged as a vehicle for the participation and mobilization of rural people in their economic, social and political development and for the defence of their rights. Relevant decrees have also established Women's Associations and Youth Associations on the same area basis as the PAs, but generally these are not nearly as prominent in rural life as the PAs. Women are involved in the PAs only when qualified as heads of families, and the establishment of women's associations has lagged far behind that of the PAs. Focus has been on the promotion of

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1/ Public Ownership of Rural Lands Proclamation No. 31/1975, Article 10 - Functions of Peasant Associations.

spinning, basket-making, poultry keeping, vegetable production and the establishment of child day-care centres. Thus women are still occupied mostly with collecting fuel and water, with food processing and child care, as well as farming.

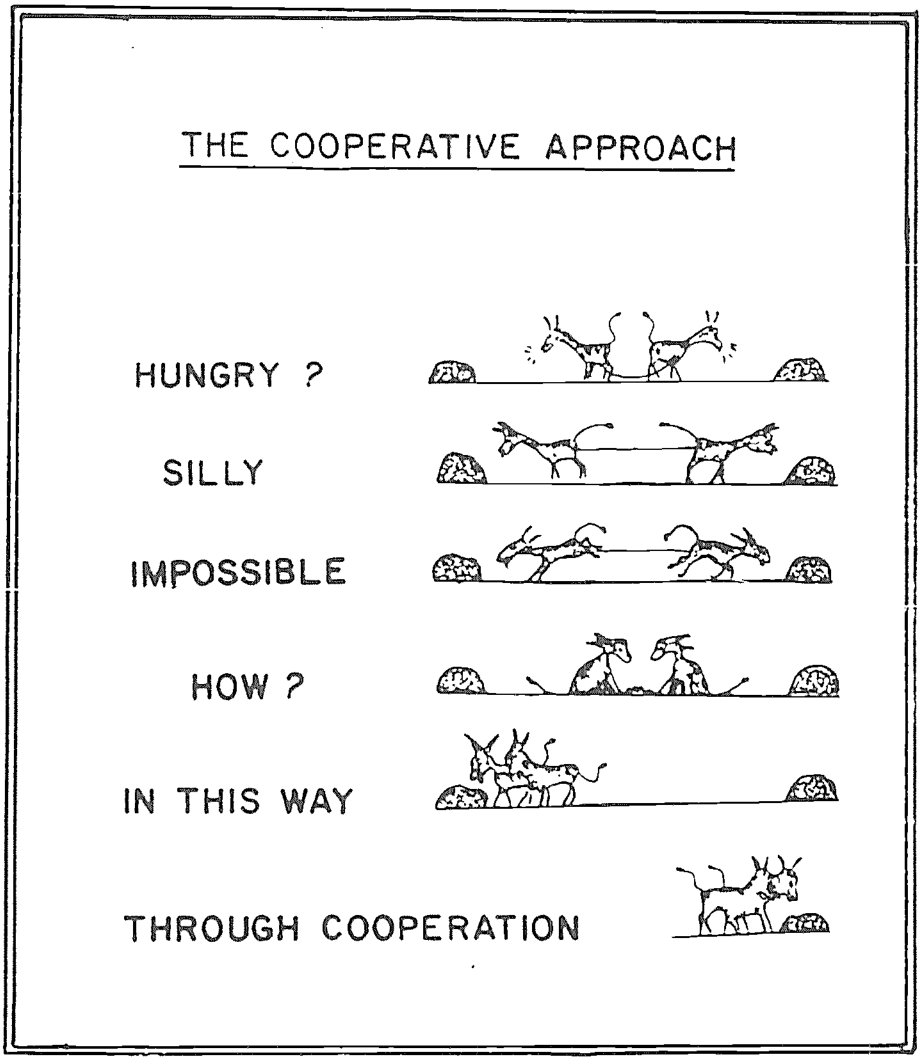
3.6.2 Producer Cooperatives

GOE believes that the creation of larger-scale production units, Producer Cooperatives (PCs), will allow better use of land and labour and facilitate the provision of such services as extension, inputs distribution and marketing. The basic rationale is illustrated in Figure 3.7, and in the following quotation:

> "Our development philosophy is not to enrich the few but to raise the living standard of the entire working people to a higher level of prosperity. To achieve this in the agricultural sector, the application of modern technology on large cooperative farms must be speeded up. And this, in turn, can be accomplished, in the conditions of our country, only if the rural areas are organized into producer cooperatives.... It is therefore imperative that the peasantry pull their resources together and organize themselves in producer cooperatives if we are to see any improvement to the quality of rural life and in the pace of development of the national economy." (COPWE, 1983.)

The Government regards a PA as a preliminary form of organization which should progress voluntarily to full PC status, given appropriate technical and political assistance. The process is initiated by a number of farmers within a PA (the minimum is three) agreeing to pool their land, manage it cooperatively and share the proceeds from its use. The exception to this process of development has been new settlements, most of which have been organized as Producer Cooperatives from the outset. Once one PC is established, it is illegal to set up a second within the same PA. The single PC is expected to progressively expand its membership and its Collectivisation of production and assets until the assets of all PA members (including implements, livestock and buildings) are held, managed and organized collectively. The formation of PCs is in two stages. In the first (Melba) stage, members continue to own their individual assets but agree to carry out communal activities - especially for land cultivation. In the second stage, all productive assets are collectivized. Over 90 percent of the PCs are still in the first stage. In both stages the cultivated land is thus operated as a single unit. The crops to be grown and the inputs needed are decided by the PC collectively. Contributions of each PC household, particularly labour and draught power, are recorded so that they can be rewarded accordingly. In the second stage, this recording process is reduced essentially to a labour work point system, because all inputs except labour are owned collectively. Devising and implementing a method of recording labour inputs that minimizes disputes has reportedly been problematic. Some individuals have been reported to be reluctant to entrust their oxen to others or to sell them to the PC. To overcome this problem and to encourage communalisation, a number of PCs have been alloted tractors (through

Fig. 3.7


THE COOPERATIVE APPROACH
HUNGRY ?
SILLY
IMPOSSIBLE
HOW ?
IN THIS WAY
THROUGH COOPERATION

medium-term financing at some subsidy), despite land areas being relatively small for mechanization. This raises the risk, however, that one of the purported advantages of cooperatives in a labour surplus, capital-short economy - better utilization of labour - might be negated.

The formation of PCs is a high priority of the Government. PCs are assisted by the MOA and encouraged by various incentives, including lower taxes (reduced from 20 to 15 Birr per member, once the PC has been registered); priority access to production inputs (seed, fertilizer, oxen, tractors), consumer goods, building materials and MOA field staff. A World Bank report (1983a) has stated that possibly 80 percent of MOA field staff time is devoted to PCs.

No PCs have as yet expanded to embrace the entire membership of a PA, however, and most PCs have been formed from groups of previously landless peasants or as parts of settlement programmes. PCs account for about two percent of the total harvested land. So far 1 257 have been organized, with a membership of over 82 000 farm families (about one percent of the total). Only 140 of the PCs have been registered. The conditions for registration with the MOA include the following:

(i) there must be a minimum of 30 members;

(ii) each member must have paid his registration fee;

(iii) each member must have paid at least 50 percent of his contribution to the capital fund, in cash or kind;

(iv) a work plan for the use and development of the PC's land must have been approved by the MOA;

(v) an office must have been constructed;

(vi) the political consciousness of the PC executive organ and its membership must be judged to be adequate.

The slow rate of registration of new PCs might be attributed to the stringency of these requirements and the limited capacity of MOA staff to assist in these matters. Given the scarcity of staff for promoting cooperatives, the pragmatic policy being followed by the MOA is to press ahead with the most promising PAs first and subsequently to use the successful PCs as working models.

3.6.3 Service Cooperatives

The PA Consolidation Proclamation of December 1975 provides that a minimum of three and a maximum of ten PAs may form a Service Cooperative (SC) society without affecting the legal entity of each PA concerned. SCs are also legal entities and may in turn establish Wereda and higher level SCs for supervisory and other purposes. SCs are empowered to procure, store and distribute inputs and consumer goods, provide credit, market crops, offer crop-processing facilities, promote rural industry and political education. As there is still a significant small-scale private sector providing consumer goods through markets, some SC services complement the private sector. However, farm inputs are not readily available through private market channels.

Each SC is run by a representative general assembly, with an executive committee of nine. The net proceeds from its operations are partly distributed to members and partly reinvested in cooperative buildings, equipment and training. As may be expected after so few years of operation, there is considerable variation in the effectiveness of the existing SCs. Their formation does not require the level of personal reorientation and commitment required for PCs and so, with their evident benefits, it is likely that the SCs will continue to grow rapidly. In early 1984, 3 815 SCs had already been established (of which 3 765 are in the Highlands), with a membership of over four million households. A 1983 joint GOE/WB mission found that SCs in cereal-growing areas have mostly concentrated on the distribution of consumer goods and the handling of grain collection for AMC. Some 742 SCs had built stores with an average capacity of around 200 tons, and training in accounting has been given to some 400 persons who work with SCs. This effort has enabled over 300 SCs in Shewa, Arsi, Sidamo, Welo and Hararghe Regions to take responsibilities for input distribution since 1981. Most SCs cannot as yet perform the services expected as they lack managerial and accounting skills, physical facilities and financial resources (GOE/WB 1983, p.27). Lack of accounting and management skills limits the registration of SCs (only around 25 percent are registered). As with the PCs, the Cooperative Development Department of MOA is responsible for helping SCs install and maintain appropriate accounting systems and management practices.

3.6.4 Cooperative development

Effective development of the cooperative movement, both PCs and SCs, needs stronger support from the GOE, and this is recognized by priority allocation of resources and services devoted to the cooperatives. Perhaps two aspects of support need further consideration: training and participation. Implementation of the strategy presented in Part III may itself depend on cooperation by and with the people.

Cooperative training needs to develop the job-specific capabilities in organization, leadership and entreprise. This is a long-term task and requires careful attention to the content of cooperative training courses. While the principles of cooperation are relevant, of more immediate practical benefit is the current emphasis on training in accounting. Accounting courses should be complemented by courses on the more practical aspects of trading, marketing, management and organization. In other countries cooperatives have too often undertaken marketing at higher costs than those prevalent in private trading, thus defeating the original pruposes: to gain from economies of larger scale and to cut out the middlemen.

The other issue is the paternalistic vs. the participatory approach to cooperative development. In its desire to support cooperative development, there is the risk that the GOE might pursue a more paternalistic approach involving heavy subsidizing and favouring of cooperatives. While this might increase the number of cooperatives, the cooperatives themselves might increasingly be viewed as arms of government rather than as peoples' organizations. The paternalistic approach jeopardizes the chances of cooperatives developing from the people; of those cooperatives developing a sense of financial responsibility and accountability to the people more than to government; and increases the risks of domination of cooperatives by imposed bureaucrats. The principle and practice of cooperation needs to be encouraged and supported by the GOE, but in such a way that cooperatives do not become alien to rural society. Cooperation, if it is to succeed in the long-term, has necessarily to be based on voluntary participation.

Despite the present gradual and voluntary transformation from individual to cooperative farming, it has been suggested that in ten years almost half the cultivated area may be farmed by cooperatives. It is also obvious from international experience that cooperative farming requires great organizational capabilities and/or close political, religious or family cohesion between members. The voluntary nature of the transformation to cooperative farming would assure that favourable preconditions exist. The concern comes when disproportionate staff and financial resources are devoted to the promotion and support of PCs. This could lead to individual farmers being deprived of these services and resources, and because 94 percent of agricultural production is from individual peasants, overall rural development will be slower as a result.

Chapter 4

THE ECONOMY

4.1 INCOME AND WEALTH OF THE HIGHLANDS

"With an estimated Gross National Product per capita of around US$140 1/ and with a vast proportion of the population living below the absolute poverty level Ethiopia remains amongst the poorest countries in the world." (World Bank, 1983c.) Many of the characteristics of underdevelopment, such as the predominance of the subsistence sector, the limited role of industry, the underdeveloped economic infrastructure (roads, water supplies, schools, and other facilities), the shortage of domestic capital, and the undiversified export structure, while shared with much of the rest of Africa, are nevertheless more pronouned in Ethiopia. Because of problems of accessibility and the slow and uneven distribution of development in the past, large sections of the population still live outside the monetary economy.

Despite its poverty, Ethiopia receives very little aid from outside - less than any other country in Africa. It gets only around US$6 per head p.a. compared with an average for the Third World of three times that amount, reflecting the lack of a colonial past, and the unacceptability of some policies of the GOE amongst some of the largest aid donors.

Agriculture is the mainstay of the country's economy, providing about 45 percent of Gross Domestic Product (GDP), 90 percent of exports and 85 percent of total employment and livelihood. Practically all cropping is rainfed and confined to the Highlands, where there is also concentrated around two-thirds of the country's livestock herd - the largest in Africa. Ethiopia's other known natural resources include gold, platinum, copper and potash. There has been some petroleum exploration, but no commercially exploitable reserves have yet been discovered. Minerals have not been exploited on a

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1/ The World Bank's per capita GNP estimate reflects official GNP and population data before results of the 1984 Census were announced. The actual population is much larger, therefore the *per capita* income estimate is too high.

large scale, and in most cases the potential for commercial exploitation remains to be established. The country's main potential lies in agriculture, for which the natural conditions in the Highlands are generally favourable (but are, in some places, deteriorating because of erosion).

Ninety-four percent of agricultural production is in the peasant sector. For most of the 34 million people in the Highlands, their "income" is largely their own subsistence production. Peasant families grow most of their needs and sell small surpluses for cash. The marketed production of food crops as a proportion of total production may be around 20 percent. The production of cereals, roots and tubers is below national requirements (see section 5.3), as evidenced by food aid. Food aid and commercial inputs account for about seven percent of estimated total food consumption tonnage in recent years. (See Annex table A4.10).

It is tentatively estimated that farm incomes in the study area average around 446 Birr p.a. which, with an average family size of 4.5 persons (CSO), gives an estimated annual income per capita of only around Birr 99. This is less than the estimate of agricultural GDP per capita of around Birr 110 a year, but part of the difference may be explained by the fact that the agricultural component of GDP includes state farms and other sub-sectors while the per capita farm income calculated here relates only to the farm gate value of the output of the peasant farms. The very preliminary nature of these estimates needs to be emphasized: they are derived from the tentative farm models presented in Annex 4. These farm models still need to be double-checked by field survey. The following observations concerning the distribution of average annual incomes should also be viewed as tentative. Average incomes per man-day worked on crops are generally highest at around Birr 4.0 in the HPPZ, reflecting primarily income from coffee (see table 4.1). Conversely, they are lowest at around Birr 1.8 in the LPC zone, primarily reflecting lower crop yields. However, farm sizes on average are smallest in the HPP zone, probably reflecting the greater population density in the cropped areas of this zone and the less prevalent use of oxen in cultivation. For this reason, average farm incomes - and therefore per capita annual income - are highest at around Birr 550 p.a. in the HPC zone. Average farm incomes, at only Birr 300 p.a., are lowest in the LPC zone.

In the EHRS Sociological Survey, only 84 of the 1000 farmers interviewed reported any non-agricultural incomes, and most of these were minimal, mostly from weaving, carpentry and selling fuelwood, dung and charcoal.

The greater part of rural income represents the imputed monetary value of subsistence production. Cash from any small surpluses has to provide such essentials as salt, cooking oil, kerosene,

Table 4.1

PRELIMINARY ESTIMATES OF AVERAGE INCOMES IN THE HIGHLANDS BY ZONE - EARLY 1980s

	Birr			
	HPP	HPC	LPC	Total study area
Per farm man-day	4.0	3.0	1.8	2.9
Farm income p.a.	508	549	297	446
Per capita income p.a.	113	122	66	99

Source: EHRS estimates.

clothing, farm tools, household utensils, blankets, etc. There are also occasional medical expenses and some school expenses for children. The standard of housing is low compared to other African countries. Only 288 of the sample of 1000 households in the EHRS Sociological Survey had tin roofs, only 95 had radios, and only 54 had spring beds. Personal possession are also minimal. Only 138 had leather shoes, 60 had watches, and only 33 had woolen suits. Altogether 596 of the households had none of these modern possessions (EHRS WP 4).

Most of the families with the higher incomes are in the cash crop producing areas, as might be expected. Altogether 83 percent of the tin roofs, 78 percent of the spring beds, 58 percent of the radios, 57 percent of the wrist watches, 53 percent of the leather shoes and 45 percent of the woolen suits were found among the 40 percent of sampled households which live in cash crop producing regions (particularly in the HPP zone).

4.2 OVERVIEW OF ECONOMIC DEVELOPMENT

The Revolution brought major institutional changes in economy and society. Despite problems of adjustments to such rapid changes as the abolition of monarchy and feudal relations, radical agrarian reform, and extensive nationalization of large enterprises, considerable social progress (see section 4.8) in the sense of a more egalitarian distribution of incomes and a reduction of rural-urban income differentials has been achieved.

Despite the social progress in recent years, economic growth has been slow. During the decade ending 1982/83 the GDP is estimated to have grown at an average rate of only 2.2 percent per annum in real terms as compared with a population growth of around 2.9 percent per annum. Economic growth has been hindered by several external factors including international inflation, increased oil prices, less foreign aid, and in recent years a global economic recession and sharp decline in coffee prices. Ethiopia's problems have been compounded by frequent droughts. The drought and famine of 1972/74 claimed about 250 000 human lives and much of the livestock, and contributed to the severe food shortages in the mid-1970s. The recurrence of drought in the 1980s has again affected several million people in many of the country's regions. As a long-term measure, the Government has initiated schemes to resettle population in less drought-prone areas (see Chapter 9).

The years since 1974 can be divded into three periods insofar as the pace of economic growth is concerned. The mid-1970s were marked by radical institutional changes, and armed conflicts created dislocations in trade and transportation, and resources were diverted from economic development to security needs. National production declined or stagnated.

In the second period, comprising the late 1970s, the economy recovered as hostilities subsided and security conditions improved. Major contributions to this growth performance came from agriculture, which benefitted from good weather, and from industry, following the resumption of industrial activity in and around Asmara. Internal transport and distribution services as well as commercial activity also improved.

The economy, however, witnessed a setback in the third period, the early 1980s. The growth of the estimated real GDP slowed to an average of three percent per annum. This slowdown was mainly due to conditions of persistent drought, capacity constraints in industry, and the low level of total investment, the last in consequence of increasingly severe constraints on domestic as well as external resources. Domestic savings, which had averaged around 4 percent of GDP in the 1970s, fell below 3 percent during the early 1980s. Foreign trade was adversely affected by a sharp deterioration in the terms of trade, declining by over 25 percent in the early 1980s, reflecting further declines in coffee prices and increases in import prices. Consequently, the value of merchandise imports rose to more than double the value of merchandise exports and the current account deficit widened to over 7 percent of GDP (see table A4.1). Notwithstanding these adverse trends, government fiscal and monetary management continued to be prudent (see section 4.9). Nevertheless, the adverse external trends are all the more detrimental when related to the growing food gap in the country (see section 5.3).

4.3 STRUCTURE OF THE ECONOMY

4.3.1 The sectoral composition

From table A4.2 it can be seen that agriculture's share of GDP, at around 45 percent, has not changed significantly in the period 1974/75 to 1982/83. The other production sectors account for around 15 percent of GDP, including manufacturing (7%), handicrafts and small-scale industries (3% - a substantial reduction in relative importance in the period), building and construction (3%). Domestic trade accounts for around 10 percent, transport and communications about 5 percent and other services about 20 percent of GDP. Within the latter, the relative importance of government-provided services, banking and insurance have increased while housing, domestic and other services have fallen in relative importance. In short, the development of the non-agricultural sectors has not significantly reduced the overwhelming domination of the economy by the agricultural sector in the last decade. Thus economic development of Ethiopia will inevitably depend on agriculture for many decades to come. Most other forms of employment are distinctively urban-based, or depend on levels of education not attainable by rural people. Perhaps 200 000 employees make up the labour force, outside agriculture.

Investment accounts for only about ten percent of GDP and this has not changed significantly between 1974/75 and 1982/83 (see table A4.1), although the share of public investment has increased steadily to reach around 75 percent of total investment while that of private investment has fallen correspondingly. The low rate of investment reflects increasing domestic and external resource constraints, as indicated in the previous section.

Given the implicit agricultural orientation of the EHRS and the importance of agriculture in the economy, agriculture is reviewed separately in Chapter 5. Industry is reviewed in section 4.5 and transport and communications in section 4.6; energy in section 4.7; and social services including health, education and water supply in section 4.8. The following paragraphs are concerned with the other minor sectors, namely fisheries, mining, construction and tourism.

4.3.2 Fisheries

The role of fishing is negligible but reviewed here (inland fisheries only) because of the potential for development and for increasing purchasing power in rural areas of the Highlands. The inland fisheries of commercial value are mainly located in the freshwater lakes of the Rift Valley and Lake Tana. There are also at least 7 000 km of rivers with considerable fishery resources. Potential annual production from the inland fisheries is estimated at about 25 000 tons (FAO 1982b). Actual fish production is negligible at around 4 000 tons p.a., including marine catches.

Average per capita consumption is less than 500 grammes p.a. The demand for fish products is highest on fasting days (160 days per year), and especially in the period before Easter, when the consumption of meat and dairy products is forbidden to those following the Ethiopian Orthodox Church. The demand for fish is also growing rapidly - the continued growth of the urban population and the increase in fish consumption in rural areas are creating conditions favourable for the development of fishing in inland waters.

The Fish Production and Marketing Corporation was established in 1978 to support the improvement of storage, transportation, marketing, and catching of fish. Because of the highly perishable nature of fish, only when marketing channels of greater capacity are organized should emphasis be given to increasing fish production, as otherwise much of the increase might be wasted. In the meantime, fuller consideration might be given to promoting the development of aquaculture as a means of increasing rural incomes (without increasing pressure on land) and rural nutritional levels.

4.3.3 Other economic activities

Ethiopia is known to have a wide range of minerals but few have as yet been exploited on a commercial scale, reflecting lack of skilled manpower and capital. Known minerals include gold, platinum, iron manganese, copper, lead, sulphur, asbestos, mica, barite, salt and potash. The contribution of mining and quarrying to the economy, however, is still small. Mining activity includes the exploitation of the alluvial gold deposits at Kibre-mengist, manganese ore near Mitsiwa, platinum in Welega, and the extraction of salt in the Danakil region and southern Borana. Exploitation of potash in the Danakil depression is given high priority by the GOE.

The construction sector has hardly grown since the late 1970s (see table A4.2) owing to shortages of building materials, skilled workers, emerging constraints on public sector capacity and shortage of project finance. Training and foreign contracting may ease the skilled manpower constraint in time, while assessment of local materials production possibilities is needed to reduce shortages of materials.

Ethiopia has considerable potential for the development of tourism because of its wildlife, scenic beauty, and places of historic interest. The GOE supports the development of tourism through conservation and protection policies, development of international flight facilities, national infrastructure and publicity. FaWCDA is responsible for the conservation of wildlife (see section 2.9).

4.3.4 International trade

Exports have fluctuated at around 13 percent of GDP between 1974/75 and 1982/83 while imports have increased from around 15 to 20 percent of GDP in the same period (see table A4.1). Consequently, Ethiopia's balance of overseas trade (including services) has been negative throughout the period and has become steadily larger, averaging 8 percent GDP in the last two years (see table A4.1).

The continued high dependence on coffee export earnings (over 60 percent of total export earnings - see table A4.7) is an inherent major risk. Pulses and oilseeds were major exports in the 1960s but have declined from 190 thousand tonnes in 1974/75 to only 47 thousand tonnes in 1981/82 (see table A4.8). Apparently there has been substitution of cereals for pulses and oilseeds, and the abolition of rents (largely paid in kind) has led to an increase in farmers' consumption and a decrease in the marketed surplus available for export (see section 5.3). But this does not fully explain the decline in the volumes of other major non-coffee exports, including fruit, vegetables, oilseed cake, live animals (see table A4.8). Many supply constraints and the lack of suitable institutions and incentives as well as unfavourable external market conditions continued to impede the development of these exports.

The rate of exchange was fixed at US$1.00 = Birr 2.07 in 1973 and has remained unchanged since then. From January 1975 through December 1982, Ethiopia's import-weighted real effective exchange rate appreciated by 37.5 percent against the currencies of its major trading partners (IMF, 1983). The resulting over-valued exchange rate has tended to reduce margins in local currency of producers of exports and has thus acted as a disincentive to export.

Over 20 percent of the value of imports are accounted for by petroleum (and its by-products), while some 40 percent comprise road vehicles, machinery and other electrical and metal manufactures. However, the most rapid growth in imports has been in food (see tables A4.9, A4.10 and Chapter 10).

Ethiopia's external debt at the end of 1982 (excluding military debts) stood at US$875 million, equivalent to about 21 percent of estimated GDP in 1981/82. This relatively small ratio largely reflects the low volume of external resource transfers. Ethiopia remains among the lowest recipients of official development assistance. In 1981/82 this amounted to about US$6 per capita as compared to an average of around US$20 per capita for Africa as a whole. The main sources of external assistance are the European Economic Community, UNDP and other UN agencies, WFP, and Sweden. The main external loan sources are the International Development Association, the African Development Bank and Fund, and the International Monetary Fund. Although debt service is still manageable, the increase in the debt service ratio is an early warning of possible debt problems ahead, and emphasizes the need to formulate policies and measures to further develop exports and to achieve efficient import substitution.

4.4 ROLES OF PUBLIC AND PRIVATE SECTORS

In its first major economic policy statement after the Revolution, the GOE indicated in February 1975 that the desired socialist reforms would be possible only if the state "directly owns and controls the natural resources and key industrial, commercial and financial sectors of the economy." (GOE, 1975.) The same Declaration distinctly specified spheres of activity for the public and private sectors. The Declaration proclaimed full government control over energy, transport (except trucks), communications and major industries including cement manufacture, oil refining, textiles, tanning and shoes, tobacco, glass, pharmaceutical and tyres. Mixed enterprises were permitted in prospecting and mining (including petroleum), food processing, the manufacture of plastics and other synthetic materials, the paper and cellulose industry, construction and tourism. Small enterprises such as handicrafts, repair shops and other service industries, much domestic trade, especially retail, and most road transport remained in private hands. The capital of private industrial enterprises was not supposed to exceed 500 000 birr, and private companies with capital in excess of this amount or in areas of activity designated for the public sector were nationalized.

The public sector is therefore large and important. Public enterprises, about 180, are considered as instruments to promote economic growth and domestic resource mobilization, to control inflation, and generally to help establish a socialist order. They account for about 95 percent of output in large-scale manufacturing and are important in agricultural marketing and provide a variety of services including transportation, communications, power and construction. They include the state farms (see section 5.7).

Domestic trade is fairly free but constrained by scare local and imported supplies. To meet the growing demand for manufactures and assure an equitable distribution of essential goods, the Government set up the Ethiopian Domestic Distribution Corporation (EDDC) with 52 branches throughout the country. EDDC obtains supplies from the Import Corporation, but mostly from the public manufacturing enterprises (including exclusive rights to purchase some items such as cloth). For scarce items, there is a black market; for other items, retail traders have legal channels of supply from wholesale traders and importers. There is very little effective price control in retail trade. Despite widespread unofficial marketing, especially in smaller towns, the availability of basic consumer goods such as cloth, sugar, salt, soap has not increased in the rural areas. The sales of these goods by the EDDC to the SC's and PA's, as a proportion of EDDC's total sales, has declined in recent years. Since there is still an acute scarcity in rural areas of such items, supplies from private traders have not offset the decline in deliveries by the public sector. The unavailability and/or very high prices of consumer goods has probably been a disincentive for farmers to expand production for the market.

Foreign trade is largely controlled by the public sector. Private traders handle about 25 percent of imports and 30 percent of exports. They dominate export of pulses, raw hides and skins, and other minor exports. Several public corporations and industries are directly involved in foreign trade, dealing in coffee, oilseeds, sugar, salt, and processed hides and skins.

In addition to direct Government involvement in the public sector, there are also various controls over the operation of the private sector to ensure equitable distribution. There is rationing of several important items such as building materials, petroleum and motor tyres, and the prices of items such as textiles, footwear, salt, soap, canned milk, cooking oil, sugar, and matches are controlled. There are also controls on wages and rents, as well as on trading in imports and exports.

The potentially complementary role of the private sector was explicitly recognized in the Chairman's speech to the Second COPWE Congress in January 1983, in which he called for new measures to restore confidence among individual proprietors so that citizens with capital and know-how can contribute to national development. With a view to increasing investment and promoting the acquisition of new technology, the Government published a Joint Venture Code in January 1983 to provide a framework for joint ventures of foreign investors and public enterprises. The Government has also recently encouraged private traders to take a more active role in export marketing, including pulses and oilseeds.

All public enterprises are under the jurisdiction of individual ministries. The Ministry of State Farm Development has several public enterprises, which in turn are divided into "State Farms" (see section 5.7). It has two specialized corporations in horticulture and in livestock, and regional corporations for selected crops. The Ministry has two service corporations, for engineering and technical services, and for seed distribution.

Among the marketing corporations the most important is the Ethiopian Coffee Marketing Corporation (under the Ministry of Coffee and Tea Development) which controls the purchase and export of coffee. Another is the Agricultural Marketing Corporation, which operates under the Ministry of Domestic Trade. Other marketing corporations are under this Ministry, the Ministry of Agriculture, or the Ministry of Foreign Trade.

With various layers of authority (ONCCP, Ministry, Corporation, Enterprise), there may be some unnecessary duplication in the planning and control of the public sector (see section 3.3), and some organizational changes may be desirable to improve efficiency. The planning and monitoring of public enterprise operations deserve more attention. As operations grow and diversify, the need for decentralization will become more apparent. Equally important is the lack of managerial autonomy and the ineffectiveness of present incentives (see section 4.10).

4.5 INDUSTRY AND HANDICRAFTS

4.5.1 Large-scale industry

About 70 percent of the large-scale manufacturing industry, mainly in Asmara and Addis Ababa, is based on agricultural raw materials, and is linked more to state farms than to the peasant sector. It is largely capital-intensive, highly import-dependent and catering to the urban areas. The oldest and most developed large and medium-scale industries are the food and textile industries, which in the mid-1970s accounted for 55 percent of fixed capital and 65 percent of production. The other major industry group is leather tanning and shoes.

The manufacturing industry has been running up against capacity constraints in recent years. This is recognized by the Government:

> "the current level of output of our industries is inadequate to satisfy even present needs, let alone meet the ever-increasing demands of the future. Acute shortages are felt in such products as textiles, foodstuffs, shoes, as well as in industrial products needed for various construction purposes. As mentioned earlier, our factories in the industrial sector are already operating at the level of their maximum capacity. The shortages therefore clearly indicate the need for the establishment of new and additional plants in various sectors in order to accelerate industrial development". (COPWE, 1983.)

4.5.2 Small-scale industry and handicrafts

While GOE efforts and limited resources were directed toward large-scale industry, the production value of which has grown by over 100 percent in the last decade, the handicraft and small industry sector 1/ has only grown by around 25 percent (see table A4.2). Activities include spinning and weaving, oilseed crushing, grain flour milling, coffee cleaning, pottery, tailoring, carpentry, and the small-scale production of carpets, rugs, rope, twine, hand-made shoes, other leather products, and jewelry. Many of these activities are usually located in households and depend on family labour. These industries are virtually all privately owned. There are an estimated 400 000 craftsmen (about half in urban areas).

This sector, labour-intensive and based almost wholly on local resources, has considerable potential to increase the supply of consumer goods and farm tools. Apart from uncertainty among private operators about future government policy, the sector has been constrained by inadequate and cumbersome bank credit procedures and inadequate technical supporting services and shortages of raw materials. There are signs, however, that this sector will be assigned higher priority in the future. GOE has announced plans to reorganize the Handicrafts and Small-scale Industries Development Agency toward a more supportive role, and policy may encourage mobilization of private capital and initiative in this sector:

> "One of the problems as regards small-scale industries is the lack of confidence by private proprietors. Thus it is believed that the necessary measures should be taken within a short time to modify the previous policy so that citizens with capital and know-how can establish and expand small-scale industries to help themselves and their country genuinely." (COPWE, 1983 p.56.)

4.6 TRANSPORT AND COMMUNICATIONS

4.6.1 Importance

The large geographical area of the Highlands, its dissected terrain and the widely dispersed settlement require more effective

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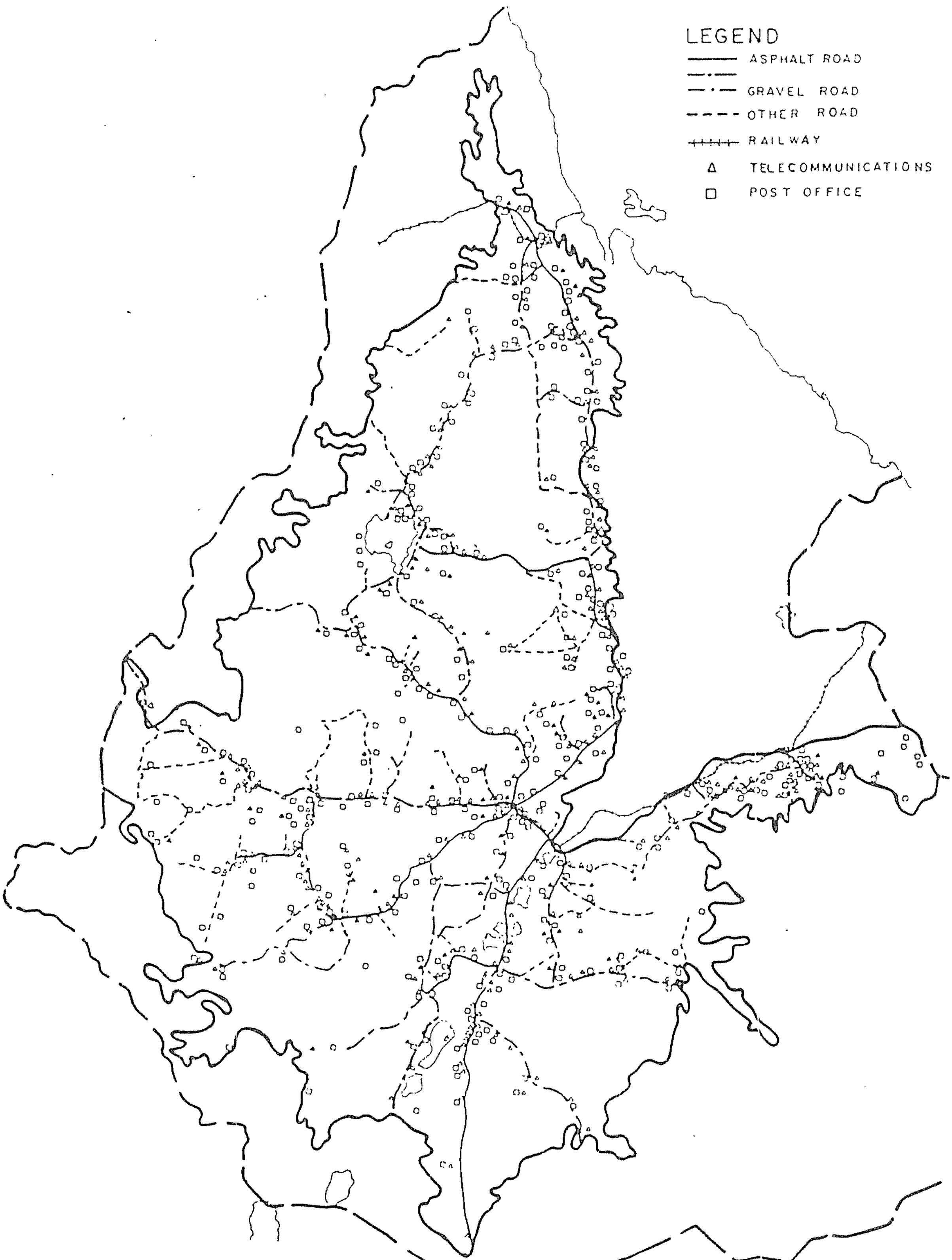
1/ Small-scale industry includes manufacturing units using motive power and having fixed assets up to Birr 200 000. Handicraft is defined as any manufacturing activity using mainly hand tools.

Figure 4.1

TRANSPORT AND COMMUNICATIONS NETWORKS



development of transport and communications. The marked subsistence nature of most economic activities in the Highlands is largely due to their inadequate development of transportation and communications. An estimated three-quarters of Highland farms are more than five km (or a half-day's walking distance) from the nearest road. Human or animal transport costs are therefore high.

If market outlets are not adequate, efforts to increase production become superfluous. The provision of inputs and extension are also limited by poor transport and communications. The demand for transport, both passenger and freight, normally increases substantially faster than the growth in population. With even small increases in agricultural productivity, the demand for transport will grow dramatically because most food production is consumed in the producers' households or in local communities.

The GOE has therefore attached high priority to the development of transport and communications, allocating now around 15 percent of its total investment budget to this sector (see table A4.5). In the Ten Year Plan around 18 percent of total investment in the coming decade is expected to be allocated to transport and communications, of which a third will be for roads. Similarly, the GOE allocates a large proportion of its foreign exchange earnings to this sector: some 35 percent of imports are related to the sector.

4.6.2 Traditional transport

The most common means of transport in the Highlands are by humans and by equines (55% asses, 45% mules and horses). However, reliable statistics on the extent of usage of such transport are lacking. Perhaps half of the Highlands equine population (about 5.3 million in 1983) might be used twice a week to carry a load of 50 kg for an average distance of 10 km (EHRS WP 16). This would result in some 260 million ton-kilometers a year being transported by equines. This may be compared with the following statistics, related to Ethiopia as a whole:

Table 4.2

ESTIMATED FREIGHT CARRIED IN ETHIOPIA IN 1982/83
(million ton-kilometers)

Road	Rail	Marine	Air
(commercial vehicles only) 2 080	23	0.2	1.8

Source: EHRS WP 6.

Annex table A4.11 presents estimates of the equine population by sub-zone in 1983. On the average there is one equine for every five persons in the HPP zone compared to one to every six or seven persons in the other two zones. Human and equine transport is generally the most important means of short distance transport of passengers, and accounts for probably well over a quarter of the ton-kms of all freight carried in the Highlands. The development of the traditional human/equine transport system has been and still is being constrained by three major factors:

(a) the more or less static equine population (see section 5.6) implies that the number of equines per household are falling, as was confirmed in the EHRS Sociological Survey. The falling numbers per household were explained in this survey by reference to reduced grazing areas and the increased dependence for cash on livestock sales;

(b) the static or even declining productivity of equines, reflecting reduced feed availability and continuing livestock diseases (see section 5.6); and

(c) the lack of any GOE policy or assistance for the development of traditional transport. It has likewise been almost totally ignored by external assistance agencies. Consequently there is very little animal-drawn wheeled transport in rural areas, while the load capacity of pack animals could be substantially increased by use of improved harnesses. To some extent the use of animal-drawn carts is limited by the lack of rural roads and trails. There would appear to be a critical need to mobilize the resources of the peasant sector in the construction and maintenance of trails and paths linking them to the road network and to promote the use of improved harnessing and carts.

4.6.3 Rail, air and water transport

There are only two railways in Ethiopia: the 781 km Djibouti-Addis Ababa line built between 1897 and 1917, and the 306 km Asmara-Massawa line built in 1922. (The latter line has not operated since 1974 because of the security problem in Eritrea - see section 3.2.) Most passenger and freight traffic on the Djibouti line is long distance and not specifically confined to the Highlands. Freight carried to/from Djibouti has fallen steadily from over 50 m ton-km in 1978/79 to 23 m ton-km in 1982/83 as the port of Asseb has been developed, but passenger-km has almost doubled in the same period (EHRS WP 6).

Although rail freight charges per ton-km are about half those by road (EHRS WP 6), the use of the railway is limited by shortage of rolling stock, loading and unloading facilities and political considerations. Domestic air transport is increasing by around 10 percent p.a. for freight and much more rapidly for passengers (EHRS WP 6), but its significance in the Highlands economy is limited - both by its scale (the number of landing strips used regularly by Ethiopian Airlines is declining) and by its cost.

4.6.4 Road transport

Road transport is by far the most important in the Highlands and is likely to remain so in the strategy period, given present GOE plans and development possibilities. The construction and maintenance of roads is primarily the responsibility of the Ethiopian Transport Construction Authority (ETCA). The road network has been enlarged considerably in the last eight years, as shown in table 4.3.

Table 4.3

ROAD NETWORK EXPANSION IN ETHIOPIA: 1974/75 TO 1982/83

	Asphalt	Gravel	New rural 1/
1974/75	2 000	6 050	-
1982/83	3 916	8 532	3 053

1/ Information on minor rural roads before the start of the present GOE rural road programme is not available: only the newly constructed rural roads can be given here.

Source: ETCA.

Rural roads with access primarily to agricultural areas began to gain importance only as recently as 1973. Table 4.3 indicates the greatly increased emphasis being given by the GOE to the development of rural roads, defined as a road of a least 6 meters in width and a maximum gradient of 12 percent. Most of these roads are not of all-weather standard, but are motorable for most of the year. Much of the rural road construction has been linked to external assistance such as that from China, the African Development Bank, WB rangelands Project, WB First and Second Highway Projects, Sweden, Germany and others. But some rural roads have been poorly maintained and are in need of repair.

The distribution of roads is shown in Map 4.1. It can be seen that total road density per '000 sq km is lowest in the northwest Highlands of Gondar, Gojam and Welega, and highest in Shewa (around Addis Ababa), the coffee-growing areas of Kefa and Illubabor and in Gamo-Gofa. However, when consideration is given to rural roads per 1 000 persons, the most favoured areas of the Highlands are Bale, Gamo-Gofa and Hararghe and the least favoured areas are Tigray, Eritrea and Arsi.

Although the GOE has stressed road development, with some success as indicated in table 4.3, the average length of roads in the Highlands at 22 km per '000 sq km and at 0.38 km per '000 persons, are low for Africa. The pace of road development has been limited by two major factors:

(a) the hilly and dissected topography makes construction and maintenance costs high: for example, the costs of constructing rural roads are 42 percent higher in mountainous areas and 6 percent higher in rolling areas than in flat areas (EHRS WP 6);

(b) the limited resources (especially foreign exchange, capital and skilled manpower) which GOE can afford to allocate to transport development.

Furthermore, the extent to which the existing road network can be utilized is constrained by:

(a) the limited stock of operational vehicles, now estimated at 3 400 buses (total seating of 90 000), 8 800 trucks (total freight capacity of 113 000 tonnes), and some 11 000 private cars (EHRS WP 6);

(b) the shortage of foreign exchange to import more vehicles, spare parts, fuel, and equipment to maintain existing roads;

(c) the lack of skilled manpower and financial resources to both service and repair vehicles and maintain roads;

(d) the higher costs of vehicle operation in the Highlands, reflecting both high altitude (average of 35 percent fewer kms/litre of fuel), and the rough terrain (fuel consumption at least a third higher; and

(e) the inefficient use of trucks, e.g., in returning empty from outward journeys. Higher user fees should help increase efficiency in the use of transport.

4.6.5 Communications

Radio transmissions - only by the Ministry of Information - in Amharic, English, Oromigna, Tigrigna, Somaligna and Afar, have the power to reach adequately all the Highlands. However, the EHRS Sociological Survey found that only 10 percent of the interviewees owned radios, which is low by African standards. 1/ Thus the major means of long-distance communications in most rural areas (and generally the only two-way possibility) is by means of postal services and/or telephone. The distribution of these services is concentrated along the main roads (see Map 4.1), and they are usually located in towns. Thus areas which are inaccessible to road transport are also generally without communications services.

4.7 ENERGY

4.7.1 Traditional fuels

For more than 90 percent of Ethiopia's population the only energy use apart from their own labour is:

(a) for cooking, heating and lighting -- firewood, dung, agricultural residues and charcoal; and

(b) for ploughing, threshing and transport -- animal power.

Consumption of petroleum and electricity, per capita, is one of the lowest in the world. Biomass fuels (fuelwood, charcoal, crop residues and dung) for household cooking account for 93 percent of total final energy use, more than half of which is in the form of dung and crop residues (WB, 1982d). Clearing for agriculture and scavenging for firewood has resulted in this century in an alarming reduction of dense forest cover in Ethiopia: from about 40 percent to less than 7 percent (see section 5.10). A continuation of this trend could lead to almost complete loss of natural tree cover within 30 years. Declining productivity in rural ecosystems and the related worsening fuelwood shortages are arguably the most important problems facing the energy sector, although other major and difficult issues in the petroleum and power sectors have to date tended to preoccupy planners and to consume financial resources available to the sector.

1/ In Africa as a whole, an estimate in an ECA study is that 20 percent of the population own radios. PADEP has estimated that in 1983, 19 percent of the population of Kefa, one of the richest regions because of its coffee, owned radios.

There is a strong cultural preference for fuelwood, either as firewood or charcoal. In those parts of Ethiopia where deforestation has reduced the availability of fuelwood to insufficiency, cereal straw and dung are used. The estimate in a World Bank report (1983d) is that currently eight million metric tons of dung and five million metric tons of crop residues are burnt annually. The EHRS Sociological survey identified cow dung as the most important source of fuel in Arsi and as being very important in Bale and Welo. Shrubs, stalks and leaves were found to be most important in Hararghe.

The demand for energy for household cooking, heating, and lighting will grow in line with population, although it will be constrained by absolute limits to energy supply in the more populous and already-degreaded ecosystems. For the purpose of production planning, a World Bank (1983) energy mission used 2 kg of dried wood as demand per person per day. Consumption levels, however, vary greatly depending on local supply constraints. This basic need can, in theory, be lowered considerably with improved stoves, although in practice there is not sufficient evidence to suggest that the use of improved stoves would become sufficiently widespread to reduce the basis of future demand projections. The growing shortages of household fuels, particularly in certain areas, is leading to soaring prices, from about Birr 40 per metric ton in 1975 to a typical present price of Birr 180, in Addis Ababa.

4.7.2 Petroleum

Petroleum fuels are consumed mainly in the transport sector (50 percent, of which 84 percent is for road transport), the government sector (13 percent, including military use), and industry (16 percent, excluding refinery use). Petroleum supply to Ethiopia is in the form both of imported crude oil and imported refined products. Ethiopia has a single refinery at the Red Sea port of Asseb, 870 km from Addis Ababa. The refinery, built in the mid-1960s with USSR assistance and equipment, has a capacity of 800 000 metric tons per year, and is operated by the Government-owned Ethiopian Petroleum Corporation. Petroleum distribution is handled by four foreign companies (AGIP, Shell, Mobil and Total) under close government regulation. Despite the small proportion which petroleum makes of total energy consumption, its annual foreign exchange cost exceeds half of export earnings, contributing to the recent sharp deterioration in the external trade balance. A World Bank study (1983d) has identified good economic prospects for improving the efficiency of petroleum use in industry, by improved combustion management and by heat recovery from waste and steam.

4.7.3 Electricity

Electricity is generated under the authority of the Ethiopian Electric Light and Power Authority (EELPA), formed in 1956. EELPA incorporates over 50 electric power stations, most of which are operated thermally by diesel, and supplies around 80 settlements with some 250 000 users. Electricity production has, so far, been concentrated in the central Highlands of Ethiopia where, since 1961, consumption has grown at an average rate of 9 percent per year. In 1982 electric consumption was divided 57 percent to industry, 17 percent to government and commerce, and 26 percent to households. In 1980 most EELPA power-generating sources, including all major hydroelectric plants, were interconnected in a power grid.

Priority has been given to the development of Ethiopia's hugh hydro-power resources, the overall utilizable potential of which has been estimated at 143 billion kilowatt hours. The potential is greatest in the Blue Nile basin (estimated at 25 billion kilowatt hours in a year of normal rainfall). But the cost of development of the hugh projects needed in remote areas are prohibitive and premature for the period of the Strategy. The first large hydroelectric generating facilities were constructed in the Awash River basin, where three plants were completed between 1960 and 1970, having a total installed capacity of 107 200 kilowatts. In 1974 the country's largest hydroelectric plant, having a generating capacity of 84 000 kilowatts, was completed on the Finchaa River, a major tributary of the Blue Nile.

4.7.4 Alternative energy sources

Advantages from developing alternative energy sources may be important, but are small compared to the magnitude of the household energy problem. Ethanol production from molasses is very economic due to a zero opportunity cost for the molasses. But there remain fuel blending and end-use problems to solve before ethanol will be practicable. Solar collectors would be economic for heating water in homes and hotels, and a small number of industries. Initially, solar water heating should be for centers supplied with oil-fired generation, e.g., Asmara. Although biogas generators are under test at many locations, such as agricultural colleges, their widespread dissemination is not technically feasible, particularly given the seasonal lack of water supplies in so many parts of the Highlands (WB, 1983d).

Sub-surface thermal gradients in Ethiopia are high and conducive to geothermal steam deposits which might provide a cheap and abundant source of energy. Exploratory drilling is now in progress at three sites in the Rift Valley lakes area supported by funding from the Commission of European Communities and the UNDP. However, of the nine holes to be drilled, three have been sunk, all of them dry, and the prospect of geothermal resources in this region competing economically with hydropower or natural gas is not great. Ethiopia has so many options for power generation in the central Highlands that geothermal energy must be considered marginal. In the north, where hydropower is not available, the geothermal resource, provided it is established, could well prove economic as a power source, which suggests that re-evaluation of the location and extent of exploration is warranted.

Coal is present mainly in the form of lignite in scattered deposits in Welega, Gondar, Eritrea and Sidamo. The Gondar resource is estimated at 20 million metric tons, though quality is poor and access is difficult. It may be possible to mount small carbonization and briquetting plants on surface lignite deposits for the production of acceptable household fuels, though this prospect has yet to be subjected to serious study. The location of deposits coincides with areas of acute fuelwood shortage; hence this energy source must not be dismissed without more thorough evaluation. While oil has been found in the Ogaden, little evidence exists of major deposits, whereas there is evidence of substantial gas deposits. Natural gas reserves of 1.3 trillion cubic feet have been assessed from one well, Calub 1, that was sunk in the Ogaden in 1975.

4.8 SOCIAL DEVELOPMENT IN EDUCATION, HEALTH, NUTRITION, FAMILY PLANNING AND WATER SUPPLY

4.8.1 Social services

Economic and social development are inherently inter-related and progress in the economy is partially dependent on social development and vice versa. In Ethiopia the government is increasingly involved in socialist economic development, but progress will ultimately remain dependent on full popular participation. On the other hand, the Government must provide basic social service such as education, health and piped water supply. The Government has outstanding achievements in the provision of education and health services, but economic development - and most particularly agricultural production - has been insufficient, despite the successful institutional infrastructure which has been established throughout the Highlands in the form of PA's.

The social service achievements of the Government, which are detailed in the following sections, have been obtained by allocating about 14 percent of its capital expenditures to this sector. This proportion has not changed much since the Revolution. Out of this, the largest share goes to education (between 40 and 50 percent), and the next largest share to health (between 15 and 25 percent). In addition, the social services have taken around 20 percent of recurrent expenditures in recent years, with well over half of this being used for salaries. The TYPP indicates the Government's intention to increase the share of its total investment funds going to social services to 16 percent. In view of the outstanding achievements to date and the rapidly escalating costs of operating and maintaining the present level of social services, it might be worthwhile to reconsider whether more emphasis should be place on the directly productive sectors.

Within the social services there is obviously scope for developing new emphases in the light of experience. Major constraints limiting progress in all the social services include shortages of trained personnel and their housing, equipment and transport. These shortages, coupled with the rapidly growing recurrent costs for the large field staff, suggests the need to review the cost-effectiveness of present delivery systems, as well as the need for greater community cost-sharing and participation. Some suggestions in this respect are made in the following sections. Arguably the most serious constraint to both social and economic development lies in the uncontrolled growth of population - a major problem which has received lip service but scarcely any public investment or support.

4.8.2 Education

The development of the Highlands physical resources has to be closely integrated with the development of human capacity to use those resources to their sustained advantage. The GOE seeks to use education to accelerate socio-economic development, transform and modernize society, strengthen national unity and pass on national culture. Rural people, on the other hand, usually see education as a means of improving living standards and reducing reliance on agriculture.

A well-known educationalist described the education system in Ethiopia in 1974 as "highly formalized and academic. It thus caters to the needs of an elite". 1/ Since the Revolution, the GOE has greatly expanded both schools and enrollment. Formal child education is undertaken almost exclusively by Government schools for which there are no fees. There are also a few (but highly popular) private schools in urban areas, for fees. All are under the authority of the Ministry of Education. The school system is divided into four levels, as follows:

(a) kindergartens for children aged between 4 and 6 years. The responsibility for financing and operating such scools is left to the rural or urban communities concerned. In 1981/82, there were 540 kindergartens with a total enrollment of about 50 000 (Kiros, 1983);

(b) primary schools for children aged from 7 to 12 years, divided into six annual grades;

1/ Blaug, M. "Employment and Unemployment in Ethiopia", International Labour Review, Vol. 110, No. 3, 1974.

(c) junior secondary (grades 7 to 8);

(d) senior secondary (grades 9 to 12), consisting of both academic and comprehensive streams, the latter providing vocational training, but not in agriculture.

By 1983 enrollment had grown rapidly to: Primary, 2.5 million (47% of the age group); Junior Secondary, 280 000 (16%); and Senior Secondary, 250 000 (8%). Further training is decided on a competitive basis and is again free of charge. Addis Ababa University has faculties of arts, science, education, technology, business administration, social work, law and medicine. The Schools of Public Health and of Agriculture are in Gondar and Hararghe Regions. Higher level-education is reviewed with specific reference to rural development in section 5.8.

The most outstanding non-formal programme has been the National Literacy Campaign, launched in 1979 with the aim of achieving universal literacy by 1987. For the majority of Ethiopians, this is their first classroom education, and participation has been beyond GOE's expectations, with almost ten million having passed the examination by 1983 (GOE, 1983). Furthermore, the dropout rate has been consistently falling and the pass rate steadily increasing. Ethiopia's overall literacy rate has increased from 7 percent in 1974 to around 50 percent in 1985. Another programme involves the establishment of Community Skill Training Centres in each Wereda. These centres are intended to provide the PA's and urban kebeles with technical as well as social skills relevant to development.

Primary school instruction is in Amharic, but this changes to English in secondary school. The literacy campaign has gradually increased the number of languages used to 15 by 1982, covering over 90 percent of the mother tongues spoken by Ethiopians. Amharic remains by far the most important language taught. The content and orientation of education has been changed toward a more general polytechnical education. Curriculum is determined nationally by the Ministry of Education but PA school committees actually control the daily operation of schools within certain limits. Rural schools are frequently built by PA voluntary labour. The number of schools and teachers has not increased as fast as participation, so student/teacher and student/classroom ratios have increased. These increasing ratios together with reduced expenditures and shortages of textbooks, have inevitably lowered the quality of education. This problem, and the problem of relating the content of education at all levels to the need for people to participate more fully in development, have been explicitly recognized by the Government (COPWE, 1983 p. 62).

Of morefundamental importance, especially in the context of the EHRS, is the future role of education. The cost of GOE extension services in various fields - crops, cooperatives, livestock, community health - is increasing with the size of those services in the field.

The most numerous GOE employees at village level are frequently teachers. The technical content of syllabuses for both primary and secondary schools is proposed to be increased substantially to help the schools produce the skills required to sustain the nation's development. (See sections 11.5.2 and 13.5 for other aspects of education.)

4.8.3 Health

Immediately prior to the Revolution, health services were concentrated in urban areas, with 43 percent of the country's health budget allocated to 3 urban centres. Services were oriented toward the richer elites with the emphasis on curative as opposed to preventive medicine, leaving 85 percent of the population without access to health services. The GOE has committed itself to provide "Health for all by the year 2000", by pursuing a health strategy in which the growing emphasis is on preventive medicine aimed especially at rural areas through community participation.

Table 4.4

BASIC HEALTH STATISTICS OF ETHIOPIA COMPARED TO OTHER COUNTRIES

	Ethiopia	Least-developed countries	All low income	Developed countries
Crude birth rate (per 1000)	48		44	14
Crude death rate (per 1000)	24		17	9
Life expectancy (at 4 years)	46	45	60	74
Infant (up to 1 year) mortality (per 1000)	144	160	94	19
Child (1-4 years) mortality (per 1000)	92	50	10	1

Source: GOE, 1984b and WB, 1983d.

From the above table, as well as from much more exhaustive analyses, it has been generally concluded by medical specialists that "the health of Ethiopians is amongst the worst in this world" (WB, 1983d).

The main health problems are related to infections and parasitic diseases, respiratory and diarrheal diseases which are worsened by malnutrition (see section 4.8.4). Leading causes of premature death in rural areas are, in order of estimated importance: gastro-enteritis and colitis, malaria, tuberculosis, pneumonia, dysentry, hepatitis, malnutrition and pregnancy complications (WB, 1983d). These health problems largely reflect poverty, unsanitary conditions and habits, malnutrition and lack of safe drinking water, an ecology which favours endemic tropical diseases and the remoteness of large areas of the country from any source of modern health care.

The groups usually at greatest risk of ill health are unborn and newly born infants, children and women of child-bearing age. Child birth itself accounts for over four percent of premature deaths in rural areas, and maternal mortality is estimated as high as 20 per thousand live births (WB, 1983d). The average life expectancy of women is five years less than that for men, at all age groups (EHRS WP 8).

In this appalling health context, the GOE has succeeded in extending modern health services so that they are now accessible to over 40 percent of the population, compared to less than 20 percent in 1974. Health facilities have increased as follows (GOE, 1984b, and WB, 1983d):

	1962	1973	1983
Hospitals	54	84	86
Hospital beds	5 158	8 415	10 933
Health centres	41	93	130
Health stations	354	650	1 850

The annual out-turn of medically trained manpower has increased from 766 in 1974 to 1627 in 1983, but rural medical staffing remains inadequate compared with other African countries. Staff and finance shortages, shortages of medicines and medical equipment (all imported) and qualified management staff generally constrain the development of health services. The GOE is tackling some of the staff and resource constraints by relying more on community participation in building health stations and by supporting community health workers. In rural areas over 50 percent of the population has to depend on the private practice of traditional medicine.

Examples of the Government's preventive approach are the Expanded Programme of Immunization launched in 1977, and the control operations for TB, smallpox and malaria. These programmes represent a shift of emphasis from urban-centered hospitals and curative medicine toward programmes designed to reduce Ethiopia's high incidence of environmentally-related diseases.

The other major emphasis has been on primary health care in rural areas, by which it is planned to extend health services to 85 percent of the population by 1990. Already there are some 2 500 community health agents and 1 600 traditional birth attendants in rural areas.

The TYPP envisages further emphases being place on preventive medicines and development of rural community health services. The TYPP also envisages the use of schools and mass media to further preventive medicine and nutritional improvement and some suggestions in this respect are made in section 4.8.4 and on birth control in 4.8.6.

Traditional healers are the only health workers immediately available to half of the rural population. As such, their importance to the health of the rural people must not be underestimated. They often have a profound knowledge of locally available herbs, and their traditional knowledge and skills should be investigated and, where appropriate, developed, pending achievement of full coverage by modern medical services. Traditional healers might be supplied with first-aid kits and encouraged to relate to health stations wherever these have been established.

4.8.4 Nutrition

Of particular importance in worsening overall health, in increasing vulnerability to diseases by depressing the body's immunity responses to infection and, itself, a major cause of premature death, is malnutrition. Apart from diseases directly attributable to malnutrition, the contributory role of malnutrition in increasing the susceptibility to infections of various kinds and in aggravating the course of such infections after they have set in, has been elucidated and described in the form of a vicious cycle leading to accelerating deterioration of health (WHO chronicle 31, 1977).

The data needed to estimate average consumption are very deficient and cannot be said to be reliable. Consumption surveys have been defective and very incomplete. Estimates of production raise serious questions, also, of coverage and consistency. 1/ For present purposes it is estimated that, on average, some 150 kg of cereals and pulses have been available for annual per capita consumption (see Annex table A4.10). This is slightly more than has been estimated in FAO Food Balance Sheets for the 1970s, which also contain estimates of average annual per capita

1/ See especially the discussion in the introductory paragraphs of Annex 4 on estimates of crop area and yields.

consumption of other foods. 1/ FAO's Nutrition Division has also estimated that the average per capita energy requirement for Ethiopia is 2 330 kcal, after allowing for ten percent wastage. 2/ From the FAO Balance Sheets, in table 4.5 it may be seen that estimated average annual per capita consumption falls short of this by substantial margins and that the situation has deteriorated in recent years. Calorie intakes are clearly below 3/ those required to sustain health and may be falling in many areas, although per capita protein consumption is high at over 50 percent above requirements (GOE, 1980c), suggesting that rural people use their excess protein for their energy requirements. A survey undertaken by the Ethiopian Nutritional/Institute (ENI) in 1980 showed average calorie intake to be below two-thirds of requirements in 7 of the 11 Regions surveyed; the worst were Tigray, Welo, Gondar, and, more surprisingly, Kefa and Welega (coffee areas) while the best, by far, was Gojam, a traditional surplus cereal producing Region. Malnutrition generally affects children most severely. The same survey found that 56 percent of the children were at least 20 percent or more below their weight-for-age standard. 4/. Of course such averages hide very wide variations within regions and age groups.

The causes of malnutrition are not just inadequate food production and availability, drought and famines, but the uneven distribution (though this has improved since before the Revolution) and poor infant weaning and feeding and poor adult eating habits. Part III of this

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1/ FAO Food Balance Sheets for Ethiopia for the years 1978 to 1980 (the latest available) estimate average annual per capita consumption in kg as: cereals 120, pulses 16, tubers and roots 35, dairy products 24, meat 18, fruit and vegetables 18, oils, fats, oilseeds, nuts 6, eggs 2, fish 0.5, spices, stimulants and alcoholic beverages 20. It should be pointed out that the various sample surveys on area and yield of cereals, pulses and oilseeds which may be the basis for the Food Balance Sheets, are from the older Ministry of Agriculture/FAO series of 1974/75-1977/78. They are not comparable or consistent with the later CSO/FAO series from 1980/81-1983/84. Minor crops, for "other foods", have not been surveyed.

2/ Communication of 31-1-84 from Director of Food Policy and Nutrition Division.

3/ According to the FAO estimates cited here, national average per capita calorie intake is around 75 percent of requirements, while the mean calculated from an ENI Survey in 1980 was 67 percent.

4/ Acute shortages of food generally decrease weight irrespective of height or age. Prolonged lack of food not only results in loss of weight but affects growth in general and causes reduced stature. Reduced stature is not normally corrected within a short time, even if later diet is improved, so that below height-for-age is usually a reliable indicator of a past malnutrition.

report addresses problems relating to food production and availability while food distribution is covered by other reports (for example, GOE 1984b and GOE/WB 1983). The strategy presented in Part III could be valuabl complemented by a nutritional development strategy. To formulate such a strategy, however, would require far more and better data to identify the most severly malnourished areas and groups and to analyse in more depth the nature, causes and extent of malnutrition in different areas and groups. This would require more thorough nutrition surveys, developing on the one undertaken by ENI in 1980. Further surveys should also be designed to establish a baseline for use in a national nutritional surveillance and monitoring system in which the concerned agencies such as ENI, MOA and RRC should collaborate.

In the absence of such a comprehensive nutritional development strategy, the existing findings and recommendations of ENI could be used to improve nutrition levels through programmes in primary, secondary and adult education and through the mass media.

Table 4.5

ESTIMATED PER CAPITA SUPPLIES OF FOOD NUTRIENTS 1961/65 TO 1978/80

Per day	1961-1965	1970-1974	1975-1977	1978-1980
Calories (kcal)	2020	1935	1807	1730
Protein (grams)	69	65	60	58
Fat (grams)	33	31	28	28

Source: FAO Food Balance Sheets: Only for the third column above are there independent estimates of major crop production by sample survey to support these consumption estimates. The ENI 1980 estimate is about 1820 cal/cap.

4.8.5 Water supply

More than 60 percent of the weight of the human body is water. To perform its functions properly, the body needs to consume 2 to 10 litres of water per day, depending on climate and work load. Food consumption does not normally provide more than one litre per day. Water is also required for personal hygiene, laundry, cleaning, etc., so that average per capita needs rarely fall below 15 litres per day.

Most of the water for the people of the Highlands is collected from streams, ponds or springs by the women. For Tigray a survey indicated that women spent an average of 2-1/2 hours per day fetching water, while livestock spent about four hours per day moving to and from watering points (GOE/Huntings, 1976). The EHRS Sociological Survey found that 46 percent of interviewees obtained their water from a source at least 1 km from their homes, while 27 percent lived more than 3 km from the nearest water source. Water is often so scarce that hygiene is often compromised, as humans and livestock must use the same sources. At other times, heavy rains and flooding cause contamination of drinking water and widespread intestinal diseases (see section 4.8.3). Improved water supplies will often be significant in improving health. For such reasons surveys usually reveal that the provision of clean water supplies is a top priority among rural people.

The provision of adequate and clean drinking water facilities in Ethiopia is still poor. Of the 28 million rural people in the Highlands only 1.1 million, or 4 percent, have access to adequate water services. On the other hand, of the 180 towns in the country, only 20 receive regular and adequate supplies of water; 116 towns have improved but sometimes inadequate water supplies, while 44 have no clean water at all (GOE, 1983b).

Some reasons can be given for this disappointing performance. First, rural settlements are widely scattered, often in rugged topography, which constrains both planning and execution of the government's water development programmes. Skilled manpower and financial resources have been short, as well as equipment and spare parts.

Aware of these problems, the Government aims to increase the rural water supply coverage to 50 percent by the end of the TYPP period. This is to be done by constructing technically simple facilities which can be handled by the rural people. Local communities will be organized and trained to operate and maintain their own facilities. To cut costs, ways will be sought to concentrate the more dispersed settlements. Construction equipment, imported at high cost, would be manufactured locally, wherever possible, to save foreign exchange. Regional and sub-regional offices will be established to coordinate rural water development activities.

The Government plans to protect 30 000 springs and hand-dug wells in the coming decade. Under the Valley Development Programme five large, 50 medium-scale, and 450 small dams are to be built to provide hydro-electric power for rural industrialization and water for irrigation as well as humans and livestock.

A number of points having a bearing on the EHRS are noteworthy in respect of implementation of the GOE's water supply development proposals. First, the use of both surface and ground water should preferably conform to a master plan for water, and this should be interrelated with the land use master plan. This is implied by the proposals presented in Part III of this report, as accepted by the GOE. A master plan for water should place each development option on water supply and use in perspective, in relation to needs of the population, time periods and present criteria for the selection of projects. Second, for water supply projects, surface water use by gravity or the use of springs is likely to be cheaper than the extraction of groundwater by shallow wells or boreholes. Costs of piping can be considerably reduced by using locally available materials such as bamboo or clay. The extra costs incurred in design are likely to be more than offset in resulting cost savings. The use of surface water in particular needs to be coordinated with the rehabilitation of sub-catchments.

Other issues which might have a bearing on the EHRS concern are: (1) the strategic choices between providing water first to the most needy areas, to the least-cost areas, or to the most rapidly-growing areas; and (2) the needs for water supply projects to fully involve people in their planning as well as implementation, to avoid over-ambition in self-help schemes and to emphasize low-cost and easy maintenance wherever possible.

4.8.6 Family planning

Improved health services are aimed at increasing human survival rates. Experience in other countries indicates that natural falls in birth rates follow only after many years the decreases in death rate brought about by improved health services. In the intervening years, the population increases more rapidly. Population density in the Highlands is already very high by African standards (see section 3.4), and further growth will increase the pressures on the Highlands natural resources. Faster population growth will also serve to divert more resources to food production and distribution and to investment in the social services (just to maintain existing per capita standards) thus leaving less resources for improving development per capita. Faster population growth will increase national consumption and limit the increase of savings and investment. It will also add to the growing unemployment problem.

Although the GOE has explicitly recognized these effects of population growth in various official documents, and has even stated its intention to develop a population policy, population policy to date has largely been confined to resettlement. The provision of family planning services has been left in the hands of voluntary agencies, and mainly the Family Guidance Association of Ethiopia (FGAE).

Family planning services have been available since 1963 through the FGAE, now operating through two clinics of its own and through 273 government clinics. FGAE provides clinical services to married couples, public education, and training for health workers. Contraceptives are prescribed and IUDs inserted by nurses and health officers. The number of contraceptive acceptors has increased from around 10 000 persons in

1970 to over 75 000 in 1982. But despite this growth rate of around 20 percent p.a., the use of contraceptives is mainly confined to towns, and even so accounts for less than 5 percent of the urban female population of reproductive age. Sterilization is normally not available, and abortion is openly available only for the strictest medical reasons.

It is understood that the Government is preparing to assume some responsibility for the provision of family planning services, probably as part of the maternal and child health services and concentrating initially on child spacing.

4.9 GOVERNMENT REVENUES, EXPENDITURES, THE FINANCIAL SECTOR AND INFLATION

4.9.1 Government accounts

The total of Government current and capital expenditures has exceeded its revenues in every year since 1974/75 (see table A4.3), the deficits being financed by both domestic borrowing and foreign borrowing. As a percentage of GDP, however, the deficits have been low by the standards of other developing countries, reflecting the financial prudence of the Government in trying to avoid inflationary financing, and indicating some success in mobilizing foreign aid. Revenue sources for the period 1974/75 to 1982/83 are shown in table A4.4, while expenditures are shown in table A4.5 and A4.6. Revenues come from both taxation (76 to 86 percent) and the profits of State-owned enterprises. Two-thirds of tax revenue is from indirect taxation. The most important taxes for the rural sector are direct taxes and the coffee tax.

4.9.2 Rural taxation

The GOE's rural Land Use Fee and Agricultural Activities Income Tax Proclamation, No. 77 of 1976 stipulates that:

(a) peasant associations would act as tax collectors, and

(b) the rural tax base would relate to use of publicly-owned land (the rural land use fee) and income from agricultural activities.

The rate of the rural land use fee is Birr 20 per family p.a., irrespective of the size or type of land or the income generated by it. Members of a Producer Cooperation pay only Birr 15 while Government agricultural organizations pay Birr 2 per hectare. The tax rate on income increases progressively from a flat rate of Birr 10 for annual income up to Birr 600, to 10 percent (for incomes between Birr 6 000 since declined, although the surtax remains. Coffee producers have to be given adequate incentives to increase their production, but the Government has become very dependent on the revenues produced by the coffee surtax.

4.9.3 Government expenditures

Government expenditures in the last decade have grown most rapidly - over 200 percent - for general service (which includes defence expenditures). Social and economic services follow at around 100 percent (see table A4.6). Current expenditures have remained consistently high and almost three times as high as capital expenditures in recent years (table A4.3). The bulk of capital expenditure has been on agriculture, industry and road construction, but the share of agriculture has declined from between 30 and 50 percent in the 1970s to less than 20 percent in the 1980s (table A4.5). This is a cause for major concern, especially considering that a high proportion of total investment in agriculture goes to the State Farms, whose contributions to total output are only six percent. The share of agriculture in current expenditures in the last few years has been between 2.0 percent and 2.5 percent - as low as that in the old regime (see table A4.6). Also important to the availability of resources for the rural sector are the continued large expenditures on defence and the increasing proportion of government expenditures spent on personnel.

4.9.4 The financial sector

The financial system was nationalized in 1975 and restructured following the 1976 Banking Proclamation. Component institutions now comprise the central and four sectoral banks as follows:

- National Bank of Ethiopia (NBE)
- Agricultural and Industrial Development Bank (AIDB)
- Commercial Bank of Ethiopia (CBE)
- Housing and Savings Bank (HSB)
- Ethiopian Insurance Corporation (EIC)

Each institution is a separate legal entity but all are controlled by one Board established by the 1976 Proclamation, and chaired by the Minister of Finance. The NBE Governor is the Vice-Chairman, and high level representation from six Government ministries and the CPSC ensures that the economy's financial flows are in accordance with Government plans. Apart from its central banking functions, NBE is responsible for making banking policies and issuing guidelines on allocation of credit and foreign exchange and setting interest rates.

The functions of the other four institutions are indicated by their names. The EIC provides all normal types of insurance, but and Birr 9 000), and reaches 89 percent for the highest incomes. There is also a modest livestock tax: Birr 1 for cattle and equines and Birr 0.50 for sheep and goats. However, this is only collected when the stock are sold in markets, and the substantial cattle wealth of Ethiopia goes largely untaxed.

In practice, taxes on the peasants are collected by the Peasant Associations, which are paid two percent of the collection they make for services rendered. They may be seen as an initial step toward tax revenue sharing. Most PA's need revenue to carry out local development programmes and to help raise various local contributions in cash labour (see section 3.6.1). Self-help projects include the construction and maintenance of community and cooperative buildings, clinics, roads, small dams, etc. These contributions can be substantial and experience acquired in these may serve the future rural development. Payments for Service Cooperatives, comprising registration and annual membership fees, are decided by the member PA's.

In addition, Government has made several calls for contributions to help finance drought relief, defence, resettlement, and the literacy campaign. In some cases, Wereda-level committees are formed to manage these contributions and specific levies are assigned to each household. Some PAs collect a monthly fee of one-quarter to one-half Birr per household to cover such levies. The linkage between taxation and incentives depends partly on how the extra taxes are used. Willingness to pay additional taxes would increase if part of these were earmarked for purposes directly benefitting the taxpayers and were administered by their local administration (Awraja or Wereda).

Besides mobilizing resources, taxes can be an incentive to the efficient use of resources. This could apply in particular to the land use fee. The existing land use fee (the same for all holdings) does fulfill this function efficiently. A first step could be to differentiate the tax according to sizes of holdings, keeping the present flat rate for small farms (for instance, up to 1.0 ha) and increasing it proportionately for larger farms. At a later stage, graduations according to land quality and farm location could be added. This should induce farmers to use land more effectively and to relinquish land they cannot make full use of. Taxing communal lands should also ensure more effective use of them. Since income from agricultural activities will be closely correlated with the size of the land holding, this will indirectly achieve some of the progressivity in taxation which eludes government through the income tax. The size of land holdings and pasture per PA and per family is well known and cannot be concealed in the same way as income.

Coffee exports, which have in recent years provided over ten percent of Government revenue, are subject to substantial taxes. A cess, a turnover tax and a progressive surtax are charged. The surtax is by far the largest element, and was first imposed after the Brazilian frost of July 1976 to absorb windfall profits. Coffee prices have marine and motor vehicle insurance comprise most of its business. A large portion of its surplus funds is passed on to HSB as time deposits. CBE has grown rapidly in terms of total assets, deposits, and loans outstanding. CBE operates in the traditional manner, mobilizing deposits - demand, savings and time - and making advances and short-term loans. AIDB is the main institution for term lending to industry and for all lending to agriculture, and is described in more detail in section 5.8.

4.9.5 Inflation

The government's prudent fiscal management, as reflected by its limited borrowing from the banking system, has contributed to financial stability. Control over credit expansion, together with the increased production of essential consumer items and the return to normalcy in internal transport, have led to a significant reduction in the domestic inflation rate in recent years - to an average rate of around 8 percent p.a. Other contributing factors to the decline in the inflation rate possibly include the effects of price controls, the maintenance of an overvalued exchange rate (see section 4.3.4) and the effects of the wage freeze on higher-level staff.

4.10 MAJOR CONSTRAINTS - SKILLED MANPOWER AND OTHERS

4.10.1 General

Ethiopia's economic development has traditionally been constrained by many factors: weak infrastructure, notably roads (see section 4.6); heavy dependence on coffee exports; low productivity in agriculture (see Chapter 5); a small industrial base; and shortages of skilled manpower (see section 4.10.2). To a large extent all these are features of under-development and inherited from pre-revolutionary times. Thus the production base from which Ethiopia seeks to move forward is very limited. The economy is now impaired by a number of other constraints, brought about by recent developments.

First, domestic resources for investment and for economic and social services are limited by the priority which had to be given to internal security needs (see section 3.2). Second, the capacity to import has been severely constrained by a deterioration in the terms of trade and by small amounts of foreign aid (see section 4.3.4). The recent recession in the industrialized countries has inhibited the expansion of exports other than coffee. Third, industrial production growth is running up against capacity constraints because of low investments in recent years. Low investments have in turn resulted from inadequate resource mobilization. Domestic savings have remained at around 3 percent of GDP, reflecting in part a per capita income of only around US$140. Central government savings remain depressed because of high current expenditure. These constraints of foreign exchange, Government finance and investment, mobilization of resources, transport and communications, and energy, have already been mentioned in the previous sections of this Chapter. The rest of this section therefore concentrates on constraints associated with skilled manpower.

4.10.2 Skilled manpower

Success in formulating and administering appropriate economic policies, in preparing and implementing a major investment programme and in operating efficiently the increasingly large number of public enterprises and agencies, will depend crucially upon the availability and motivation of professional, technical and managerial staff.

Compared to many sub-Saharan African countries, Ethiopia has had a well-educated civil service from pre-revolution times. There were also many expatriates in business and in the education system. Many highly-qualified and experienced Ethiopians and most of the expatriates in business left the country after the Revolution. Although many qualified Ethiopians remained in the country, and positions vacated by the "brain drain" have been filled by promotion or training of less experienced nationals, the skilled manpower gap widened. The gap has widened further despite rapid growth of the higher education system and some special training programmes.

High-level skilled manpower (e.g., all new univeristy graduates) is centrally allocated each year according to requirements submitted by the ministries. Judging from the proportion of requests for manpower not filled, there are shortages in virtually all fields, but more particularly for qualified managers, engineers, accountants, economists and agriculturalists. There is also a general scarcity of middle-level manpower. Its extent is not easily assessed, but there are indications (e.g., greater growth in new graduates than in diploma holders) that this problem may be growing more severe relative to shortage of high-level manpower.

Government departments and agencies have training programmes to meet manpower needs; these programmes are, however, not coordinated. The nearly fourfold increase in enrollment in post-secondary education has not produced a commensurate increase in output of trained manpower because of high dropout rates. The high wastage rate in tertiary education partly reflects poor secondary education, the lack of adequate equipment and facilities in tertiary education, inadequate orientation of the higher education system to science and technology, and the low return flow of trainees from abroad.

It will cost much to improve the quality of equipment, provide more textbooks, etc., and expand vocational training. Foreign assistance could help more in these. Also more extensive use could be made of fee-paying education. The growth of private secondary schools, with their high fees, indicates that parents are willing to pay for quality education. The Government might, for example, use a bursary (loan) scheme for meritorious university students and direct students to courses such as agriculture, medicine and engineering which are of immediate need to the country.

The formal wage sector, which covers the civil service, corporations and large employers, includes only a small fraction of the labour force. In the private sector, until the passage of the 1975 Labour Proclamation Order, there was no official minimum wage. This Proclamation established for the formal sector a minimum wage of Birr 50 a month. For civil servants, there have been no general salary adjustments since 1975/76. As the cost of living index has more than doubled since 1974/75, the real income of civil servants has fallen substantially. The decline has been even larger for those higher in the salary structure, including professional and technical staff, despite salary gains through promotions. While this salary freeze has reduced income disparities and has helped contain inflation, it has also had negative effects through loss of motivation and lack of incentive. An important objective of wage policy should be to support a desirable and rational incentive system. This means that wage policy should be used to encourage workers to take up positions where their contribution to economic development will be greatest. It might be opportune for the Government to review its salary freeze policy and consider some selective salary increments consistent both with improving productivity and prudent financial management.

4.11 GOVERNMENT PLANS AND PRIORITIES

The Government is addressing some of the issues raised in the previous sections through the formulation of a Ten Year Perspective Plan (TYPP) covering the period 1984/85 to 1994/95. The Government's announced long-term development objectives (see Chapter 11) remain the improvement of living standards of the people, a structural transformation of the economy toward self-reliant development, the creation of employment opportunities, a more equitable distribution of benefits of development and laying the foundations of a socialist society. To realize these, the main elements of the strategy are: to increase investment and savings; to promote cooperatives in agriculture, handicrafts and cottage industries; to mobilize people's organizations and employ labour-intensive techniques for agricultural and small-scale industrial production, rural roads, and social services; to increase productivity in peasant agriculture through improved technology and input use; to expand and diversify exports; and to expand industries to meet the basic needs of the people and to increase exports. The extent to which the TYPP objectives will be achieved will be severely limited by financial, manpower and foreign exchange constraints. The prospects for overcoming these constraints are reviewed briefly in section 4.12. This section summarizes the targets and priorities.

Agriculture is expected to generate surpluses and foreign exchange to finance the long-term industrialization programme and to absorb most of the labour force. Agriculture "will determine the nation's general economic growth or stagnation. There can be no choice at this critical stage but to give priority to the development of this economic sector.....Top priority has been accorded to the agricultural sector to develop the economy" (p. 38, COPWE). About 22 percent of total investment is for agriculture. Industry is also allocated 22 percent, transport and communications 20 percent, mining, energy and water supplies 18 percent, and the social services 16 percent. The small share for agriculture is surprising, given the dependence of the people and economy on agricultural development.

In agriculture, various actions to increase yields in traditional rainfed agriculture are to get 11 percent of agricultural investment in the TYPP, especially in the high growth potential areas. Small-scale irrigation development, mainly through low cost river diversion works, is given high priority (39 percent), especially in Gojam, Gondar, Welo, Tigray, Shewa and Welega, to reduce farmer dependence on unreliable rainfall. Resettlement is allocated 22 percent of agricultural investment, State Farms 6 percent, export crop development 10 percent, livestock 8 percent and forestry 4 percent.

In industry, the TYPP's main objectives are big increases in production of basic consumer goods, intermediate goods and farming implements, through modernization and expansion of existing units, establishing some new units and supporting expansion of handicrafts and small industries. However, the latter sector receives only 4 percent of the investment to be allocated to industry. Some industrial exports are to be developed; important projects include expansion or establishment of factories for textiles, sugar, paper, and spare parts for various industries.

In the transportation sector, the TYPP's main objectives are to improve and construct feeder roads for some inaccessible agricultural areas, upgrade the international airports, and rehabilitate two seaports and a shipyard. In mining and energy the programme is designed basically to save and earn foreign exchange and to provide certain basic inputs for the development of industry and agriculture. Over half (54 percent) of the investment allocated to this sector is for the generation of electricity, 22 percent for mining, 20 percent for water supplies, and 4 percent for construction.

Within the social services sector, the TYPP allocates 45 percent of investment to housing, 40 percent to education and 15 percent to health.

4.12 PROSPECTS FOR ECONOMIC AND SOCIAL DEVELOPMENT

4.12.1 Overview and the dependence on agriculture

The aim of this section is to indicate some of the prospects for economic and social development and thus provide the macro-economic context within which the strategy is formulated. Prospects will be very largely influenced by the recent developments and constraints, as summarized in the earlier sections of this chapter.

There is substantial scope in Ethiopia for broad economic and social development led by the rural sector, because the physical resource is still advantageous despite the extent and threat of degradation, and because of success in organizing the peasant sector (Chapter 3). There is now a great need to accelerate economic growth by mobilizing local resources and attracting overseas resources (section 4.12.4) and by increasing productivity (section 4.12.5). With its achievements in social development, Ethiopia needs to orient economic policy toward expanding the directly productive sectors, especially agriculture.

The performance of agriculture will continue to be crucial in determining the rate of economic development. The share of industry is so much smaller that even rapid rates of industrial development can have only a modest impact on the overall rate. Furthermore, large-scale industrial growth is now heavily dependent on capital-intensive investments (see section 4.5.1), but there is substantial scope for more development of labour-intensive small-scale industries to supply simple agricultural implements and consumer goods and to process agricultural produce (see section 4.5.2).

Increased agricultural production can be achieved through the allocation of more resources to the sector (particularly the peasant sub-sector) and to related infrastructure and by the implementation of certain policy measures. Part III of this report formulates specific proposals for the sustained development of agriculture.

4.12.2 Alternative macro-economic scenarios

The task of expressing the economic perspective of the Highlands in quantitative terms is formidable, given the country's weak data base; the uncertainties affecting future policy, export prospects and aid flows; and the dependence on agriculture, plagued by the vagaries of weather. Notwithstanding these difficulties, the World Bank (1983d) has attempted to assess medium-term prospects (i.e., the 1980s) for economic development for Ethiopia as a whole in terms of two scenarios, based on two sets of assumptions. In the absence of other analyses, it is assumed here that these assessments also provide useful if tentative indicators of prospects in the strategy period, for the country as a whole as well as for the Highlands.

In the more optimistic scenario, GDP is projected to grow at a rate of 4 percent per annum. This rate is crucially dependent on agriculture, which is projected to grow at progressively increasing rates averaging 3.8 percent a year. This is much higher than the estimated average rate of 2.1 percent for the fire years ending 1981/82. The average rate of 3.8 percent is based on several assumptions, among which are broader use of improved seed-fertilizer packages, expansion of cultivated area, better extension and research, and increased availability and effective use of agricultural credit. Industry (including utilities and construction) is projected to grow at an average annual rate of 4.8 percent. This is slightly lower than the 5 percent achieved over the five years ending 1981/82. The realization of this rate is based essentially on creation of new industrial capacities. Underlying assumptions include:

(a) increased output of small-scale industry, through tax incentives and other support measures;

(b) an increase in total investment from the current 10 percent of GDP to 14 percent by the end of the 1980s, which will require restraints on public consumption in real terms and policies and programmes to stimulate private savings and investment.

This scenario provides for real growth in total consumption of around 3.3 percent a year which is higher than the projected population growth rate of 2.9 percent. This scenario implies that if exports grow about 6.8 percent in real terms, a sustainable current account deficit and a manageable external debt situation can be realized. A related implication is that real import growth should be contained at 4.4 percent a year, through restraints on consumer goods imports, permitting the higher growth of capital goods imports needed for the investment programme.

In the less optimistic scenario, GDP would grow at about 2.5 percent per year, essentially a continuation of the trend in the early 1980s. This rate is largely influenced by a growth of agricultural output of 2.2 percent, which could result from a continuation of the trends until the recent severe drought. The projected industrial growth rate, 2.5 percent, reflects increases in value added resulting from new industrial plants. This scenario assumes investment to remain at around 11 percent of GDP. The implicit real growth of total consumption would then be 2.1 percent a year, which implies that per capita private consumption would decline unless public consumption were reduced quite substantially. With a low export growth rate of 4.7 percent, total import growth of around 2.2 percent and lower capital goods imports, this low growth scenario implies that the balance of payments would steadily worsen.

4.12.3 Overcoming the foreign exchange constraint

The value of merchandise imports is double the value of merchandise exports. Without substantially more concessionary assistance, a major expansion in exports and increased import substitution are called for in order to reach a more sustainable external current account deficit. The objective is to strengthen foreign exchange reserves by expansion of export earnings and by import-substitution. The policy should aim at maximizing the earning or savings of foreign exchange per unit of domestic resource expended. The expansion and diversification of exports would be helped by implementing export incentives schemes; export marketing and other promotional measures; and strengthening the institutional framework. The possibility of excessive expansion of export crop production at the cost of food production (or the reverse) might be guarded against by relating producer prices of tradable crops to their relative prices in the world market and taking into account the domestic resources required to produce them. Such a price policy should stimulate exports.

Serious consideration should also be given to using the foreign exchange rate as an instrument of trade policy. The overvalued exchange rate has tended to reduce producer margins in local currency and has inhibited the growth of exports, especially of pulses, oilseeds, etc. (see section 4.3.4). Since total import demand is effectively managed by financial policies and strict controls, the case for an exchange rate adjustment in Ethiopia is not so much to curtail demand as to make domestic producer prices reflect economic costs, improve resource allocation, and provide better producer margins.

4.12.4 Mobilization of resources

The GOE needs to mobilize increased resources for development, both domestic and external. More external resources can be attracted if well-considered projects are prepared, appropriate for both the TYPP and the Conservation-based Development Strategy presented in this report. Particular efforts should be made to obtain more concessional assistance, from both bilateral and multilateral sources, while containing the volume of borrowing on commercial terms to keep the debt service burden manageable.

External resources, however, will inevitably remain far less important than domestic resources. Given the continuing uncertainties of world economic development and the strings frequently attached to foreign aid, as well as the GOE's objective of self-reliance, domestic resource mobilization is all the more important. Greater efforts in improving efficiency in the assessment and collection of direct taxes, the efficient implementation of the new system of indirect taxes and raising larger surpluses from public enterprises through increased efficiency and the curtailment of less essential current expenditure would enable the Government to mobilize more domestic financial resources to raise public investment. The public sector, however, can neither mobilize all domestic savings nor undertake all investments. It is therefore essential to adopt measures to stimulate private savings and investment in both rural and urban areas, in agriculture and non-agricultural sectors. For example, if the Government could provide a minimum level of technical services, farmer savings and labour could be mobilized to construct common grain storage facilities, access roads, workshops for improved agricultural implements, etc. The Peasant Associations could play a pivotal role by mobilizing their organizational, financial and human resources for local development - provided motivation, technical assistance and guidance are offered by the Government. In addition to encouraging private investment through removal of perceived uncertainties among many individual operators in industry, trade, transport and construction, there is scope to stimulate savings through offering higher rates of interest on bank deposits, and selling to the public government bonds of small denominations.

The greatest resource available for rural development is the people themselves. Part II reviews how people have already been mobilized to tackle the degradation problem, while Part III makes some suggestions for the larger scale mobilization of the peasant sector for rural development and conservation.

4.12.5 Efficiency in resource use

In view of the likely continued serious scarcity of resources, there is particular need for improving the efficiency of resource use. In this regard it is important to use appropriate sets of price signals to influence behaviour of the large number of decentralized decision-making units regarding resource allocation. Whether the decision-making units are individual peasant families, cooperatives, private firms or public enterprises, the prices provide information and incentives at low cost and influence behaviour. The use of such prices and incentives to influence behaviour of production units and therefore to direct resource allocation is not inconsistent with socialism; on the contrary, prices are used to further the aims of socialism in other socialist countries. Ethiopia also uses prices as market signals and as administrative devices, but the prices used are sometimes no longer appropriate. The aim is to make prices more closely reflect economic costs in order to improve resource allocation.

Since such a large proportion of resources are used in the public sector, better planning and project selection are needed in this sector. In particular, in project appraisal by the Development Project Studies Agency, the use of shadow prices of foreign exchange, capital and labour should be closely adhered to. Part III of this report proposes criteria for selecting priority reclamation projects.

Chapter 5

THE RURAL SECTOR

5.1 LAND USE

The destruction of much of the natural vegetation of the Highlands has been briefly reviewed in section 2.8. The estimated area coverage of major vegetation types by zone in the Highlands in 1983 is shown in table 2.9 and by sub-zone in the Annex 4 tables. From the viewpoint of potential economic land use, three main categories of use may be identified in very broad terms:

(a) Forestry, in the categories forests and woodlands. Primarily collection of fuel and other wood, herbs, bee-keeping and limited livestock browsing in the thinner woodlands.

(b) Livestock raising in the shrublands and grasslands. The grasslands, comprising both temperate and savannah pastures, are used almost exclusively for grazing livestock while the shrublands offer possibilities for browsing, low quality grazing, and fuel wood collection. No firm distinction can be drawn here between open grazing lands and "fallow".

(c) Agriculture (cropping) in the croplands. These should include land actually harvested, failed crops, and various kinds of fallow. Insufficient study or field survey has been conducted to define fallow with any precision. No data are available on the length of fallow periods. Livestock are grazed on croplands after harvesting, and much of the dung is collected for fuel.

The relative importance of these three forms of potential land use in terms of the area of land so used is given in table 5.1 by zone and may be calculated by sub-zone from Annex tables A4.1-A4.4.

Much of the remaining natural forests in the HPP zone is inaccessible for economic use. Cropping areas are defined here, unfortunately, to include only harvested, because it has not been possible to specify fallow land.

An important qualification which has already been emphasized elsewhere in this report is the difficulty in reconciling various data

Table 5.1

ESTIMATED LAND USE IN THE STUDY AREA IN THE EARLY 1980s BY ZONE

Zone	Percent of land area in each zone		
	Forestry	Livestock	Cropping
HPP	11	64	13
HPC	5	68	16
LPC	1.4	73	14
Total Study Area 1/	6	68	15

1/ Between 1 500 and 3 000 masl. "Waste" account for another 11 to 12 percent.

Source: EHRS team estimates.

obtained from different sources and/or by different methods. The above land use estimates are based primarily on interpretation of satellite imagery, aerial photography and ground surveys by the Land Use Planning and Regulatory Department of the MOA. Croplands comprise some 15 percent of the study area (between 1 500 and 3 000 masl), defined as harvested lands. On this basis the total harvested area would amount to around 6.6 million ha. CSO statistics for "private" peasant harvested areas (cereals, pulses and oilseeds) total around 5.6 m ha. The cropped area under State Farms and PC's accounts for a further 300 000 ha. The remainder is about 700 000 ha accounted for by perennial crops, including: coffee, about 400 000; chat, about 30 000; and enset, about 250 000. For other minor crops, statistics are lacking but these could hardly add more than another 100 000 ha. The data here can generally be regarded as only indicative.

This chapter reviews these three important forms of land use, giving most attention to cropping because it is the major source of livelihood in the Highlands and a prime determinant of the land left over for livestock and forestry, which are reviewed in sections 5.6 and 5.10, respectively. Parts of sections 5.8 and 5.9 on agricultural support services and markets are also relevant to livestock and forestry.

5.2 THE AGRICULTURAL SECTOR - IMPORTANCE AND COMPOSITION

When defined to include cropping, livestock and forestry, agriculture is by far the most important sector of the national and Highlands economy, accounting for around 45 percent of the GDP. Furthermore, this percentage share has only fallen by around 3 percent since the Revolution. Ethiopia's industry (section 1.5) is largely dependent on agriculture for its raw materials, while agriculture also provides around 90 percent of Ethiopia's exports. The performance of the agricultural sector will thus remain critically important for development in Ethiopia.

Agriculture in the Highlands of Ethiopia has been described in qualitative terms by several authors (Huffnagel, 1961; Westphal, 1975; Amare Getahun, 1978a; World Bank, 1973, 1983a), but little attempt has been made to provide substantial and consistent data to support the descriptions. The reason for this is that there has been too little quantitative field survey of either land use or farming systems. Available information from mapping surveys, satellite imagery, aerial photography and statistical sample surveys has not been reconciled by enough independent field work. Even for the major cereals and pulses (by far the greater part of food production), the time series of production, areas and yields are quite unsatisfactory, with serious anomalies and gaps which confound serious analysis. 1/ Notwithstanding these limitations, this report attempts to present a substantial and internally consistent data base for the Highland agricultural sector, differentiated by zone as appropriate and when considered practicable with the time, resources and data available to the EHRS team. This attempt at quantitative support is based on interpretation of official statistics, and of various surveys, both ground and aerial, undertaken by the Land Use Planning and Regulatory Department of the MOA, as well as on the team's own field surveys and professional judgements.

The agricultural sector itself is dominated by cropping and livestock; forestry, according to national accounts (see table 4.2), accounts for less than 2 percent of the value of the sector's output. (Because of its potential importance in conservation, forestry is reviewed in section 5.10.) Less than one percent of the estimated area under crops is irrigated, and most of this is in the lowlands. (Because of the priority attached to irrigation by the GOE, this is reviewed in section 5.7.) Primarily because of climatic factors, practically all rainfed cropping in Ethiopia is within the study area.

1/ For example, official figures imply a difficult-to-explain increase of 50 percent in cereal production in 1979/80 over the previous year. The CSO now conducts an annual agricultural sample survey which seems to provide fairly plausible agricultural production figures from 1980/81. The survey is based on a stratified sample of 12 500 agricultural holdings drawn from 500 PA's in 12 regions (excluding Eritrea and Tigray), and uses a combination of interview and objective methods (area measurements and crop-cutting). In 1979/80 a special *ad hoc* survey was mounted by the MOA. In 1978/79 only interviews were conducted. For 1974/75-1978/79, the Planning Unit of the MOA made systematic but very small-scale sample surveys.

Two percent of the cropped land (as defined in section 5.1) is under State Farms (section 5.7); the balance is farmed by peasants. Within the peasant agricultural sector over 98 percent of the cultivated land is farmed on scattered, individually-held plots, and from one to two percent is farmed on larger consolidated blocks by PC's (see section 3.6). The share of land cropped on individual holdings is decreasing as the share of land under PC's and State Farms has increased in recent years. Most peasants also own livestock, and the crop and livestock components of their diverse farming systems are interrelated in various ways. For examples, oxen are generally used for cultivation in the HPC and LPC zones and also, though to a lesser extent, in the HPP zone. Crop residues are important sources of livestock feed in all zones. It is estimated that livestock provide around 30 percent of total peasant farm income, on average. (See Farm Models, Annex 4.)

The peasant sub-sector is therefore by far the most important component in Highlands agriculture, and to a very large extent Ethiopia's economic growth prospects during this strategy period will be determined by the level of attention, planning and resource allocation that is devoted to this sector. Most of Parts II and III of this report are related primarily to the peasant sector. But before reviewing the diverse farming patterns of the peasant sector (section 5.4) and peasant cropping practices (section 5.5), the next section summarizes some distinguishing characteristics of the agricultural sector as a whole and identifies major trends.

5.3 AGRICULTURAL OVERVIEW, TRENDS AND CONSTRAINTS

Between 1974/75 and 1982/83, and after allowing for inflation, the real monetary value of agricultural production, according to the national accounts, increased by around 15 percent, while GDP increased by around 23 percent; the overall share of agriculture in GDP, therefore, fell from around 48 percent to 45 percent. In the same period Ethiopia's population probably increased by some 25 percent. Based on this reasoning, agricultural production per capita may have fallen by around ten percent or, on average, by over one percent per year. 1/ Trends in cereal production can also be inferred from free market price movements. Despite increasing cereal imports (see table A4.10),

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1/ In official (but not publicly released) CSO data, total peasant sector production of cereals, pulses and oilseeds in 1982/83 was about 60 percent higher than in 1974/75, but it has already been pointed out in section 5.1 that the data prior to 1979/80 are strictly non-comparable with the data from 1979/80 onwards. FAO (Policy Analysis Division, 1984) has estimated that the annual growth in food production in Ethiopia, on average, has been falling short of demand by about 0.7 percent p.a.

cereal prices in Addis Ababa rose sharply from 1975 to 1979 but stabilized or even declined slightly in 1980 and 1981, despite a considerable reduction in imports in 1981. But cereal prices have again surged since early 1982.

Table 5.2

CEREAL PRICE INDEX 1975/76 TO 1981/82 1/
(1963=100)

1975/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	Mar.85
224	290	350	408	395	400	458	445	545	813

1/ Free Market prices in Addis Ababa.

Source: AMC; CSO.

Despite the apparent anomalies in the official CSO time series of data on cereal production and yield, most analysts (including the Government, itself, FAO, World Bank, etc.) have concluded that average food production per capita has declined in the past decade, with the result that Ethiopia has become increasingly dependent on imported food (see table A4.10). Analysts also conclude that production and consumption of food is much more evenly distributed now than before the Revolution, as a result of effective land redistribution (section 3.5). A major effect of land redistribution has been to redistribute food production and incomes to the lower-income groups of the rural areas. Of these, those who were (or are close to) the subsistence level had (or have) the highest propensity to consume additional food. Accordingly, marketed surpluses both of food and export crops (particularly pulses and oilseeds) fell dramatically after the Revolution (see table A4.8). Pulses and oilseeds had been grown increasingly by share-croppers for large landlords. This generated considerable foreign exchange.

The tendency noted above for many peasant farmers to reduce their efforts to produce for the market and to concentrate on subsistence, was further strengthened by dislocations of marketing and distribution systems during the 1970s and by deterioration of the agricultural terms of trade as agricultural producer prices declined relative to the prices of inputs and consumer goods. Cropping patterns have shifted toward the food required for on-farm subsistence, and in particular production of cereals and pulses has increased compared to that of oilseeds.

MAJOR HIGHLANDS CROPS AND DIET

Ethiopia is unique in its heavy dependence on crops not grown elsewhere. This imposes severe difficulties on crop research, and particularly for the development of new varieties.

Of the total land harvested, cereals account for around 70 percent, pulses around 10 percent, and 20 percent divided among perennials, including coffee and enset (Ensete ventricosum), oilseeds, fruits and vegetables, cotton, and some roots and tubers. Cereals are the main staples over most of the Highlands, except in parts of the southwest, where enset is the staple food. The EHRS Sociological Survey indicated cereal preference in the following order:

(1) teff (Fragrostis teff)
(2) barley
(3) sorghum
(4) maize
(5) wheat.

Teff, sorghum and maize are generally grown below 2 000 m; wheat and barley are grown above 2 000 m. Cereals are usually milled into flour for the fermented flat bread (enjera) which constitutes the base of the national dish.

It is estimated that 15 to 20 percent of the population depends on enset for its basic food supply - yet, like teff, the crop has received little research attention. The underground corm of the enset tree and the pseudostem are high in carbohydrate prior to flowering; both are consumed, usually in a fermented dough-like substance which forms the basis of various types of bread and porridge. Enset fibre is used for thatching, rope, baskets, mats and brooms.

Pulses, a most important source of protein, are widely consumed - especially as the fasting rules of the Ethiopian Orthodox Church prohibit consumption of all animal products except fish for about 150 days of the year. Field peas, chickpeas, horse beans, haricot beans, lentils and other pulses are used in cooking wot, the spiced sauce eaten with enjera (meat is much less frequently used in wot). The main oil crop is noug or niger seed (Guizotia abyssinica) which grows predominantly at 1 500-2 500 m. A wide range of seeds are utilized for their oil content, including linseed, safflower, sesame and sunflower.

Various tubers, yams and cassava are grown, particularly in the southwest. Sweet potatoes are cultivated in warmer humid areas (Hararghe), and Irish potatoes are widely distributed, mostly on the higher lands, but the quantity produced is small. These potatoes, as well as the "Galla potato" (Coleus edulis) of the southwest are often used as constituents of wot, which is usually made of flour of pulses, with onions, and often with tomatoes. Chilli (Capsicum frutescens) is the most widely grown vegetable. Boiled cabbage leaves (Brassica carinata) are often eaten with enset. However, vegetables and fruits have not traditionally been important components of the Ethiopian diet.

Ethiopia is reputed to be an origin of arabica coffee (C. arabica) which grows wild in the southwestern forests. About 90 percent of the coffee, however, is from cultivated trees; it is the principal export. Another original crop: chat (Catha edulis), a perennial bush producing leaves with stimulant properties, is widespread, but particularly important as a source of cash in Hararghe.

The geographical distribution of major crops is shown on the map in Figure 5.1.

Similar tendencies toward reliable subsistence crops and away from higher-value marketable crops may also be discerned within the national cropping patterns (see table A5.1). Thus the relative shares of sorghum and maize in total cereal production have increased (compared to the preferred higher-value teff) and the share of relatively low-value horsebeans in total pulses has increased markedly since the Revolution, while higher-value haricot beans, chickpeas and other pulses have declined.

It is not possible to discern from official statistics (after allowing for the inconsistencies caused by the statistical changes of 1979/80) any significant crop yield increases in the country as a whole. Nor are there major agronomic reasons for expecting any yield increase. 1/ The 1 000 farmers questioned in the EHRS Sociological Survey believed that crop yields were declining and attributed the decline primarily to the decreasing opportunities for resting or fallowing the land (erosion was also mentioned by 25 percent of the respondents). To the extent that national crop production has increased in recent years, this more probably would be due to expansion of the cultivated areas. That the official area statistics show little significant change in total cultivated area (see table A5.1) is puzzling, to say the least. This implies that rural population growth is associated mostly with reduced size of holdings, rather than with at least some extension of cropped area. Some expansion of cultivation into areas previously grazed or forested is a much more plausible assumption and is scarcely contested. Generally, apart from episodic droughts, the major causes of slow growth include the inadequate supplies of appropriate improved seeds, the high relative price of fertilizers, and weaknesses in agricultural extension and marketing. Low official producer prices 2/ (reflecting GOE's attempt to keep retail prices of major food low), coupled with the high prices and inadequate supplies of consumer goods, have provided little incentive to farmers to expand production for the market. In the case of coffee, specific factors constraining growth have been its susceptibility to disease, seasonal shortages of labour for picking, and the high tax levied on it.

To summarize, the performance of the agriculture sector has matched neither the country's needs nor its potential. However, despite

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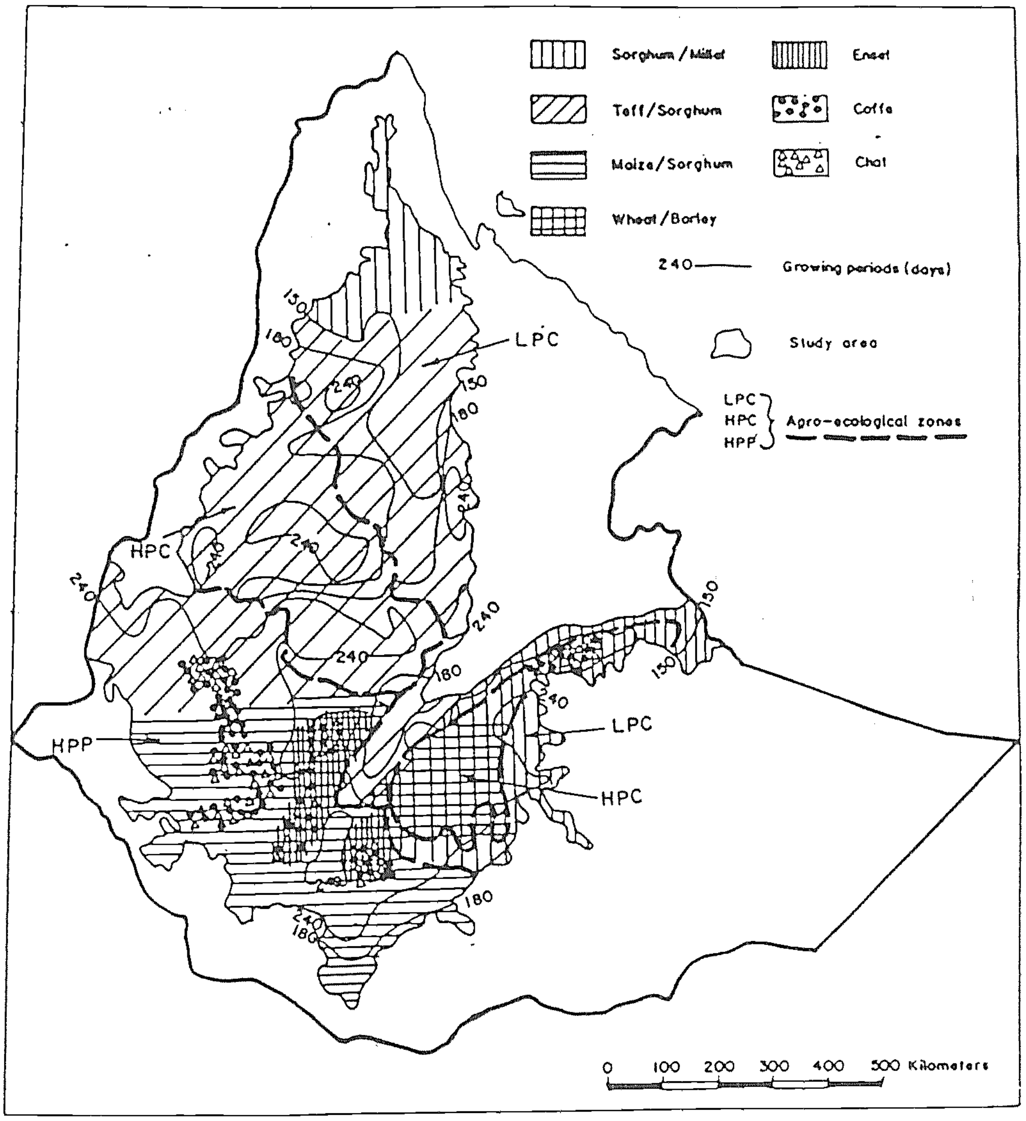
1/ For central Tigray, the low or declining yields (compared to their potential) were attributed in a detailed survey (GOE/Huntings, 1976) to poor quality and diseased seeds, late planting, low plant populations and weed competition. The same survey pointed out that no modern inputs were used, but that their use was often not justified (in Tigray).

2/ Official AMC prices, i.e, many sales are therefore at much higher parallel prices, but the proportions of sales at official and at unofficial prices has not been estimated. Because of the offical marketing "quotas" sought from the PA's, it is assumed that most sales probably are at the official rates.

Figure 5.1 MAJOR CROPS AND GROWING PERIODS



increasing soil erosion and the dependence on rain and on traditional farming practices, Ethiopia has a substantial potential for agricultural development, thanks to the large areas of fertile land with reliable growing periods in the southern and much of the central area of the country.

5.4 PEASANT FARMING SYSTEMS

The changes in land use proposed in Part III will depend ultimately on the peasants themselves. It is therefore important to understand their farming practices and their limitations.

Altitude (i.e., temperature) and length of growing period are the most profound influences on what crops will grow in a particular location (see section 2.2). Temperature affects the crops which can be grown. The altitude ranges for major Highland crops are shown in table 5.3. Generally, the higher the altitude, the longer the cropping cycle between planting and harvesting. Thus the minimum crop maturity periods tend to coincide with the maximum altitude range for that crop. Altitude is therefore a prime determinant in the extent to which the growing period is actually used for each crop.

Altitude also influences cropping patterns, through its high correlation with growing periods (see section 2.2). As was seen in section 2.2, growing periods also generally lengthen toward the southwest. The geographical distribution of major crops and growing period contours are demarcated on the map in Figure 5.1.

Cropping patterns are also influenced by socio-economic considerations. As was indicated summarily in section 2.2, there are two traditional, but fundamentally different, groups of systems of farming. One is almost entirely based on use of the ox plough - in systems that depend on annual crops, planted by seed. The other group of systems is based more on manual cultivation, using the hoe - with heavy dependence on perennial crops and vegetatively-propagated tuberous and root crops. Most of these systems, however, still show some important use of the ox plough. Historically, the hoe culture was brought by the Cushitic peoples from nearby Africa; the plough-seed culture was brought by the Semitic peoples from Arabia (see section 3.1).

In light of such considerations, three basic agro-ecological zones and nine economically important sub-zones were identified in section 2.2. For each of these nine sub-zones, Annex 4 presents:

(a) a model of each farming pattern with quantitative estimates of the inputs (land, labour, oxen, seed, fertilizers, etc.) and the outputs (crop and livestock yields) in both physical and monetary terms; and

(b) a diagrammatic cropping profile showing both the relative importance and the times of planting, growing and harvesting of different crops.

The areas under individual crops, livestock numbers and farming for each of these farming patterns are summarized in table 5.4, based on the models and profiles presented in Annex 4. It is appreciated that farming patterns are by their nature dynamic in both their inputs and outputs and also highly variable, even within relatively confined locations. Nevertheless, the models are regarded as a useful analytical tool which will be used to develop analyses of development scenarios "with and without" degradation in Parts II and III of this report, respectively. These analyses, however, will play a supporting rather than a leading role because of the data limitations and the dynamic and variable nature of farming systems. The farm models are meant as indicative, rather than definitive or exhaustive pictures. The farm models are tentative and must be refined as a result of field experience.

Despite the diversity there are some common features in the Highlands peasant farming. These include the very limited use of either improved seeds or fertilizers. The only inputs on most farms are the seeds traditionally set aside from the previous crop, and the labour of the farmer's household and oxen. The typical family (4 or 5 persons) has a homestead and a small barn or shed, surrounded by a fence. The enclosed area is generally large enough to hold all farm livestock, but these are normally grazed extensively on communal lands. Forage cropping is not practised, but feeding on crop residues is becoming more important as areas of grazing become less (section 5.6). Livestock dung is more often used for fuel than as manure, reflecting fuel shortages rather than lack of appreciation of the fertilizing value of manure. Equines are widely used, but almost entirely for transport.

Labour availability is basically a reflection of family size and composition, but also of religious beliefs (section 3.2). For families belonging to the Ethiopian Orthodox Church (particularly in the northern and central Highlands), most field work is not performed on the many holy days. Land preparation and planting is done mostly by men, but women and children do much, if not most, of the other crop activities. Most of the labour concerned with livestock is done by young boys. Girls help mothers collect water and firewood, cook and prepare dung cakes for fuel. All adult household members are involved in marketing, and at least once a week some family member visits the local market.

Surpluses of food crops for cash sale are irregular, but it is estimated that 15 to 20 percent of production is marketed, mostly locally. Most households own at least 1-2 head of cattle and at least 2 head of sheep or goats, as well as some poultry and an equine

Table 5.3

ALTITUDE RANGES AND MATURITY PERIODS FOR MAJOR HIGHLAND CROPS

Crop	Minimum Altitude Masl	Optimum Altitude Masl	Maximum Altitude Masl	Maturity Periods 1/ (Days)	
				Min.	Max.
Cereals					
Barley	1 600	1 800-3 800	4 000	120	210
Maize	-	500-2 000	2 200	90	180
Sorghum	-	500-2 000	2 400	90	180
Teff	1 500	1 700-2 200	2 400	80	150
Wheat	1 600	1 800-2 300	2 500	120	165
Pulses					
Chickpea	1 600	1 700-2 000	2 200	120	180
Horse bean	1 800	2 000-3 000	3 200	150	180
Field Pea	1 700	2 000-2 500	2 200	120	180
Oil Crops					
Linseed	1 600	1 800-2 500	2 700	90	120
Noug	1 500	1 700-2 300	2 400	90	150
Stimulants					
Coffee	1 250	1 500-2 000	2 200	3.5	4 yrs.
Chat	900	1 500-2 100	2 400	2.5	3 yrs.
Tuber Crops					
Enset	1 200	1 600-2 000	3 000	4	7 yrs.
"Galla potato"	1 600	2 000-3 000	3 100	190	250

1/ Days between planting and harvesting.

Source: Amare Getahun, 1978b, and EHRS project team estimates.

Table 5.4

SUMMARY OF AVERAGE CROP AREAS, LIVESTOCK NUMBERS AND INCOME PER FARM IN EACH SUB-ZONE

		HPPZ ('00 masl)			HPCZ ('00 masl)			LPCZ ('00 masl)		
		15-20	20-25	25-30	15-20	20-25	25-30	15-20	20-25	25-30
Major crops	(Units)									
Teff	ha.	0.15	0.22	-	0.38	0.48	-	0.32	0.13	-
Barley	"	0.01	0.03	0.31	0.06	0.08	0.53	0.04	0.18	0.54
Wheat	"	0.01	0.07	0.06	0.07	0.20	0.15	0.06	0.21	0.16
Maize	"	0.16	0.18	-	0.17	0.17	-	0.09	0.06	-
Sorghum	"	0.09	0.11	-	0.17	0.18	-	0.28	0.17	-
Millet	"	0.01	0.02	-	0.05	0.06	-	0.08	0.04	-
Oats	"	0.02	0.01	-	0.01	0.01	0.01	-	0.02	0.04
Pulses	"	0.01	0.06	0.24	0.06	0.14	0.38	0.10	0.20	0.20
Oilseeds	"	0.01	0.03	0.02	0.03	0.08	0.06	0.03	0.05	0.03
Enset	"	0.05	0.11	0.30	-	-	-	-	-	-
Coffee	"	0.31	0.03	-	-	-	-	-	-	-
Chat	"	0.02	0.01	-	-	-	-	-	-	-
Total	"	0.85	0.88	0.93	1.00	1.40	1.13	1.00	1.06	0.97
Livestock										
Cattle	no.	1.7	4.2	3.0	6.1	6.2	4.9	1.7	2.0	1.7
Sheep	"	0.6	1.5	6.0	3.3	5.7	6.2	2.7	4.0	4.8
Goats	"	1.0	1.0	1.2	5.5	2.0	1.5	2.6	3.0	0.5
Net income from crops	E.B.	515	269	250	286	359	253	203	197	180
Income from livestock	E.B.	68	156	152	253	249	201	95	108	85
Total farm income	E.B.	583	425	402	539	608	454	298	305	266
Net crop return per man-day	E.B.	4.6	3.2	3.5	3.1	2.9	3.2	1.8	1.8	2.0

Source: Annex 4, Peasant Farm Models, by sub-zones.

(donkey, mule or horse). Generally the proportion of sorghum (and to a lesser extent maize) increases, as does the share of goats in total livestock, at lower altitudes. Conversely, barley, pulses and sheep are more important at higher altitudes.

Rainfed agriculture can generally be practised for over 240 days in the HPP zone and progressively less towards the northeast (see Fig.5.1). The growing period in much of the northern part of the Highlands is enough for only one crop, and even this is marginal. However, in the southern and southwestern Highlands the growing period is long enough for more than one crop to be grown. This is not being done much now because in these areas there is no pressing need, in terms of food supply, to intensify cropping, although this would not be at all difficult. In the northern regions, where pressure to produce more food is most severe, growing periods are usually too short to allow double cropping (an exception is in the Sirinka area where farmers are attempting to double-crop with a 240-day growing period). The HPP farming patterns are also distinguished by the cultivation of perennial crops including coffee, enset and chat, the lesser importance of livestock and much less use of oxen in cultivation. Within the Highlands, the hoe culture areas are in the south and southwest. (i.e., the HPP zone). Ploughs and cultivations using seed are, of course, not absent in the HPP zone hoe culture areas, but in the plough culture areas there is an almost complete dependence on the plough and seeds. It is testimony to the value of the plough that it has spread (albeit surprisingly slowly and not completely, given the long time it has been in use in northern Ethiopia) to the hoe culture areas, and not vice-versa.

5.5 PEASANT CROPPING PRACTICES

5.5.1 Introduction

There is a wide range of agronomic practices in the Ethiopian Highlands. Some of those specific to particular crops are reviewed in EHRS WP No. 11. More general practices are described in this section.

5.5.2 Land conservation

Attitudes to, and hence the adoption of, soil conservation measures vary throughout the Highlands. Soil conservation, as exemplified classically by terracing, is not generally part of traditional practice. There are some notable exceptions however: the Konso area of southeast Gamu Gofa and the sides of the Blue Nile and some gorges. Most soil conservation measures have been the result of extension activities by the MOA since the early 1970s. The degradation problem was, of course, recognized before 1970, but was not seriously addressed because of staff limitations and prevailing land tenure (see section 3.5).

5.5.3 Land preparation

Although Ethiopian agriculture, at least in the northern part of the country, has been using the plough for probably 2 000 years (Westphal, 1975), the implement is still basically unchanged. The traditional plough, commonly called the "maresha" (after the word for the point of the instrument), is a refinement of a pointed digging stick, with a wooden beam and yoke for harnessing, and a steering stick attached to a steel-tipped point (see Figure 5.2). It is usually made in the household and is light enough to be carried easily. It is drawn by two oxen, supervised by an adult man. It is more suitable for lighter soils, and since valley bottoms tend to be waterlogged during the ploughing season, cultivation has concentrated more on the slopes. The plough has no mouldboard and thus does not invert the soil. The chisel plough action is an effective method of land preparation but thorough weed control could generally be achieved with fewer passes with a mouldboard. The draught requirement, however, is greater with the mouldboard, though it appears that the reason for the persistence of the maresha is traditional rather than comparative performance. The minimal tillage of the maresha possible leaves the soil less susceptible to both splash and run-off erosion (see Chapter 6), than would the mouldboard.

Prolonged land preparation times are a common feature of farming in the Highlands. This is often attributed to the unequal distribution of oxen, but the necessity to make up to six passes with the maresha to prepare a reasonable seedbed for teff is also important. For other cereals only two to four passes are required and normally given. The fact that many farmers need to borrow an extra ox and use an implement that requires extra passes constrains full use of the growing season. The extended land preparation times can be critical in areas with short growing periods such as Eritrea, Tigray and Welo regions. For these reasons there is a need to carry out a study (probably adapting from other countries' experiences) into the physical economic and social feasibility of the use of single oxen ploughs and the use of females and equines for draught. ILCA has already undertaken some preliminary work in this field (see Chapter 16). 1/

1/ ILCA's work is summarized by G. Gryseels, *et al.*, in the ILCA Bulletin No.18, April 1984, pp. 20-25.

THE TRADITIONAL ETHIOPIAN PLOUGH — THE MARESHA

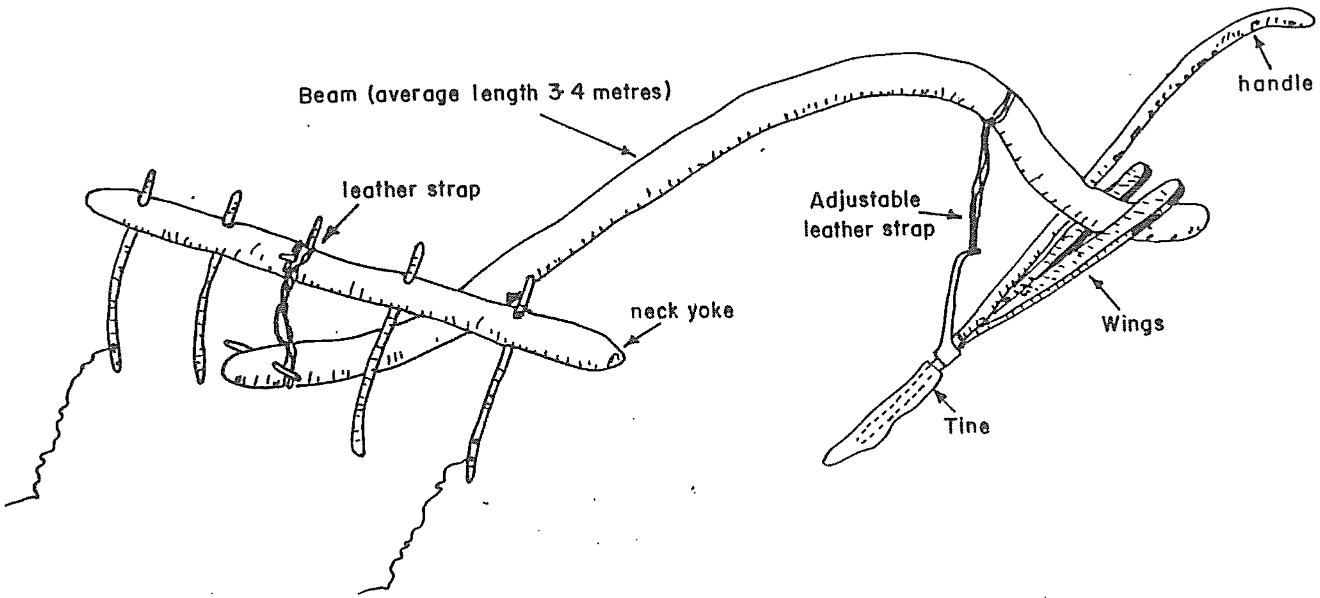


Fig. 5.2

5.5.4 Seed varieties and planting

With the exception of maize and wheat, yields of improved seed varieties have not been consistently better than those of traditionally used local varieties (see table 5.5).

Table 5.5

AVERAGE YIELD OF MAJOR GRAIN CROPS ON MOA TRIAL PLOTS
1980/81 AND 1981/82

(t/ha)

Crop	Local	1980/81 Improved	% Change	Local	1981/82 Improved	% Change
Wheat	1.31	1.66	+27	1.50	1.84	+23
Teff	1.19	1.09	- 9	1.02	1.06	+ 4
Barley	1.62	1.58	- 3	1.81	1.74	- 4
Maize	2.92	3.26	+12	3.22	3.44	+ 7
Sorghum	1.80	1.75	- 3	not available		

Source: EHRS WP 11.

Only around 5 000 tons of improved seed are used by the peasant sector and most of this is by PC's. Thus most peasants keep their own seed from season to season. Unfortunately, some premature attempts have been made to distribute "improved seed varieties", which have not performed as well as traditional varieties, and this has tended to undermine farmer confidence in both agricultural research and extension. Breeding new varieties is normally a long process and is likely to be more so in Ethiopia because the rich base of natural genetic material has already led, over the centuries, to farmers selecting the varieties most suitable to their environments.

Practically all seeds are broadcast with a final ploughing to cover the seed. The major exceptions are for small seeds, such as teff, which are left on the surface. Fortunately, birds do not seem to like teff. Planting, as well as seed bed preparation, is usually undertaken by men, sometimes assisted by children.

5.5.5 Fertilizers, weeding and plant protection

Fertilizer use is negligible, being confined to 2.5 percent of land cultivated by peasants. Low fertilizer use probably reflects its limited availability (it all has to be imported), transport and communications difficulties in supplying it at the right time, inadequate credit facilities, the relatively high cost of fertilizer (and the resulting unfavourable benefit/cost ratio), fears that top dressings on sloping land will be washed away by excessive run-off before it can be absorbed to advantage and, perhaps most importantly, the apparent lack of visible yield increase as a result of its application (grain yield responses of less than 50 percent are difficult to detect by untrained eyes in the field, and most trials in the Highlands have not yet produced consistent responses as high as this).

Once seeds have been sown, little effort is generally spent in weeding. This constraint is more important in the areas of short growing periods, where competition for moisture is higher. Elsewhere weeds may even be regarded as beneficial (for livestock subsequently feeding on crop residues). Teff receives most cultural attention. Surveys indicate that teff is usually weeded three times - because it is the preferred staple, and is more sensitive to weed competition. Teff weeding reduces the labour available for weeding other crops.

Plants do not appear generally to suffer from major diseases or insect damage, and farmers rarely undertake any plant protection measures.

5.5.6 Cropping intensity and rotations

Generally it is possible to consider double cropping only where there are two rainfall seasons (where there are belg and krempt rains on the central eastern Highlands) or where the single growing season is at least 240 days. Pressure on land in the long growing season areas such as the south and southwest Highlands is lower, and there is no pressing need to seek two crops a year on the same land (i.e., there is more fallow land 1/). However, for parts of Welo and northern Shewa, the apparent cropping intensity observed in the Sirinka project area of nearer 200 percent (double cropping - see Chapter 8) may be found to apply. Intensification of land use usually accompanies increases in population pressure, which has reached very high levels in some parts of the Highlands. Even in the less densely populated areas of the southwest many farmers cultivate all of their holdings. The main reasons for not cultivating part of their holdings, which farmers gave in the EHRS Sociological Survey, were because parts were barren (usually because of erosion) or required for grazing or for fallow.

Rotations vary widely, reflecting temporary home and market demands as much as agro-climatic and soil conditions. Generally cereals are

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1/ As no systematic examination of fallow has been done in Ethiopia, this should receive high priority in the FS-oriented research called for as an important component of the Conservation-based Development Strategy.

rotated with pulses or oilseeds and, to a decreasing extent, fallowed. Certainly little study has been conducted on rotational patterns. This should be remedied in the farming-systems-oriented research called for in the Conservation-based Development Strategy.

5.5.7 Post-harvest practices

Harvesting of grain, principally men's work, is done with a sickle; women and children assist by collecting the tied bundles of cut grain in the field. Cereal crops are often stacked to dry. Threshing is done in the open field on an earthen "floor" prepared with stamped cow dung. The crop is either beaten manually with sticks or a team of several oxen are driven round the threshing floor to crush the grain. Winnowing is done by tossing the grain into the air with a wooden pitchfork, though a wooden spatula or shovel is sometimes used to allow the wind to separate the grain from the chaff. Women collect and store the grain in earthen containers and/or in hand woven buildings made from local materials and elevated and protected by a thatched roof. Teff is unique in being effectively free of storage pests. The small grain is apparently unattractive both to rodents and insects.

5.6 LIVESTOCK

5.6.1 Importance and functions

All rural land use systems in Ethiopia, with the exception of some State Farms, have livestock components which are not only integral parts of the system, but also usually essential to them. The nature of these livestock components varies substantially from the almost total dependence on livestock in the pastoral systems of the lowlands to the various integrated mixed-farming systems of the Highlands - which deserve particular attention in the farming-systems-oriented research programme.

Various surveys (EHRS WP Nos. 7 and 16, and GOE/AACM 1984) have established that rural people keep livestock in the Highlands for the following main reasons:

(a) as a form of insurance, for sales in years when crops fail;

(b) as a form of savings to be drawn upon for special occasions;

(c) for breeding draught animals;

(d) for transport;

(e) to supply manure for fuel; and

(f) to a much lesser extent, as a source of food, usually for dairy products rather than meat.

For these reasons, and bearing in mind that households do not own the lands they use (see section 3.5), livestock are usually the single most important asset of rural people. Considering their multiple functions and their capacity for self-renewal, livestock are viewed by rural people as a uniquely productive asset. It is thus not surprising that average livestock density is substantially higher in the Highlands at 35 TLU per km^2 than in the rest of Africa. Ethiopia's livestock population is the largest in Africa. Livestock also provide the second most valuable export of Ethiopia - hides and skins (see table A4.7).

The total value of annual livestock production in the Highlands is estimated as follows:

Table 5.6

ESTIMATED VALUE OF ANNUAL LIVESTOCK PRODUCTION IN THE HIGHLANDS, 1983

	E. Birr (million)
Meat and hides, etc.	
- from cattle	213
- from sheep and goats	264
Milk	253
Draught	509
Transport	218 1/
Dung	140
Total	1 597

1/ EHRS WP 7.

Source: EHRS WP 16.

Bearing in mind that this valuation includes some products (draught, transport, dung) which are not normally valued in national output accounting, the total as calculated is equivalent to around 15 percent of Ethiopia's GNP. In section 5.4 it is estimated that livestock contribute around 30 percent of average farm incomes in the study area, distributed by sub-zone as shown in table 5.7.

In view of the large number of livestock per km^2 and per capita, it is surprising that per capita consumption of livestock products is not particularly high in Ethiopia compared to other developing countries.

Table 5.7

LIVESTOCK INCOME AS A PERCENT OF
ESTIMATED TOTAL ANNUAL FARM INCOME

HPP	%	HPC	%	LPC	%
1500-2000	11	1500-2000	47	1500-2000	32
2000-2500	37	2000-2500	41	2000-2500	35
2500-3000	39	2500-3000	44	2500-3000	32

Source: Calculated from farm models in Annex 4.

5.6.2 Types, trends, and distribution

Almost all livestock in the Highlands are kept in small family herds, comprising zebu-type cattle and indigenous goats and sheep. They are generally grazed on communal grasslands 1/ for seven to nine hours daily, often in the care of children, and penned in the family compound at night. Stock holdings are small, averaging around two cattle, three sheep or goats, and one equine (EHRS WP 4). Livestock management skills are rudimentary. Pigs are rare, being consumed neither by Christians nor Moslems.

Table 5.8

ESTIMATED LIVESTOCK POPULATION IN ETHIOPIA
AND IN STUDY AREA, 1982

	All Ethiopia ('000 head)	Total Proportion %	Study Area 1/ ('000 head)			
			Total	HPP	HPC	LPC
Cattle	27 000	75	20 147	6 085	10 114	3 948
Sheep	24 000	83	19 979	3 658	8 897	7 424
Goats	18 000	71	12 828	2 351	4 986	5 491
Equines	8 000	89	7 084	483	3 264	3 337
Camels	1 000	0	0	0	0	0
Poultry	53 000	90	47 700	15 000	17 700	15 000

1/ Between 1 500 and 3 000 masl.

Source: EHRS estimates based on PADEP data.

1/ The size of individual holdings being so small that they are usually cropped to the maximum.

Table 5.8 shows the estimated livestock population of Ethiopia and of the study area, while table A2.2 shows the estimated distribution by sub-zone.

The available statistics indicate that for all practical purposes the national cattle, sheep, goat and equine populations seem to have remained constant over the past twenty years, probably owing in part to the more frequent droughts. Respondents to the EHRS Sociological Survey tended to confirm this (WP 4). There is also general agreement that the pastoral herds in the lowlands have grown slowly, with the major exception of the 1973 drought which killed large numbers of stock in the northeast. If lowland herds have grown by 1.5 percent per annum (which implies a reduction of around one percent p.a. in the number of stock per capita), then the Highlands livestock population would have decreased at an annual rate of about 0.5 percent in the last twenty years. In this period the Highlands rural population has been increasing by around 2.5 percent p.a. so that the total number of livestock per capita has fallen by around three percent p.a., or by well over 50 percent in the last 20 years. That livestock numbers per family have declined substantially in the Highlands is confirmed by the EHRS Sociological Survey (EHRS WP 4) and was explained by the interviewed peasants primarily by reference to reduced grazing areas and increased dependence on livestock sales for cash.

The poultry industry in Ethiopia is characterized by small scavenging flocks of birds (average 6) kept by individual households. The total population is estimated at 53.5 million, of which only 0.6 percent comprise improved modern breeds. The majority of the improved chickens (90 percent) are maintained by the Poultry Production Enterprise of the Ministry of State Farm Development. Production of the indigenous birds is low, egg yields are about 30 to 60 eggs per annum (around 40 gm each), and mature weight is about 1.5 kg (for males). Total production amounts to around 74 000 tons of eggs and 60 000 tons of meat per year.

Honey production is a well established industry in Ethiopia. Wild bees exist in abundance in the southern, southeastern and southwestern parts of the country, and in the northeastern and northwestern areas bee colonies are kept in traditional hives. Honey is consumed as a food and a drink (tej). It is estimated that around 7 500 tons of honey are produced annually, mainly from traditional beehives. In addition, up to 5 000 tons of wax is produced. Yields per hive are low, at around 5 kg p.a., usually obtained by farmigating the hives. Surplus crude honey in rural areas is sold to private traders who transport it to Addis Ababa in leather sacks, where it is sold to tej bars. The residue from tej making is rich in beeswax and is sold to several wax factories in the city, from where the wax is exported. Very little honey reaches retail markets.

5.6.3 Feed availability and requirements by zone

Sources of livestock feeding in the Highlands are:

(a) grazing and browsing;

(b) crop residues;

(c) agro-industrial by-products.

Forage cropping and improved pasture species are not used on a significant scale in the Highlands.

Grazing occurs in permanent grasslands, fallow land and on land following harvest (aftermath grazing). The permanent grasslands in the Highlands are generally unimproved and include:

(a) afro-alpine grasses above 3 000 m, which are short and cold-resistant. Low temperatures result in slow growth.

(b) temperate pastures of grass and legumes, with the legume component decreasing as altitude decreases. Above 2 000 m there is a wide range of annual and perennial Trifolium species and of annual Medieago species. These pastures are generally located in depressions subject to waterlogging. Waterlogging on the heavier depression soils makes these areas less suitable for cultivation with the maresha (see section 5.5).

(c) savannah grasslands, which have been utilized for grazing for centuries. The resulting selection processes, as well as those caused by frequent fires (to encourage new and more palatable growth), have proved the adaptability of remaining plant species and have enhanced their capacity to survive the change in the ecosystem. Unlike the temperate pastures, the savannah grasslands do not form a turf, while they have fewer legumes and they are more often of the trailing or climbing forms and thus less tolerant of heavy grazing pressures.

In plateaus and valleys, many grasslands become waterlogged during the rains and therefore grass growth is slow. Most active growth is during the short rains (and during the main rains if there is no waterlogging), and up to a month or so after the main rains.

Cereal straws of teff, barley and wheat are the main crop residues used for feed in the Highlands. They are stacked after threshing and fed to animals during the dry season, as are pulse crop residues. Teff straw is equivalent in nutritive value to medium-quality hay, but the other cereal crop residues are of poor to fair quality. On the other hand, pulse haulms are high-quality roughage with 5-8 percent protein. Maize and sorghum stovers are either left for grazing in the field or cut and dried for fuel (but see exception below). Working oxen and lactating cows are given priority in the use of straw during the dry season, while other stock are confined to grazing. A more intensive feeding system, however, has developed in the more intensively cultivated Highlands of Hararghe, where oxen are tethered continuously and fed crop stovers, cut grasses and weeds, but not specific fodder crops. Such oxen are frequently purchased for fattening from nearby lowlands.

The use of agro-industrial by-products for livestock feed is neglected, according to the Livestock Sub-sector Review (GOE/AACM 1984), which estimated that of the 700 000 tons or so produced, about 60 000 tons are exported, and 160 000 tons are used locally. Examples of wastage of potentially useful by-products as animal feed include coffee pulp (almost all) and oilseed meals (much, although there is an organized trade, mostly for export).

During the rainy season, when cultivated land is occupied by crops, livestock graze fallow lands and those edaphic grasslands which are not subject to waterlogging. As waterlogging is frequent in some areas, there are problems in keeping stock from cropped areas. After harvesting, stock are moved onto the cultivated land for stubble grazing, and subsequently to grasslands. Feed supply is thus at its lowest at the beginning of the rainy season, when the demand for oxen for land preparation is greatest, although some work at ILCA suggests that feed intake has to fall to very low levels before draught power is affected. Furthermore, the quality of fee is also generally lowest at this time - reflecting the greater proportion of stem as opposed to herbage. Pressures are becoming such as to force grazing on waterlogged/flooded grasslands in some areas.

Livestock Eating Habits

Cattle	- mainly non-selective grazing but only eat tops of plants/grasses; browse more in dry weather.
Sheep	- bite herbage close to the ground; very selective and therefore damage plant communities; less dependent on water intake than cattle.
Goats	- graze and browse leaves, young shoots of bushes and trees; damage young trees.
Equines	- graze close to ground and selective.

Estimates of feed availability by source and by zone are presented in table 5.9. It is assumed that all the Highlands grasslands are free

Table 5.9

ESTIMATED FEED AVAILABILITY BY SOURCE IN EACH ZONE

Zone	Area ('000 ha)	Yield 1/ (t DM/ha)	Annual Production ('000 t DM)	Proportion of Total Production %
HPP				
Crop residue and stubble	1 276	2.25	2 871	13.8
Fallow, failed, etc., open grassland 2/	3 825	2.20	8 324	40.0
Wooded grassland	3 744	2.00	7 488	36.0
Wood/shrubland	1 848	1.15	2 126	10.2
Total HPP	10 693	1.95	20 809	100.0
HPC				
Crop residue and stubble	2 081	2.25	4 682	19.7
Fallow, failed, etc., open grassland	6 121	1.90	11 573	48.5
Wooded grassland	2 429	2.47	5 997	25.2
Alpine grassland	15	2.00	30	2.1
Wood/shrubland	839	1.86	1 557	6.5
Total HPC	11 485	2.08	23 839	100.0
LPC				
Crop residue and stubble	2 158	1.50	3 237	27.7
Fallow, failed, etc., open grassland	6 388	0.83	5 282	45.2
Wooded grassland	3 793	0.70	2 655	22.8
Alpine grassland	78	0.75	59	0.5
Wood/shrubland	889	0.50	445	3.8
Total LPC	13 306	0.88	11 678	100.0
Grazing areas 3/	21 712	1.80	39 512	70.1
Cultivated areas 4/	13 772	1.20	16 814	29.9 5/
Grand Total	35 484	1.60	56 326	100.0

Source: EHRS estimates.

1/ These yield estimates relate to the estimated yields consumable by mixed herds of livestock. Yield estimates vary enormously: the LSR estimates an average grazing yield of 4.5 t DM/ha (not distinguishing between savannah, pastures and fallow), 1.4 t DM/ha for cereal crop residues, 0.5 t/ha for pulse residues and 0.4 t/ha for aftermath grazing. However, the LSR states "MOA suggest that the estimate of 4.5 t DM/ha was too high by a factor of up to 2.2... their suggestion of 2.0 to 3.0 t DM/ha...."; Annex 5 p.22. A consultant (Taylor) to the LUPRD of the MOA estimates average DM grassland yields at 1.5 t for all Ethiopia, but ranging from 2.8 t in Arsi to 1.2 t in Tigray.

2/ Includes temperate pasture.

3/ Includes open grassland, wooded grassland, alpine grassland and wood/shrubland.

4/ Includes crop residue and stubble, and fallow, failed, etc. There is no firm distinction between "fallow, etc." and open grasslands.

5/ This is more than estimated by the LSR but considerably less than estimated by Huntings for Tigray, in a detailed study. Tigray is a much drier and degraded area, where grassland yields would be lower. In a year of average rainfall it is estimated that 46 percent total feed supply (in terms of nutrients) came from crop residues, 19 percent from stubble grazing and only 35 percent of feeds were derived from grazing, even though grasslands covered more than half the total land area.

of Tsetse and can therefore be grazed. Average grassland yields for each zone have been guestimated in the light of available data and consideration of the growing periods.

From table 5.9 it is concluded that around 30 percent of livestock feeding is obtained from croplands and 70 percent from permanent grasslands, the latter begin more important in the HPP zone (86 percent) and least important in the LPC zone where a greater proportion of lands are cropped.

The above calculated feed availabilities are compared with requirements for each zone in table 5.10.

Table 5.10

ESTIMATED ANNUAL FEED AVAILABILITY COMPARED TO ESTIMATED REQUIREMENTS BY ZONE

	HPP	HPC	LPC	Total Study Area
Livestock population (million TLUs)	5.1	10.5	6.2	22.9
Feed availability (million t DM)	20.8	23.8	11.7	56.3
Feed requirements 1/ (million t DM)	11.7	24.0	14.2	50.1
Surplus (+) or deficit (-) as percent of requirements	+ 77	- 1	- 18	+ 13

DM = Dry matter

1/ Estimated at 2.5 percent of liveweight per day, i.e., 2.28 tons per TLU per year.

Source: EHRS Estimates.

From table 5.10 it is concluded that forage availability is just sufficient to meet maintenance requirements in the Highlands as a whole; a conclusion reached by different calculations in the LSR. However, it is the differences among the zones that are significant. While the HPP and HPC zones would appear to meet the feed requirements, livestock in the LPC zone would appear to be over one-third below maintenance requirements. Although this may be an exaggeration which cannot be corrected with available data, it certainly reflects a serious feed shortfall in the LPC zone which is causing a decline in the livestock population there. It should be added that the above analyses have also been carried out in a more refined manner in EHRS WP 10, taking into account feed requirements by herd composition and by examining feed availability for total digestible nutrients and digestible protein by feed source. The results show somewhat higher feed availability compared to requirements but confirm the pattern presented here. The LSR further estimated that 85 percent of feed intake was used to meet livestock maintenance requirements and only 15 percent for production.

5.6.4 Livestock production, marketing and support services

With an ever-increasing demand for draught power, cattle breeding in the Highlands is geared primarily to the maximum number of oxen in the herd, as reflected in the herd structure. Of ten heads of cattle there are typically three oxen; the rest of the herd can be regarded as the necessary reproductive apparatus for oxen. Only 30 percent of the herd are cows that can also be used for milk. Since the oxen are kept for work, offtake for meat is as low as seven percent. Offtakes from sheep and goats are much higher, at 30 and 36 percent, respectively (GOE/AACM, 1984), due to their high reproductive potential and because they are used for sale to supply ready cash. Equines account for 20 percent of grazing animals in tropical livestock units (TLU), but their only products are transport and manure. Consequently, per TLU of 250 kg liveweight requiring 2.3 tons of dry matter of feed during the year, the output for the average of all types of livestock is 27 kg of milk and 23 kg of meat. This is an extremely low efficiency in terms of milk and meat, even by tropical African standards (see table 5.11), but in the farmer's eyes the important functions are draught, transport and provision of manure for fuel, as well as the critical asset/security function. Ethiopian productivity indicators are up to one-third lower than the average for tropical Africa. It can be assumed that the figures for the Highlands are lower than national averages because the prevalence of draught oxen leads to lower herd productivity for meat and the low proportion of cows results in low herd milk yields; the milking of sheep and goats is less common in the Highlands than in the lowlands.

With an average cattle carcase weight of around 125 kg, total beef production in the Highlands amounts to about 165 000 tons (carcase weight) annually. Most of this comes from old cows and working oxen and is of poor quality. Around 1.2 million hides are produced annually, but their poor quality reflects poor flaying and inadequate curing.

Probably over 70 000 tons of sheep and goat carcasses are produced annually. Sheep and goats are not usually milked. Sheep are mainly of the hairy type and their wool is not suitable for large-scale spinning though it is used in traditional cottage industries to make carpets, blankets and clothes.

Table 5.11

LIVESTOCK YIELDS IN ETHIOPIA AND IN AFRICA IN 1980

(kg/head year)

	Ethiopia		Tropical Africa	
	Meat	Milk	Meat	Milk
Cattle	8	26	13	39
Sheep	3	1/	4	7
Goats	3	1/	4	7

1/ Shoat milk is not often consumed in the Highlands.

Source: EHRS WP 16.

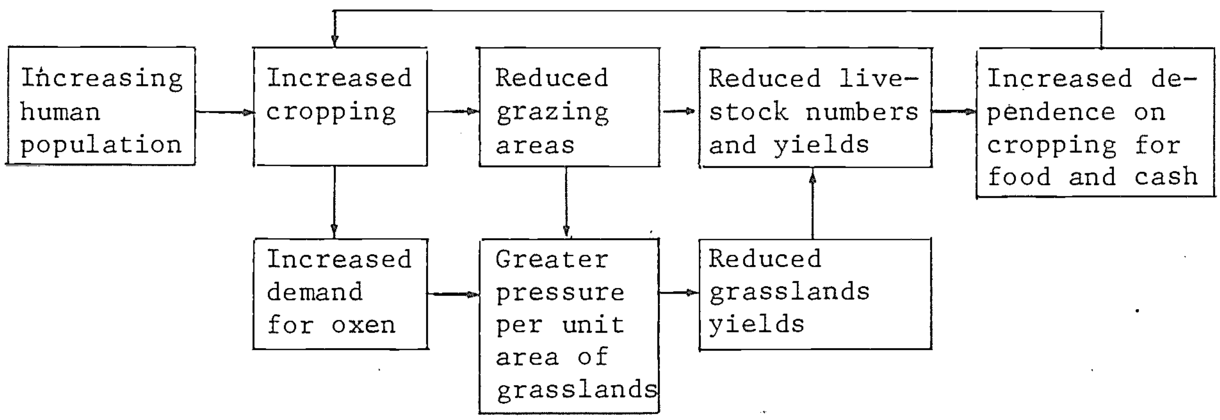
The extent of trading in oxen and equine draught power has not been quantified, although it is believed to be common throughout much of the Highlands. Manure is generally burnt as a household fuel, but is also sometimes sold in towns. Organized livestock marketing is thus confined to livestock meat, milk, butter, hides and skins. Meat is sold to private traders, state-owned meat processing plants (under the Ministry of Industry) and exported live through Djibouti or across Ethiopia's other frontiers. Most milk is consumed on the farms where it is produced and commercial sales are limited to urban areas. Peasants in areas more distant from towns often convert surplus milk to ghee or butter which is transported to urban markets by donkey. Hides are generally purchased by licensed private traders for sale to the regional warehouses of the Government-owned Hides and Skins Marketing Corporation, which exports most. Some private traders are also licensed to export.

The Animal Resources Development Department (ARDD) of the MOA is responsible for supporting livestock development in Ethiopia. It does this primarily by the provision of veterinary, breeding, husbandry, artificial insemination and marketing services, facilities and advice. ARDD has been assisted by a number of external agencies, including the World Bank, for rangelands development - generally in the lowlands - and marketing. Livestock research is undertaken by the IAR and emphasizes milk production through cross-breeding with exotic cattle, pasture and forage improvement, and milk and meat production in sheep and goats. Research is constrained by a lack of qualified personnel. Livestock training below university level is generally combined with agriculture (section 5.8). Livestock activities are not a major concern of the Ministry of State Farms Development, which includes 13 dairy farms around Addis Ababa, milk processing, beef feed-lots, intensive poultry units, three feed mills, and livestock marketing.

5.6.5 Constraints

The greatest constraint to livestock development lies in the importance that is attached to functions other than producing meat and milk. Breeding for oxen and the upkeep of equines results in a cattle herd which is inefficient in terms of meat and milk production. For fulfillment of the traditional livestock functions noted above (transport, security, etc.), productivity (per animal) is not an important concept. Numbers are more important. Two lean oxen have to be used for ploughing by the traditional method (see section 5.4); one fat ox - with presently used techniques - is useless. The farmer who owns two small sheep can sell one in times of strife and is still left with one, unlike the farmer who owns only one big sheep. Two small donkeys transport almost twice as much as one big one. The more animals kept, the more manure can be collected. Thus each farmer is well advised to maximize his herd if he wants maximum fulfillment of these functions. As the human population grows, more and more families will try to build up their herds. Most grazing is communal. The larger an individual's herd, the larger the benefits to himself, while the decrease in productivity due to overgrazing is shared by all. Thus the optimum carrying capacity from the collective point of view is constantly surpassed. The inherent tendency to overgrazing makes improvements a formidable task.

This overriding constraint is not only inherent and self-feeding, but its effects are likely to become even more severe and accelerate in the future, as illustrated below:



In the long term, for ecological conservation reasons, a proportion of the total feed produced in each growing season should not be consumed. Although a positive feed balance has been calculated for the Highlands as a whole (see table 5.10), the significant point is that the quantity of feed being consumed every year is greater than is compatible with the long-term maintenance of productivity. The combination of cattle and sheep/goat grazing complement one another in reducing the sward to ground level: the cattle will utilize the coarser longer growth, the shoats the finer shorter herbage. The reduction of carrying capacity of the grasslands usually proceeds gradually, but is greatly accelerated by steep slopes and/or aridity. First, cattle or sheep will eradicate the palatable forage. The area may contain or be invaded by shrubs which are subsequently grazed by a combination of sheep and cattle, and as the forage quality is reduced, with the production of more fibrous plants, goats are introduced, which considerably reduce the ground cover. Throughout this process denuded ground is increasing, so producing a greater potential for erosion. There is ample visual evidence, most widespread in the LPC zone, that the proportion of grass being left is too low because of high grazing pressures, i.e.:

(i) not allowing soil organic matter build-up;

(ii) allowing invader species, e.g., Pennisteum, into the pastures; and

(iii) aggravating the soil erosion problem.

In these circumstances the positive feed balance is reconcilable with the conclusion drawn from field visits that the grasslands are deteriorating and that their carrying capacity is falling.

The extensive savannah grasslands have low inherent productivity. This and the fact that most of the grasses have a tufted tussock growth form with no turf between, facilitates invasion by low feed-value shrubs. The exclusion of fire and the introduction of grazing lead to a reduction in more palatable forage, the reversion of grasslands to poor unpalatable material such as Aristida and Metropogon. Other more subtle changes, of a genetic nature, occur in such situations where overgrazing has reduced the more palatable forage. Grasses usually maintain their phenotypic vigour and genetic variability through out-breeding. As the out-breeding population is reduced, so the potential for out-breeding is restricted, and future populations must resort to inbreeding, which tends to reduce both plant vigour and adaptability.

EHRS WP 16 presents model calculations which indicate the likelihood that the abovementioned processes will force declines in livestock numbers in the future far greater than the 0.5 percent per annum in the past. This of course particularly applies to those areas with the highest population pressure and the most pronounced degradation problems. The same processes result in increasingly widespread and severe undernutrition and malnutrition which have already been identified as major factors constraining animal production in Ethiopia (GOE/AACM, 1984). Nutritional stress causes low animal growth rates, poor fertility, high mortalities and high susceptibility to livestock diseases.

A number of other factors, in addition to the increasingly unfavourable stock/grazing area ratio reflecting the above processes, also contribute to nutritional stress:

- poor use of grasslands, for example by grazing stock altogether, non-rotational grazing, etc.;

- lack of knowledge among peasants concerning most forage crops, improved pasture species;

- the orientation of GOE policy, projects and research toward more intensive (and higher-technology) livestock systems, particularly dairying, and ranch-type developments, thus reducing attention focused on the development of feed strategies appropriate to the mass of peasants' livestock. For example, the potential role of fodder trees has been almost completely neglected. Introduced fodder trees (*Leucaena* and *Sesbania* spp) have only been used within the erosion control programme. There have been no attempts to introduce either grasses or legumes into traditional grazing areas on a significant scale. Inoculation of legume seed with suitable *Rhizobium* strains has been infrequent (even on research plots), although nodulation often appears to be ineffective. The techniques for large-scale pasture seed production have not yet evolved in Ethiopia. Also, despite very limited availability of seed, there is little information available on minimal seeding rates, with recommended rates often extremely high, e.g., the generally recommended rate for sowing Rhodes grass is 10 kg/ha, even in environments where 1-2 kg/ha would suffice. Lower cost establishment techniques have not been thoroughly assessed. GOE/AACM, 1984.)

Other constraints, of lesser importance than the livestock numbers and nutritional constraints already mentioned, include livestock disease, poor breeding and husbandry, and inadequate marketing and other support services. These constraints are reviewed in detail in the LSR (GOE/AACM, 1984) and need only be mentioned briefly here. The occurrence of serious animal diseases limits production through mortality rates and the effects on fertility, growth, milk production and draught power output. Disease also limits the contribution of exotic breeds to livestock development in Ethiopia, and presents a serious threat to Ethiopia's export markets. In the peasant sector, where the vast majority of livestock exist, the standard of animal husbandry is generally low. There is little deliberate production of forage, diseases are not adequately prevented or treated. Controlled breeding is not practised, and livestock are mainly left to fend for themselves. In addition, many local breeds have a poor ability to respond to improved inputs. Government support services are inadequate due to organizational problems, manpower shortages and inadequate support facilities including training, extension and research.

Constraints to marketing and processing arise because of insufficient facilities and inefficiencies.

Apiculture is constrained primarily by the lack of knowledge of modern bee-keeping technology and its application to Ethiopian conditions, but given its non-intensive use of land and its potential complementary with agro-forestry, its development might be considered in the EHRS as a means of promoting purchasing power in rural areas constrained by extension of land use and/or labour availability. Some specific suggestions in improved technology are made in GOE/AACM, 1984.

5.7 STATE FARMS AND IRRIGATION

5.7.1 State Farms

State Farms were first established to take over the large private commercial farms expropriated at the time of land reform. Their declared objectives were to promote import substitution, to produce export commodities, and to bring additional land under production. More recently COPWE has stated:

> "The far-reaching and very important objective of state farms is to help speed up the transformation of agriculture which occupies such a prominent space in the economic life of the nation, by introducing better farming technology and organization, by supplying choice seeds and, in general by setting an example". (COPWE, 1983.)

The total area and variety of crops under State Farms has expanded rapidly since the initial nationalization of 67 250 ha of large-scale commercial farms in 1975, to almost 300 000 ha in the 1980s, or about two percent of the total cultivated area. In 1979 the Ministry of State Farms was established to, among other things, support this expansion.

At present, because food crop surpluses from the peasant sector are insufficient, State Farms fulfill a valuable role in providing some of the food for the urban population, the military and other institutions. Currently they produce mainly wheat (40 percent of total area) and maize (20 percent), with cotton the major non-food crop (15 percent of total area). Management is generally well trained, with opportunities for in-service training (World Bank, 1983a). It is recognized, however, that the State Farms have been in economic, management and financial difficulties persistently. While their yields are higher than corresponding yields in the peasant sector, their costs of production and use of scarce production inputs (per unit of output) are much higher still, and they are paid for their production at prices 20 percent higher than the prices paid to peasants.

"It is clearly recognized that the lack of detailed (feasibility) study on the selection of sites of certain state farms has contributed to this operational deficiency, low productivity .... The fundamental reason, however, remains to be the inherent defect in the utilization of manpower, equipment and, as a whole, lack of control over the widespread inefficiency of managements". (COPWE, 1983.)

A high-level FAO mission recommended in 1982 that the GOE reassess the role of State Farms in the light of the following criteria:

"(i) in general, since the emergency need of takeover of commercial farms is over, there is no reason why the state farms should undertake ordinary crop production if, indeed, the latter is done cheaper, at less capital and people's participation, through peasant production structures. This applies expecially to cereal production by the state farms, which accounts for 80 percent of their output. This could be justified if their yields are substantially higher than those of the peasant sector in respect of the same crops or if their costs and foreign exchange costs per unit of output are substantially lower. Neither of these seem to be the case.

"(ii) state farms would be justified if they undertook certain specialized production involving greater technical and economic efficiency, than could be provided by other types of production structures. Thus, they could play a role in seed production and multiplication, special industrial crops and breeding stock for the livestock sector - if indeed they can prove their relative efficiency in these fields.

"(iii) they would also have a justification as centres of technical excellence, diffusing breeding material or high-level technology for specialized crops to adjoining peasant organizations. However, both their capital-intensive types of production and high level of mechanization, make their technical expertise rather irrelevant and inappropriate for the peasant sector - which, unfortunately, does not have access to the high level of inputs available to the state farms.

"(iv) state farms could have a role in the opening and development of new lands for agricultural production. In fact, they have developed more than 80 000 hectares of new land, especially in the south, where not much land clearing is involved. But this justification would depend on the economic and social efficiency with which they do so in relation to alternative methods of land development (such as through peasant land settlement). This calls for an evaluation of the economic, social and land-use advantages of state farms in relation to peasant land settlement in bringing new land under production.

"(v) they may also have a potential role in specialized processing and agro-industry. But this again would depend on the type of industry, the type of technology utilized, etc." (FAO 1982c)

The tentative indications (from, for example, other analyses by the World Bank and FAO) are that State Farms, although they have performed an important service in ameliorating urban food shortages and guaranteeing some stability to both marketed food production and export crop production, do not have, under their current and likely future operating conditions, comparative advantage over peasant agriculture, in the areas referred to above. This reflects their high costs in terms of scarce, highly-qualified agricultural manpower and financial resources. It is difficult to defend more capital-intensive techniques of production in the face of increasing population pressure and the need to resettle population from the steepest and most severely degraded slopes (Chapter 6). For these reasons, the costs of production gains in the peasant sector are likely to be lower and the distributive impact braoder. Even very modest increases in average output per hectare in the peasant sector would have a much greater impact on total production than would major gains in State Farm production. 1/ In the light of such considerations, it is suggested that priority within the State Farm sub-sector now be given to consolidating and improving the existing farms rather than in further expanding the area of state farming. Consideration might also be given by the GOE to:

(a) redeployment of the smaller, least efficient and poorly located state farms for peasant farming, possibly by way of resettlements;

(b) concentration of resources allocated to the state farm sub-sector on increasing the efficiency and intensifying the production of those farms with the greatest development potential;

(c) stricter monitoring and supervision of management of state farms with the introduction of some bonus incentive schemes for workers; and

(d) reassessment as to whether a separate Ministry of State Farms is really justified.

The suggested policy emphasis on consolidation rather than on expansion of State Farms reflects GOE's objectives of people's participation, greater employment and self-reliance in production and welfare, and would enable more resources to be devoted more directly to the development of the peasant sector, on which Ethiopia primarily depends.

1/ Very roughly, 100 percent increase in state farm yields would be less than half the production increase resulting from a 10 percent increase in peasant crop yields.

For the reasons given in this section, the Conservation-based Development Strategy proposed in Part III of this report does not envisage an expanded role for State Farms in the Highlands.

5.7.2 Irrigation

Irrigation in Ethiopia has been developed largely over the past 30 years and has focused almost exclusively on large-scale schemes for production of crops other than for local staple food production. 1/ These schemes were nationalized from private owners following the Revolution, and most irrigated areas are now managed by the Ministry of State Farms (the MOA and RRC participate in some schemes). The total irrigated area amounts to around 85 000 ha 2/, all from surface water. This is little more than one percent of the total cultivated area, but it produces all Ethiopia's cotton, sugarcane and tobacco. Only around 10 000 ha of this irrigated area is in the Highlands. (See table 5.12.)

Apart from some more modern irrigation schemes in the Rift Valley, the only other irrigation in the Highlands consists of very small areas of traditional irrigation, generally based on diversions from perennial or seasonal streams. However, such schemes have not developed to any great extent, probably due principally to land tenancy arrangements which have acted, both before and since the land reform (see section 3.5), as a major disincentive to the development of irrigated agriculture in the peasant sector. Existing systems in the Highlands usually range in size from 10 to 100 ha and may total about 5 000 ha in extent. In general they consist of simply-constructed dry stone or brushwood river structures diverting seasonal or perennial supplies to unlined earth canals. On-farm distribution networks (to irrigate mainly vegetables) are rudimentary, with few permanent control structures.

Overall responsibility for the planning, development and use of national sub-surface and surface water resources lies with the Water Resources Commission. Within this Commission the Water Resources Development Authority (WRDA) is concerned with the utilization and administration of national inland and coastal water resources. More specifically, it is responsible for developments in irrigated agriculture and in conjunction with EELPA, possible hydro-electric projects. In addition to operating a national network of hydrological stations and analyzing resultant data, WRDA is responsible for undertaking feasibility studies. Responsibility for the development of small-scale (less than 200 ha) irrigation lies with the SWCD of the MOA.

1/ Sugar, citrus, grapes, vegetables.

2/ Including a guess-timate of 5 000 ha irrigated by peasants.

Table 5.12

ESTIMATED AREAS OF IRRIGATION IN 1984

A. Distribution of area by location:

Location (L=Lowlands) (H=Highlands)	ha	Principal Crops
Upper Awash Valley (L)	22 100	Sugarcane, Cotton
Middle Awash Valley (L)	14 400	Cotton
Lower Awash Valley (L)	22 900	Cotton, Maize
Total Awash Valley	59 400	
Mereb-Gash (L)	8 800	Cotton, Maize
Rift Valley Lakes (H)	4 800	Cotton, Maize, Tobacco, Vegetables, Fruit
Wabe Shebelle Valley (L)	3 500	Cotton, Maize, Pulses
Other Lowland Areas	3 500	Cotton, Cereals, Pulses
Other Highlands (peasants)	5 000	Various
Total	85 000	

B. Distribution of area by crop:

Crop	ha	Percent of Total Crop Area Irrigated
Cotton	50 000	95
Sugarcane	17 600	99
Pasture	4 200	-
Maize/Sorghum	4 100	-
Bananas	1 100	95
Tobacco	900	99
Tree Fruits	800	80
Vegetables	5 700	90
Pulses, Oilseeds and others	600	-
Total	85 000	

Source: EHRS Working Paper 20.

The GOE has placed strong emphasis on the development of irrigation in recent years, and this emphasis is continued in the Ten Year National Plan. Most emphasis has been placed on the development of large-scale irrigation in the underpopulated lowlands, but in 1978 a programme was prepared, with UNDP/FAO assistance, for the development of irrigation in major valleys, which identified priority projects. Some of these have subsequently been studied to either pre-feasibility or full feasibility level, as shown in table 5.13.

These and other studies generally show the technical feasibility of many possible schemes but also the considerable investments required for irrigation development which, according to a survey (FAO 1983d), could be expanded to well over 700 000 ha in total. The schemes studied show relatively high costs, averaging over US$6 000 per ha at 1983 prices, without correspondingly high benefits (most have modest expected ERR's), and most have severe logistic problems posed by poor accessibility. The World Bank has commented that "the cost appears to be at least five times higher than under similar circumstances in India, and high by African standards". (WB 1983a). The high costs are attributed to the need to provide infrastructure for State Farms and/or settlements, including access roads, buildings/housing, etc., in addition to usual irrigation costs. Large-scale irrigation development also makes heavy demands on scarce skilled manpower. Other problems inherent in the large-scale approach in Ethiopia have been listed:

"Most project developments are in arid areas where the traditional inhabitants have little or no tradition of settled agriculture. Conflicts have and still arise over the integration of local nomadic pastoralist populations with the requirements of modern intensive irrigated agriculture;

"The successful development of irrigated settlements to incorporate both local and immigrant communities has yet to be demonstrated;

"Many of the rivers are not suitable for perennial irrigation due to their low dry season flows, and storage works are often both prohibitively costly and liable to rapid sedimentation due to the accelerating soil erosion in their Highland catchments." (FAO, 1983d.)

Although the GOE continues to plan for development of large settlement or State Farm irrigation schemes in major river valleys, the reluctance or inability of multilateral funding agencies to consider such projects for financing has led to increasing emphasis being placed on the development of peasant irrigation. In particular, it is recognized that investment in small-scale irrigation works in the Highlands has several advantages:

- it has the possibility of reducing localized food-grain deficits;

- it complements benefits flowing from intensive extension and input supply schemes;

- it is less reliant on scarce skilled manpower;

- it requires less investment and foreign exchange;

- it provides opportunity for genuine participation of the local people concerned;

- it can create viable farm units on which producer cooperatives could be based.

Table 5.13

SOME IRRIGATION PROJECTS RECENTLY PREPARED IN ETHIOPIA

Name/location of project (H=Highland) (L=Lowland)	Stage of study (*)	Date of study	Area to be irrigated (ha)	Total cost (Birr million)	Average cost (Birr per ha)	Economic rate of return %
Weito (L)	F	1981	4 500	120	26 660	12.7
Lower Omo (L)	P-F	1980	6 000	45	7 500	9.5
Dabus (H)	F	1982	5 100	178	34 902	9.4
Meki/Zway (L)	R	1982	22 000		n.a.	
Galana (H)	R	1982	10 960		n.a.	
Angele Bothamon-nand Amibi saba Irrigation Expansion (L)	F 1/	1982	11 000	190	17 272	16.1
Ribb Gumera (H)	R	1980	32 000	188	5 875	n.a.

* F=Feasibility; P-F=Pre-feasibility; R=Reconnaisance

1/ This is a re-appraisal and updating of a previous feasibility study.

Limited small-scale irrigation development has recently been initiated by the Soil and Water Conservation Department (SWCD) of the MOA with financial assistance from the EEC and OXFAM. These schemes, in scattered areas of the Highlands, have concentrated on the construction of river diversion or weir structures. They are based on the premise that the completion of main canals and on-farm works would be done by the farmer beneficiaries. To date little land development has been achieved, although modest progress has been made on the construction, with some main canals being constructed by farmers' voluntary labour.

In view of the apparent advantages of small-scale irrigation development, the GOE requested the assistance of the FAO Investment Centre in preparing a small-scale Highland irrigation extension and improvement project, which would strengthen Government's capacity to assist peasant communities to execute simple engineering works, to provide supplementary irrigation during the dry and small rainy seasons. (FAO, 1983d.) In the project's first phase, run-of-river schemes would be constructed, and in a second phase, programmes based on storage structures. The project would cost a total of US$12.4 million, to develop 4 800 ha over five years at an average cost of US$2 585 per ha. The ERR of the project was an estimated 17 percent. The prepared project would tackle identified constraints to small-scale irrigation including capital shortages, technical know-how and extension, in 21 selected Awrajas in Gondar, Gojam, Welega, Shewa, Gamo Gofa, Arsi and Sidamo Regions. The project preparation calculations show that small-farm incomes would increase considerably as a result of implementation of the project.

A grant of up to US$2 million for capital equipment to assist in the development of small-scale irrigation is now being considered by the United Nations Capital Development Fund, and it is understood that this might be linked to the abovementioned project, which is currently being considered by the African Development Bank. These projects would do much to support the development of small-scale irrigation in the Highland valleys, in which most of the potential for irrigation development lies (EHRS WP 20).

5.8 AGRICULTURAL SUPPORT INSTITUTIONS AND SERVICES

5.8.1 Institutions

The several Ministries and ministerial level Commissions concerned with agriculture have been listed in section 3.3. Under these Ministries and Commissions there are several corporations, authorities and institutes concerned with specific sub-sectors. While the Ministry of Agriculture is charged with the development of crops, livestock, fisheries, forestry, wildlife and with the strengthening of Peasant Associations, the development of SC's and PC's, the Ministry of State Farms has as its main responsibilities the alleviation of food shortages and the production of raw materials for local industry and of export crops. The Relief and Rehabilitation Commission (RRC) has as one of its duties the creation of large-scale permanent settlements based on peasant agriculture. These three agencies, the Ministry of Coffee and Tea Development, and the other organizations concerned with agriculture, are therefore directly in competition for the inputs of land, seed, fertilizer and skilled labour which are used in agricultural production and its administration. Inadequate coordination among these is a continuing problem which is felt at various levels in the implementation of agriculture-related policies.

The difficulties of coordination and some overlap and duplication in functions have prompted recent proposals to reorganize institutional responsibility for the agricultural sector. It is understood to have been agreed upon in principle that settlement activities should be taken back into the MOA, and that the MOA should take over the coffee and tea extension activities of the Ministry of Coffee and Tea Development. FAWCDA is being more closely integrated into the MOA. The new organization of the MOA is presented in Figure 5.3.

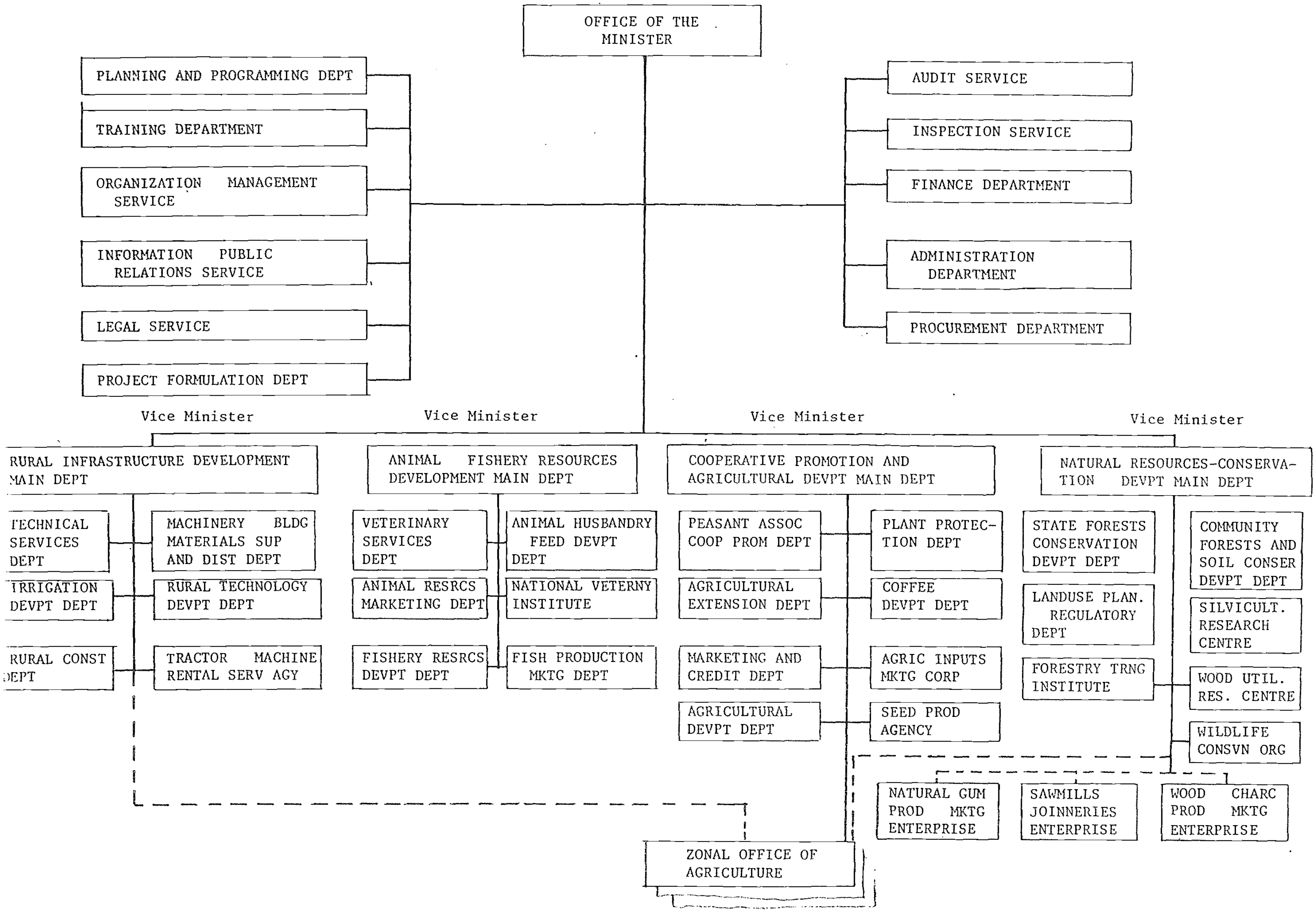
The activities of the agricultural sector could be integrated better if the Planning and Programming Division of the Ministry of Agriculture focused more of its attention on integrated planning and policy analyses. The Division should be in a position to carry out in-depth social and economic analyses of the sector at the farm level and above, and determine, among other things, factors inhibiting the adoption by farmers of new techniques or improvements. An FAO technical assistance and training project for strengthening these activities in the Planning and Programming Division is planned.

5.8.2 Agricultural education and training

At the higher level, the Alemaya Agricultural College, which is one of the faculties of Addis Ababa University, annually provides about 300 B.Sc. graduates in various agricultural disciplines. Recently it has started post-graduate courses leading to M.Sc. At the junior level there are two junior agricultural colleges, in Awassa and Debre Zeit, respectively - the latter recently being linked to Alemaya College. These turn out in total about 460 diploma holders each year. In addition there are two Institutes of Agriculture, at Ambo and Jimma, which together award about 230 diplomas yearly. A newly established Veterinary College is expected to award its first 20 diplomas in 1985. There is also a School of Forestry at Wondo Genet.

To satisfy their manpower requirements, most of the development agencies of the country have developed their own training units.

Figure 5.3 ORGANIZATIONAL STRUCTURE OF THE MINISTRY OF AGRICULTURE



These consist mainly of in-service training courses and seminars for upgrading their staff. For advanced training they generally send selected officers overseas. The programme of the training section of MOA is as follows:

(a) in-service training in which potential rural development workers are recruited from high schools and trained in rural development, home economics and cooperative organization;

(b) in-service training designed to develop existing staff capabilities and improve performance to the level required;

(c) farmer training, in which representatives of Peasant Associations participate in short-term courses; and

(d) multi-purpose Farmer Training Centres to improve farmer productivity and make them more effective cooperative members.

The proposed locations of the Farmer Training Centres and areas to be served are listed below; only the Agarfa project is operational at present.

Location	Regions to be served
Agarfa	Bale, Arsi, Sidamo, Gamo Gofa
Werota	Gojam, Gondar
Bako	Kefa, Illubabor, Welega
Chafa	Eritrea, Tigray, Welo
Zwai	Shewa, Hararghe

Two intakes of farmer students per year are planned, and each will be in excess of 2 000 farmers per centre. During the six-months' training programme farmers will take courses in literacy, physical education, agriculture, cooperatives, metal work and woodwork; courses in home economics and basketry will be available for female trainees. The centres are expected to be self-supporting in food, and to this end - and to gain practical experience - trainees will cultivate an adjoining farming area. The training centre at Agarfa, which is typical of proposals, occupies some 5 600 ha, and a supporting model producers' cooperative for additional training has an area of 5 000 ha.

It has been estimated (FAO, 1982b) that GOE institutions within the agricultural sector require annually, on average, over 300 graduates and 1 500 diploma holders. Present annual output within Ethiopia is around 300 graduates (from Alemaya) and 700 diploma holders. However, various other institutions outside the agricultural sector, including educational institutes, in the past have taken some 30 percent of the graduates and 20 percent of the diplomates while others go on for further training before taking up jobs. As a result, the trained manpower shortage probably accumulates at present at the rate of some 100 graduates and almost 1 000 diplomates annually. Serious thought will have to be given to ways of filling the gap for middle-level personnel, in particular. One possibility is to run courses for such staff in the training centres of the Ministry of Agriculture described earlier.

5.8.3 Research

When the Institute of Agricultural Research (IAR) was set up in 1966 it was entrusted with "the formulation of national agricultural research policy designed to further the growth and development of agricultural production in Ethiopia and conceived within the framework of overall national develpment planning", and with "the implementation of such policy through the conduct of applied research programmes". At the same time, it was recognized that IAR's capacity to conduct adequate research to meet these needs would take some years to build up and that, in the meanwhile, other organizations would conduct their own research programmes, but the IAR was given official responsibility for the sponsorship and coordination of all agricultural research. The University, the agricultural colleges and ARDU are IAR's so-called "collaborators" in conducting research, while the Ministries of Agriculture, State Farm Development, Coffee and Tea, and the RRC conduct a number of local adaptive trials.

The IAR is governed by a Board of Directors which includes the representatives of the various Government agencies who are the main potential users of research findings. The IAR was initially set up under the wing of the MOA and the Minister was chairman of the Board of Directors. In 1979, the Institute was made a semi-autonomous entity outside the MOA, though more recently the Minister has again been appointed as chairman of the Board.

The development of the IAR has been largely dependent upon technical assistance from outside Ethiopia. The chief source of funds has been four successive phases of a UNDP-financed, FAO-executed project ending in 1983. IAR now has a total of eight main stations built or acquired between 1966 and 1978 and 18 sub-stations. Over the years, IAR staff has gradually gained good experience in experimental work. Almost all senior posts are now occupied by Ethiopia staff, and the management and administration of IAR has been entirely nationalized since 1978. IAR has a total research staff of around 140 graudates. This is generally sufficient, but certain research disciplines remain short of staff. While field crops and crop protection departments are very well staffed, others - particularly livestock, horticulture, soil and water conservation, agricultural engineering, and the socio-economics and liaison departments or sections - still have to be strengthened. There is also need to strengthen headquarters management of research and to establish a biometrics unit. The proportion of technical support staff to graduates, at present 1.8 to 1, suggests that shortage of staff with diploma or certificate training may be preventing IAR from getting the maximum productivity from its graduate research staff. Research is undertaken within eight major Departments, as indicated in the following paragraphs.

The Field Crops Department is primarily concerned with major food crops, and is grouped into three main sections. These deal with food grains, pulses, and oilseeds. Research is aimed at developing higher-yielding and better-adapted varieties, optimum planting rates and times, plant spacing and crop husbandry. Substantial yield increases have been recorded, mainly on research stations, but these have frequently not been replicated in field trials and in farmers' fields, especially where the agro-ecological conditions vary (often not markedly) from the location where the variety was originally selected and tested. The output of improved varieties with wide application has been limited, in spite of many man-years of dedicated effort. This is considered to be due mainly to the widely varied agro-ecological conditions in the country, coupled with a very wide indigenous genetic base for all major food crops that has enabled farmers over very many generations to select varieties that are highly adapted to local situations. Only with maize (due to the relative lack of local genetic material compared to other crops), where imported material has been introducted, and wheat (where disease-resistance developed outside Ethiopia has been beneficial), have improved varieties been at all widely adopted. Fertilizer responses have been studied, and deficiencies of nitrogen and phosphorus quite widely identified, but little work has been done on trace elements or other nutrients such as sulphur. Field responses have not been as great or as universal as chemical analysis of many soils would indicate. Little work has been done on farming systems, or on seeking other agronomically desirable characteristics such as quicker maturity. Yield, per se, is generally the parameter used for deciding the merit of a variety. While this is important, others must be considered.

The Horticultural Department has undertaken variety screening for performance under local conditions and disease resistance, cultural techniques, fertilizer, and in some cases water requirements and pest control measures on fruits and nuts, vegetables, roots, herbs and spices.

The Coffee Department has concentrated on the selection and distribution of varieties and strains from among the local population which are resistant to coffee berry disease (CBD). In addition, research has been conducted on weed control on the stumping cycle and on intercropping of coffee with cereals and pulses. IAR is engaged in a hybrid coffee seed production programme in which CBD-resistant strains are crossbred with high yielders of good quality coffee.

The Department of Animal Science, Pasture and Forage Crops undertakes research on cattle, sheep and goats, pasture and forage crops and animal nutrition. The research tends to emphasize cross-breeding with exotics. Since livestock improvement is a long-term undertaking, and because the cattle research programme was launched only in 1973, the impact on production has been low thus far. Research on sheep and goats has been constrained by lack of qualified personnel. Good work has been carried out on pasture and forage crops, but the integration of fodder crops in the farming system has now become the major problem. Studies on the productivity of rangelands have been conducted in a few small areas.

After the Department of Field Crops, the strongest department is that of Crop Protection. Investigations and pioneer work on pest and pathogen identification and screening of pesticides resulted in the publication of recommendations for pest and weed control in Ethiopia. Besides CBD, work has concentrated on rust in wheat, maize, groundnuts, sesame and cotton; bacterial blight on cotton; late blight on potatoes; stalk borers on sorghum, etc. The activities of the phytopathological laboratory, established with USSR bilateral assistance at Ambo, could be better coordinated and integrated with IAR's activities.

The Department of Soils covers laboratory services, surveys, soil fertility, conservation and irrigation and drainage. The laboratory at Holetta, currently the only well-equipped one in the country, is overloaded with work. The establishment of a National Soil Laboratory is under way with UNDP/FAO assistance. The neglect of applied research on soil and water conservation is a fundamental weakness of the programme, given the soil erosion problems of the Highlands. The work on the management of irrigated land, particularly on drainage requirements, is also weak.

The Department of Agricultural Engineering has a small workshop in Nazareth where research is being carried out. Prototypes have been built of chain pumps, grain threshers and implements for maize shelling, insecticide dusting, etc. Some research in tillage and land preparation practices appears to have been undertaken without much coordination with the Soils Department.

The Department of Socio-Economics is entrusted with the task of integrating research results into applicable farming systems. Research so far, however, has been crop-specific, and largely foodgrain specific, while the lagging of livestock research has not permitted work on the development of improved integrated crop/livestock systems. Liaison with extension also falls under the responsibility of this Department, but staff has never been sufficient to give the necessary support.

It is therefore not surprising that criticism of IAR's performance and its capacity to serve the specific needs of each of the Ministries and institutions involved in agricultural production is rather severe; it is never easy to serve more than one master. It should be remembered, however, that prior to 1966, nothing much was done in the country in terms of research. It required the creation of the necessary infrastructure, and staff had to be trained to appropriate scientific levels in sufficient numbers and procedures had to be developed. Research is inevitably a long-term undertaking, particularly in the fields of livestock and perennial crops such as coffee. In light of such considerations, an FAO Research Mission concluded that IAR's performance has been generally satisfactory. (FAO, 1983.) Nevertheless, a number of shortcomings may be noted:

(i) IAR has failed to develop properly detailed research policies and priorities that should guide it in developing and maintaining a balanced research programme appropriate to Ethiopia's needs; the procedure by which the annual research programme is formulated, although it allows for interested institutions to participate, reportedly has not functioned well in practice in the last years, resulting in programmes reflecting too much the personal interests of the researchers - which often do not reflect the needs of the farmers. The GOE Ten-Year Perspective Plan, supplemented by the Conservation-based Development Strategy presented in this report, when agreed, should be the foundation for the preparation of more detailed and quantified agricultural research policies and priorities;

(ii) With the important exceptions of work on food crops, on CBD-resistant coffee, and on crop protection, specific research lines often have not been focused on clearly defined applied research objectives and on priorities of direct relevance to agricultural production;

(iii) Due to weaknesses in planning and management, there has been a large turnover in staff, and some senior officers have not returned to IAR after obtaining higher degrees. As a result, serious imbalances in research have developed, particularly in livestock, pastures, soils, chemistry, engineering, land use, and agricultural economics. The effect of the salary freeze on senior staff in IAR during a period of steady inflation (see section 4.10) and the removal of the hardship allowance, and the problems of finding adequate housing on the more remote research stations, pose an increasing threat to the maintenance of the IAR's research capability. In the past this threat has been minimized by the incentive provided by the opportunities offered in IAR to study (generally outside Ethiopia) for higher degrees.

(iv) The major beneficiaries of IAR's early research efforts have been the large-scale farms that were nationalized after the Revolution of 1974. There appears to have been little significant uptake of IAR recommendations by peasant farmers. This reflects both the failure of IAR to adapt its single-commodity-specific recommendations to area-specific farming systems, as well as weaknesses in agricultural extension and in the linkages between research and extension. IAR needs to be more responsible to on-farm problems through an improved extension feedback system.

IAR's performance has been constrained by insufficient laboratory capacity, office space, staff housing, foreign exchange (to sustain existing research capacity) and the lack of research stations in some ecologically important areas. In order to overcome these constraints, FAO has assisted in preparing an agricultural research project (FAO, 1983). The project would strengthen farming systems research and expand specific research in soil and water conservation, irrigation, and specific field crops - including coffee physiology and fertilization; establish a biometric analysis unit; strengthen the planning and programming of research; construct IAR's headquarters building and additional housing and office space for existing research stations; and provide for replacement equipment and supplies. The project, costing some US$16 million, has attracted World Bank funding.

5.8.4 Extension

Before 1967 there was little extension and it was virtually ineffective. Staff and budget were minimal, there was no coherent programme of work, no tested package of recommendations, and no parallel credit or delivery system for seeds, fertilizers, etc. In 1967 the first systematic and serious attempts to promote the improvement of peasant agriculture began with two significant developments:

(1) The FAO Freedom from Hunger Campaign (FFHC) started an annual series of widespread simple fertilizer trials, which immediately demonstrated economic responses (at ruling grain and fertilizer prices). These were continued for several years, providing a basis for the later Minimum Package Programme (MPP), into which the FAO/FFHC Fertilizer Programme was integrated. The trials also tested fertilizer responses to a limited number of improved varieties, mainly of bread wheats and maize. A pilot programme of "fertilizer credit cooperatives" was also operated as part of the FFHC project in 1970-72 in many of the fertilizer trial centers. These conclusively demonstrated, on a significant scale, that small peasant farmers (often even tenants) would borrow and repay credit for fertilizers when clearly profitable opportunities were demonstrated.

(2) The Swedish International Development Association (SIDA) and the Ministry of Agriculture began its pilot (though full-scale) regional peasant development project in Chilalo Awraja of Arsi Region: the Chilalo Agricultural Development Unit (CADU) 1/ of the Ministry of Agriculture. This project was designed explicitly: (i) to determine a

1/ With its later expansion to the other Awrajas of Arsi, this became the present Arsi Agricultural Development Unit (ARDU).

comprehensive package of actions (credit, inputs, cultural practices, etc.) which could be effective in raising productivity and living standards in a concentrated area, and (ii) to learn by field experience appropriate organizational and administrative forms and procedures which, with appropriate modifications, could be replicated in a national programme.

The CADU pilot project was also the first attempt at integrated rural development in Ethipia, including nutrition and other social programmes based on social surveys; cooperative organization; experiment with organizations of forestry; animal husbandry; mixed-farming, peasant dairy development, farm implement research, and other activities. Somewhat less than half the Chilalo peasants were small-holders, but for the majority, share-cropping tenants, CADU also developed and applied with some success in the years 1969-1973 model tenancy contracts, under which tenants would receive most of the benefits from the fertilizer, etc., packages. SIDA has largely financed and supported with much technical assistance this regional project, which has contributed significantly to the devising, by field experience, of appropriate organization and methods for extension and rural development programmes.

In 1970, largely with World Bank finance and a full complement of technical assistance from the World Bank and the UK, a second regional development project was begun in the Welamo 1/ Awraja of Sidamo Region. The Welamo Agricultural Development Unit (WADU) was similar, though on a smaller scale, to CADU, in an area of much smaller holdings, more densely settled, intensively cultivated, and far more degraded by erosion.

These two projects amply demonstrated that in principle peasants will readily accept new technology (mainly improved seeds and fertilizers), and repay credit, when profitable packages are made available. Substantial production increases resulted. These successes were achieved with a heavy concentration of skilled staff and other resources. Because of their cost, even at the outset, they had not been considered replicable as such to broader areas. But based on CADU and WADU experience, and also on the FAO/FFHC Fertilizer Trials Programme results, the Minimum Package Programme (MPP) was started in 1971. The MPP was implemented by the MOA with a World Bank loan, and again with extensive technical assistance from SIDA. With the less intensive extension and other activities, and with much simpler institutional development, the MPP grew, both intensively in the centres set up in the first years, and extensively to many new centres by 1975. In the latter half of the 1970s there were serious organization problems (see next pages, b through d), but by the early 1980s, after a phase II project, the MPP was covering most of the areas accessible by all-weather roads in three-quarters of the Weredas, mainly in the Highlands. A number of serious shortcomings, however, had become apparent. The "package" had become basically confined to fertilizers because little progress had been made in developing better varieties, or in improving cultural

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1/ Now termed Welaita, following the indigenous language.

practices. Fertilizers, however, become much less attractive to farmers following substantial increases in their prices relative to producer prices. Whereas CADU and WADU had succeeded in reaching significant proportions of farmers in their areas, MPP was unable to continue to do so due to the shift in relative prices and also because of the organizational problems noted below (b through d) as well as its less intensive extension. An intermediate approach is now under preparation in the form of the Peasant Agricultural Development Programme (PADEP), which is aimed at decentralizing agricultural support services and introducing greater popular participation in planning at Regional and sub-regional levels. PADEP again is receiving critical financial and technical assistance from SIDA and negotiations are underway with World Bank and EEC.

Most of the MOA's extension activities are currently undertaken through the MPP. The extension service is now organized at "Zonal", Regional, Awraja and Wereda levels. At headquarters level, the activities of the extension service are planned and coordinated by the various technical departments of the MOA. Staffing at the Zonal level comprises a number of experts of various disciplines, with degrees from Alemaya Agricultural College, assisted by diploma or certificate holders. Their work is guided and directed by a Zonal Agricultural Officer who is the representative of the MOA. At the Wereda level the extension workers are all-purpose Development Agents (DAS). Most of them have completed secondary school followed by 6-12 months' training in general agriculture at MOA training centres. The Wereda extension workers are those who are in daily contact with farmers. The multi-disciplinary approach might have some advantages, but due to the limited number of extension staff it also means that an extension worker has to spread his available time over several different fields. The Training and Visit system (T and V) of extension under the PADEP programme has been started in key pilot areas (see section 12.6, Part III, for more detail). The technical expertise in agronomy available at headquarters is around 30 graduates and around 50 diploma holders while there are some 900 development agents in the field, each serving some 15 to 20 PA's on average. This contrasts with the Ministry of State Farms which has over 200 graduates and over 700 diploma holders.

Extension in coffee is under the Ministry of Coffee and Tea and is supported by the EEC-assisted Coffee Improvement Project, covering 5 Regions. There are some 550 coffee extension workers in total, and the emphasis in extension is on increased yields and improved quality through improved cultural practices, disease and pest control and improved processing.

Weaknesses in agricultural extension may be attributed to:

(a) the weak link with research. Extension services cannot be fully effective without the backing of an appropriate research programme, while a sound research effort depends on a close link with extension and feedback from the field.

The lack of coordination in recent years between research and extension and the lack of an effective extension service has hampered the passing on of research results and the feedback of farm level information. Institutional links need to be formed at all levels. The new zonal organization, which also is designed to integrate the work of IAR much more closely, and the T and V system promise much improvement in these respects. Extension advice is largely limited to the use of fertilizers and improved seed, which have not been readily available to most PA's because of high costs and/or limited supplies (see section 5.8.5). Recommendations are not sufficiently specific to either areas or farming systems which, in fact, have not yet been specifically studied. There are even inconsistencies (e.g., in fertilizer recommendations) between the MOA's 1982 handbook for Extension Agents and the most recent (1980) Crop Production Guidelines of the IAR. The educational background of the agents plays a considerable role in the effective execution of their work. Most of the agents at the Wereda level are certificate holders whose training includes very little instruction in working with people or in methods of extension education. Hence their competence may be questioned by the local people when they realize that the agents have little experience of rural life and its problems. The training programme for the T and V system should greatly improve this situation. To facilitate the attainment of their goals, they should receive instruction on the social and agricultural background of their respective areas, and studies should be carried out to provide this local knowledge.

(b) the lack of trained staff, who have become spread more thinly as the area coverage of extension has expanded, resulting in increasing farmer/extension agent ratios. To avoid this, among other reasons, extension efforts have been concentrated on the PC's and in those areas considered to have high potential and more accessibility.

(c) recurrent cost funding has not increased commensurately with the increased area coverage of extension. Salaries of most have been frozen, resulting in decreased real purchasing power.

(d) limited transport facilities have resulted in the location of most field extension staff at Wereda and Awraja level, with little contact with farmers. This and the lack of staff at Regional and Headquarters levels also results in inadequate management supervision, monitoring and evaluation of extension activities.

(e) the wastage caused by the overlap and duplication of different agencies involved in extension (see section 5.8.1). There is competition between these agencies for scarce trained agricultural manpower.

It is partly because of the difficulties in reaching down to the farmers in greater numbers that the GOE is, simultaneously with its extension activities, training an intermediate cadre of farmers at five Farmers' Training Centres. It is envisaged that these trained farmers will pass on their training to other farmers in their PA's or PC's. It is also envisaged that the knowledge of these "contact farmers" would be updated and improved by regular visits of the locally-based DA's who themselves will receive (under the PADEP proposals) regular training by subject matter specialists to be based at the Regional level. The extension service is currently being strengthened and organized along the lines of the World Bank-supported Training and Visit (T and V) system which has defined and formalized in-service training and farmer contact procedures. However, successful implementation of the T and V system depends heavily on adequate access and transport - two aspects that are still only rudimentary in the Highlands. The whole question of the impact of extension is pursued further in the context of the development strategy proposals presented in Part III (section 12.6).

5.8.5 Input supplies and distribution

Purchased inputs have traditionally made up a small fraction of peasant production costs (see Annex 4). If the production possibilities of the sector are to be exploited, substantially greater use of these inputs will be needed. In the present peasant context, the most important purchased inputs are fertilizer and improved seeds. Hiring labour is no longer permitted in the peasant sector, although labour is shared. The small size of farm units and the relative abundance of labour and shortage of capital make mechanization on a large scale uneconomic. Selective mechanization may contribute to production increases in certain cases and as farm units are enlarged (through the formation of PC's and possibly less formal arrangements within PA's), but factor proportions cannot be altered in a major way until labour begins to move out of agriculture. 1/ Official population projections indicate an increasing agricultural labour force through and beyond 1990.

The major fertilizer used in Ethiopia is diammonium phosphate (DAP). Fertilizer imports rose dramatically from very low levels in 1970 to 43 000 tons in 1976 and to 129 000 tons in 1979, but since then have declined to about 75 000 tons. The major allocation of fertilizer is to the State Farms which have consumed 50-60 thousand tons in the

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1/ which depends on substantial increase in the other sectors.

past three years. Those allocated to the peasant sector have been sufficient to benefit only about two percent of the area cultivated; about 80 percent goes to four regions: Shewa, Arsi, Sidamo and Gojam. The substantial reduction in fertilizer use by the peasant sector in recent years reflects the sharp increases in fertilizer prices without commensurate increases in crop prices. Fertilizer prices are not subsidized at present, and the domestic price increases reflect world market price increases and higher costs of domestic transport, handling and storage, which amount to about 40 percent of the total farm gate price.

The distribution system for fertilizers has recently changed with the establishment of the Agricultural Inputs Marketing Corporation (AIMC). AIMC imports fertilizers on the basis of the estimated aggregated requirements of the PA's, which it is envisaged will eventually be supplied through their SC's and the State Farms.

Table 5.14

FERTILIZER PRICES AND DISTRIBUTION OF FERTILIZERS AND IMPROVED SEEDS 1973/74 TO 1981/82

	1973/74	1978/79	1979/80	1980/81	1981/82
Price of fertilizer (DAP) Birr/quintal	42	55	65	85	116
Fertilizer distributed to PA's and PC's ('000 tons)	10	32	48	43	30
Total improved seed distribution (tons)	na	5 316	9 831	10 880	22 042
Improved seed distribution to PA's and PC's (tons)	na	2 316	2 684	3 401	3 517

Source: Ministry of Agriculture.

Improved seeds are produced and distributed by the Ethiopian Seed Corporation (ESC). Most of the seeds produced are distributed to the State Farms (see table 5.14). Peasant demand is low, reflecting the lack of suitable new varieties of improved seeds and ESC's use of old seed which has lost much of its yield-potential and disease-resistance. The problems of improved seeds therefore appear more to be inadequate selection, production techniques and quality control, rather than distribution. Because of the unpredictable demand which sometimes requires that surplus seeds be sold as grain, ESC does not chemically treat its seeds, and this further reduces their value.

5.8.6 Credit

All official lending to agriculture is provided by the Agricultural Industrial Development Bank (AIDB), established in 1970. AIDB does not operate savings or deposit schemes and uses CBE branch facilities for credit disbursements and recoveries. While AIDB has the mandate to perform a wide range of development finance functions, its role has been confined to short-, medium- and long-term lending to industry and agriculture and to managing various funds. AIDB is planning, however, to strengthen its manpower considerably so that for agricultural lending it can fulfill other roles assigned to it, such as identification and preparation of projects. AIDB has some 130 professional staff or only around 40 more than in 1971, reflecting the small growth in its activities.

AIDB's credit funds have been boosted in recent years by a 1982 World Bank credit for industrial development and by an African Development Bank credit of US$9 million to assist PC's. Agricultural credit has become AIDB's main business, accounting for around 80 percent of its outstanding loans. Of the credit provided to the agricultural sector, over 85 percent has been allocated to the State Farms, over five percent to PC's and SC's and around eight percent for fertilizer loans under the MPP. 1/ Lending to PA's as such or to individuals is negligible. Two-thirds of the loans have been short-term. Over 80 percent of the lending to cooperatives has been in coffee areas, although loans to SC's and PC's in other areas for flour mills, construction of offices and stores, tractors and water pumps are rapidly increasing. However, AIDB credit to the peasant sector is constrained by its stringent repayment conditions. New credit is not granted unless 95 percent of previous credits have been repaid.

It is not surprising that private money lending is reportedly very important, despite high interest rates (30 to 200 percent), and the fairly widespread distribution of public banking facilities. Reasons for this include informality, speed and ease of access. GOE/Huntings (1976) estimated that over half of the peasants in Tigray borrowed from local money lenders to buy seeds and consumer goods for periods averaging around six months at a rate of interest of about 40 percent. Similar findings have been made under ARDU.

1/ Combining credit to the PC's and the SC's obscures the percent going to the PC's as such. Some of that going to the SC's may presumably go to peasants other than PC members. For the MPP loans there is similar difficulty in determining just what percent of the fertilizer goes to ordinary PA members.

The increased flows of credit to the rural sector are potentially very important in rural development. At present, to augment the scarce resources that can be spared from the Government budget for constructing rural works, peasants raise money for the entire cost of a project before it can be carried out. To overcome funding constraints, the possibility of credit for constructing roads and water supplies, or establishing fuelwood plantations, schools or health centres, should be considered. PA's would seem to be the most suitable channels for such lending, since they are entitled to levy fees or rates on farmers that would be needed to service such loans. In addition, because of the Wereda, Awraja and Regional PA structure, there would be a possibility of undertaking works beyond the scope of an individual PA. In lending for rural works, close consultation with farmers is imperative before such loans are granted, to identify the most keenly felt needs for additional infrastructure, to help ensure its correct siting, and to contribute to repayment.

5.9 AGRICULTURAL MARKET PROSPECTS AND MARKETING

5.9.1 Market prospects

The development of agriculture in the Highlands is unlikely to be constrained by lack of product markets. Domestic demand is expected to grow rapidly from present low consumption levels in view of the projected average annual population growth of 2.9 percent p.a. (section 2.4) and the expected growth in average per capita incomes (section 4.12). With present low per capita calorie intakes (section 4.8), it is expected that the demand for basic foods such as cereals, pulses and tubers, will increase at least as fast as the population - at least 75 percent increase by the year 2010. Food production would have to increase by more than this if the GOE's aims of self-reliance (i.e., reducing food imports and accumulating a food reserve to cope with famine years) are to be achieved.

Among the cereals, it is expected that the demand for wheat will grow particularly rapidly as tastes for wheat flour and bread are developed, both by the distribution of imported wheat and by increasing urbanization.

The demand for vegetable oils, vegetables, sugar, meat, dairy products and fish is expected to increase even more rapidly (probably by well over 100 percent by 2010) than the demand for basic foods. The demand for the former has a generally greater income elasticity (that is, it increases at a faster rate than the rate at which average income increases).

Coffee will probably continue to dominate exports in the strategy period because of its outstanding profitability, both to the nation as a whole and to the coffee growers. (The farm models in Annex 4 show the comparative profitability of coffee to peasant farmers.) Although world demand is growing by only around two percent p.a., Ethiopia could increase its share of both quota and non-quota markets within the provisions of the International Coffee Agreement, if it has sufficient coffee to sell. Furthermore, the revenues generated by coffee could also be increased by quality improvements and, in particular, by exporting increased quantities of washed coffee and by improving classification and grading systems.

Neighboring countries are the principal market for live animals, fresh and chilled meat and ghee (butter oil). A large part of the live animal exports consist of unrecorded border crossings into Somalia, compensated by reverse movements of other goods into Ethiopia. Due to proximity and the commercial links of its Arab traders, Ethiopia enjoys a competitive advantage in the Saudi Arabian peninsula for sacrificial animals and chilled meat. These markets could be further developed and expanded in the intermediate term through an appropriate combination of improvements in livestock production and marketing. Although the demand for unprocessed beef and veal in the developed countries is expected to remain strong, Ethiopian exports to these countries are barred by health regulations. Exports of cooked and canned meat could be increased sharply under the impetus of strong demand in Western Europe. World trade in hides and skins is limited more by supplies than by demand. There is considerable scope to improve the price of Ethiopian hides and skins through improved processing. Their present poor quality results in comparatively low prices.

The chief oilseed exported by Ethiopia has traditionally been sesame, which has shown a remarkably strong export growth, when Ethiopia has had sufficient production. Again the main constraint is production rather than export demand, in which there is a preference to handle larger consignments. The export demand for pulses has been growing at a stable rate and should continue to do so. Although most pulses are in demand in the United Kingdom and Europe, the more typical demand is for particular products, e.g., horse beans in Saudi Arabia and chick peas in Ceylon and Singapore. There might also be possibilities for Ethiopia to enter into speciality fresh-vegetable export markets, and to regain previous markets in Europe.

5.9.2 Marketing

Major changes have taken place in the marketing system for agricultural products since the Revolution. The impact of these changes has been greatest on the marketing and pricing of basic grains. They include:

(i) the rapid expansion of the Agirculture Marketing Corporation (AMC) in the purchase and sale of cereals;

(ii) the establishment by government of fixed and uniform producer prices (throughout the country and during the year) for commodities purchased by AMC;

(iii) limitations placed on the private trading system; and

(iv) a variety of regionally-imposed administrative controls on the movement of cereals.

The objectives of government in introducing these changes were to stabilize and equalize supplies and prices of basic foods throughout the country; to provide farmers with incentives to produce and market more by reducing the marketing margins of merchants and traders; to ensure supplies and reasonable prices for consumers in food deficit areas, particularly Addis Ababa.

The current marketing system permits peasants to sell grain in retail markets, to private traders, and to AMC through quotas set for the Peasant Associations. Marketing patterns suggest that farmers tend to sell their produce at different market places, which operate on a weekly basis. Most walk to the market place, and about 90 percent use pack animals. Most grain sellers appear to visit markets from once a week to once a month. A major problem is the lack of transport and access roads. Such problems, together with low producer prices, probably account for the limited proportion of grain marketed by peasants.

Quotas are set by Government each season on a regional basis, then further set within each region for each PA. Private traders are required to deliver at least 50 percent of their purchases to AMC, but 100 percent in Gondar, Gojam and Arsi Regions. AMC sales are restricted to specific buyers, principally the kebeles of Addis Ababa, which absorb around 70 percent of AMC's sales. AMC's domestic purchases of cereals (and much smaller amount of pulses and oilseeds) from all sources have risen rapidly from 118 000 tons in 1976/77 to 605 000 tons in 1982/83. The State Farms provide most of AMC cereals purchases. Until the severe drought, famine, and food relief shipments of 1984, commercial imports of cereals declined and food aid imports fluctuated (see table A4.10) as AMC's domestic purchases increased.

Official cereal purchase prices (which are maintained by AMC, but established by the Council of Ministers) are set at three levels. The lowest price (farmgate) is that paid to peasants for quota purchases through their PA's. The next higher price (wholesale) is that paid to merchants, PC's and SC's, which is E.B. 4 or 5 per quintal higher than the farmgate price. This higher price is to provide a special incentive to PC's and a "fair margin" for merchants and the SC's. A still higher price (20 percent above the wholesale price) is paid to State Farms. The purpose of this further price differential is to partially compensate the State Farms for their higher production costs.

Farmgate prices paid by AMC would seem to be at roughly world market price levels; therefore they are relatively high by comparison with prices in many developing countries, and for low-income Ethiopian consumers. They are nevertheless below import parity in the major producing areas when internal transport and marketing costs are properly added. Since AMC buys little grain directly from peasants, however, its farmgate prices do not act as a significant price support in the major producing areas. The low open retail market prices in these areas suggest that actual farmgate prices are much below AMC levels and these low prices present a major impediment to the rapid growth of output.

While AMC farmgate prices may not be much below world market price levels, the wholesale and retail prices in the Addis Ababa and coastal open markets are now at or above import/export parity levels and so too are AMC selling prices. These high retail prices and low farmgate prices suggest that food marketing efficiency has deteriorated in recent years.

In addition to the public sector marketing outlet through AMC, a substantial private trade exists about which little has been documented, but comparison of MOA estimates of marketed output with AMC's actual purchases suggests that the private sector handles in excess of one million tons of cereals annually.

Coffee is marketed by the Ministry of Coffee and Tea Development. It is estimated that domestic consumption absorbs more than half of total production. Coffee exports are a major source of taxation revenue for the GOE (see table A4.4), with the result - after also deducting domestic marketing and processing costs - that farmers receive about one-third the f.o.b. export price. Inadequate investment in such needed marketing facilities as purchasing stations, pulping factories, rural roads and trucks for coffee transport, warehouses and washing stations hinders the improvement of quality and quantity of coffee produced. Owing to the effective nationalization of a large part of coffee marketing, and the take-over of washing stations by the cooperatives, there has been negligible investment in coffee processing in recent years. The Government has made a major effort during the past several years to improve the transport situation, particularly rural roads, but financial stringencies have limited the level of investment in all sectors. Until recently Ethiopia's producer pricing and financial management systems for washed coffee have not provided adequate incentives to farmers to deliver fresh cherries to the washing stations instead of sun-drying them. This has resulted in a low level of utilization of existing washing stations. The Government, however, has taken a number of steps to correct these deficiencies, most notably by increasing the price premium for washed coffee in the 1981/82 season and then by introducing a differential pricing system based on quality in the 1982/83 season.

While marketing arrangements are unsatisfactory for crops, they are even more so for dairy products, fishery products, etc. Many of these inadequacies stem from lack of effective rural marketing infrastructures and of capital development (such as roads, storage and processing facilities) and not merely from inadequate institutional delivery systems.

The potential importance of improving traditional local marketing systems has been neglected, corresponding to the neglect in improving traditional means of transport on which such local trade depends. In addition to informing peasants of the importance of cooperation in marketing their produce and providing their representatives with the necessary accounting and trading skills (see section 3.6), improving transport and communications is critical for better performance of traditional trade channels. The removal of these and other constraints has received relatively little emphasis compared to the attention paid to supplementing traditional marketing systems at the Wereda level and above. (See Part III, section 12.7.3 for recommendations.)

5.10 FORESTRY

5.10.1 Deforestation

Various historical and more recent sources suggest that around 40 percent of Ethiopia's land area was covered with forests as recently as the end of the last century (see section 2.8). As late as the early 1950s, it was estimated that 16 percent of Ethiopia was covered by forests. The third Five-Year Development Plan (1963-68) mentions that about 7 percent of Ethiopia's land survace was forested in the 1960s. It is estimated by the EHRS team that around 3 percent of the study area between 1 500 and 3 000 masl, or some 15 000 km^2 are forests, of which over 70 percent is in the HPP zone in the southwest. Section 2.8 provides a summary description of the remaining natural forest cover, while its sub-zonal distribution is presented in Annex 4, tables 1-4.

The following table presents estimates of the supplies of wood becoming available in the Highlands per annum in the early 1980s. 1/ However, of the total of around 15.3 million m^3, it is considered that at least a third of natural annual production from forests is not actually cut because of inaccessibility. On this basis, total annual wood supplies are estimated at about 14 million m^3.

1/ See also Annex table A13.1.

Table 5.15

ESTIMATED ANNUAL SUPPLIES OF WOOD IN THE HIGHLANDS
IN THE EARLY 1980s

	Area ha (million)	Standing Volume m^3/ha	Standing Total Volume million m^3	Mean Annual Increment m^3/ha	Natural Annual Production million m^3
Forest	4.1	25	100	1.0	4.1 1/
Woodlands	4.0	5	20	0.5	2.0
Wooded Grasslands and Shrubland	22.0	4	88	0.4	8.8
Eucalyptus	0.04	100	4	10.0	0.4
Total	30.14	-	212	-	15.3 1/

1/ Because about one-third of natural production from forest is inaccessible, the total is only about 14.0.

Source: EHRS estimates.

Annual demand for fuelwood is estimated in table 5.16 at 32.5 million m^3. However, demand exceeds annual consumption of wood to the extent that in some areas demand is met by wood substitutes such as dung for fuel (see section 4.7). Accordingly, it is tentatively estimated that annual wood consumption has probably averaged between 25 and 30 million m^3 p.a. in the early 1980s. This is between 11 and 16 million m^3 greater than annual naturally exploitable wood production (14 million m^3 from table 5.15). 1/ This shows the extent to which forests are being cut in excess of their annual growth - perhaps to the extent of several hundred thousand hectares annually. This situation is likely to worsen at an accelerating rate as consumption will increase with population growth while wood supplies resulting from natural growth of forests will decrease as the area of forest itself is cut at an accelerating rate.

1/ Annex table A13.1 shows somewhat different estimates of total supply and demand than those shown in tables 5.15 and 5.16. The deficit of demand over supply would be even greater: between 16 and 24 million m^3/year instead of 11 to 16 as shown here. The differences in the estimates arise from different assumptions made in the admittedly tentative analyses where hard data are not available (cf. Part III, 13.2.1).

Table 5.16

ESTIMATED ANNUAL DEMAND FOR WOOD
IN THE HIGHLANDS IN THE 1980s

	m^3
Fuelwood (0.8 m^3 per capita p.a.)	26 000 000
Poles (0.1 m^3 per capita p.a.)	3 250 000
Sawnwood (0.1 m^3 per capita p.a.)	3 250 000
Pulp	9 000
Total	32 509 000

5.10.2 Objectives and institutional framework

The Rural Lands Proclamation of March 1975 (see section 3.5) abolished the private ownership of forests, and the GOE's forestry administration became responsible for all forests covering more than 80 ha, while the newly-formed Peasant Associations became responsible for smaller plots. The forestry administration was strengthened during the late 1970s, culminating in "A Proclamation to Provide for the Conservation and Development of Forest and Wildlife Resources" (Proclamation No. 192 of 5 September 1980), which established as an autonomous authority within the Ministry of Agriculture, the Forestry and Wildlife Conservation and Development Authority (FaWCDA).

The main objectives of FaWCDA include:

(i) the protection, development, rational utilization and management of forest and wildlife resources of the country; and

(ii) the establishment and administration of national parks, game reserves and other conservation areas.

FaWCDA prepares and implements national afforestation programmes, supervises organizations dealing with processing and marketing of forest products, undertakes scientific research and gives technical assistance to government offices or mass organizations engaged in afforestation. It also designates and demarcates land as protected forests for the purposes of soil conservation, flood control, etc. FaWCDA has more than 4 000 permanent workers and 25 000 daily labourers, but only 20 professionals.

Despite the strengthened institutional structure, there is as yet no logically formulated and coherent national forest strategy indicating, among other things, the extent, pace and characteristics of deforestation, the nature and growth in demand for forest products, inventories of forest resources, the potential and realistic targets for reafforestation by location, alternative options and priorities. Much of this information, however, is under preparation in FaWCDA, with assistance from SIDA. But the lack of trained staff and basic data (e.g., growth rates of species in different Ethiopian localities, etc.) limits the pace of progress.

The country's forestry programmes are heavily supported by external aid. The main aid sources and inputs are from the World Food Programme, the Swedish International Development Agency and the Federal Republic of Germany.

5.10.3 Activities and achievements

Overview of activities

Only FaWCDA programmes are described here, because the specifically conservation and settlement programmes are reviewed separately in Chapters 8 and 9, respectively.

FaWCDA's main activities include:

(a) demarcation, designation, inventory, management, reforestation of State high forests. Some 150 000 ha had been demarcated by 1982/83;

(b) afforestation to provide fuelwood for urban and other commercial markets. A 15 000-hectare state plantation (eucalyptus) project in the vicinity of Addis Ababa is being implemented under AFDB financing. Plans are in preparation for fuelwood plantations under bilateral arrangements around Nazareth, Debre Berhan and Dire Dawa;

(c) reforestation of eroded catchment areas, with WFP assistance. This is concentrated in 19 catchments, on slopes above 35 percent, in the northeast Highlands;

(d) support of peasant associations and urban dwellers' associations, through provision of seedlings, training, demonstration and advice;

(e) operation of 13 of the country's sawmills. It also operates a Lumber and Joinery Marketing Enterprise, a Firewood and Charcoal Marketing Enterprise (to supply major urban centres), and a Natural Gum Marketing Enterprise;

(f) forestry research, mostly on species trials, factors affecting natural regeneration of indigenous species, seed collection, handling, testing, storage and distribution. Wood technology research concentrates on properties and uses of indigenous species; and

(g) operation of the Forest Resources Institute at Wondo Genet, established in 1978, providing middle level (diploma) training. The annual intake is now more than 60. The Institute also provides in-service short-course training.

Reforestation

Afforestation and/or reforestation is taking place in four different areas: watershed areas for soil conservation, state forests, community forest developments and settlement areas. The various schemes are implemented by various agencies, and it is difficult to give a clear picture of achievements and current programmes. The table below attempts to summarize the total number of seedlings raised and areas planted in the last decade.

Table 5.17

ESTIMATED SEEDLINGS RAISED AND TREES PLANTED
1974/75 TO 1982/83

	1974/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83
Seedlings (millions)	10	18	27	85	71	129	113	89	79
Planted area (ha.000)	3	8	12	38	15	19	16	33	23

Source: FaWCDA, WFP and EHRS estimates.

Research

In common with other forest activities, research has suffered from a lack of continuity. Some work was done in the early 1950s with the assistance of FAO foresters. In the 1970s the responsibility for forest research was given to the Institute of Agricultural Research; a forestry research officer was provided by the United Kingdom. He compiled a useful document on selection of species for the bio-climatic zones of the country, but left before he could initiate field testing. The longest sustained species trial programme was started with the assistance of SIDA in 1967 at CADU. In 1975, UNDP/FAO assistance was provided to forestry research to support the reforestation of the steep slopes in catchment areas in Eritrea, Tigray, Welo and Hararghe Regions. In 1979 these activities were broadened and absorbed by the GOE/FAO Soil and Water Conservation Project.

The main investigations in current research are: collection, handling, testing and storage of seeds; maintenance of existing species trials, the establishment of new trial sites and the interpretation of data from older trials; nursery techniques for raising indigenous species and for planting techniques (especially spacing); and factors affecting the natural regeneration of forests. Growing emphasis has recently been given to multipurpose species. A major problem is to identify species for altitudes above 2 500 m; most forestry research has been undertaken at lower altitudes. A major constraint in forestry research is the severe shortage of trained staff; at present there is only one graduate forester working in research. Others are abroad studying for forestry degrees. On their return they will require additional in-service training in research methods and techniques; therefore continued technical assistance will be needed for some time.

Training and extension

One of the major components of the community forestry programme is the education and training of representatives of PA's who are expected to act as forest development agents responsible for the establishment of the trees and woodlots required to meet the needs of the rural population. It is estimated that some 27 000 representatives of PA's and members of forestry task forces have been trained in nursery and planting techniques and over 600 nurseries have been established, reportedly capable of producing some 60 million seedlings. It is planned to extend training to forest technicians, forestry task forces, school children and others involved in forestry for local community development, in conjunction with publicity and propaganda campaigns related to conservation and the development of existing forests. With financial assistance from SIDA it is also proposed to establish another Centre for Training and Demonstration in Community Forestry at Mertule Maryam in Gojam Region. This Centre is expected to train the additional technical staff required at Wereda and sub-Wereda levels.

Forest management

Logging rights in the natural forests are vested with the Government. About half of the exploitation is carried out directly by

FaWCDA, while the rest is covered by logging rights granted to companies or individuals. The management and maintenance of the polewood and fuelwood plantations are of very low standard. Logging rotations are irregular, and there is little long-term management. The majority of the introduced trees being planted have rotations varying from 15 to 25 years and indigenous trees from 30 to 60 years, depending upon site factors. However, at present the only form of long-term management is to clear, fell and replant. Little consideration is given to develop two-tier forestry and to selective logging. In general, young plantations of 5 to 15 years of age are grossly overstocked, thus inhibiting the quality and growth of timber. Cutting practices are poor, the coppice and polewood being slashed with axes, leaving a series of badly scarred debarked stumps, many of which die-back. It is standard practice to maintain manual methods of felling and cross-cutting and to manhandle logs to the nearest extraction route. Few power saws and tractors are used. Wastage is estimated at one-third to one-half of log production. It is also estimated that an average of only 50 m^3 of sawlogs are obtained per hectare of high forest exploited.

Needs for poles and fuelwood in rural areas are mainly satisfied by cutting from wooded grasslands and by illegal cutting in State Forests. Around the cities cutting is controlled by FaWCDA, which also carries out part of the exploitation, and competes with private traders for both fuelwood and charcoal sales.

Processing

The value of forestry production has been estimated as follows:

Table 5.18

ESTIMATED VALUE OF FORESTRY PRODUCTION 1/
(million of Birr at current prices)

1974/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83
117.1	118.8	124.2	131.7	136.9	143.4	145	144	150

1/ Source: National Accounts Division and Central Statistical Office.

The share of processed products has increased from 17 percent to more than 26 percent, reflecting the development of forest industries.

There are 39 sawmills in the country, two plymills, one chipboard and one hardboard factory, and one paper mill. Processed products (from some 200 000 m^3 logs) include sawnwood and sleepers, 100 000 m^3; plywood, 2 500 m^3; and particle and fibreboard, 6 000 m3. Sawmills are dispersed, and very often located far from their source of raw material supplies, thus resulting in high initial raw material input costs. Equipment is generally old and suffers from lack of maintenance and spare parts.

The charcoal industry is mainly in the hands of peasant producers who use simple earth kilns for burning. It is believed that cooperative organization in this field would encourage efficiency and be financially beneficial to the producer. Charcoal is mainly sold at the roadside, much being resold in town centres. Cooperative action to collect, transport and sell at organized "charcoal retail centres" would eliminate the "middle man" and probably ensure a more efficient distribution. Charcoal supplies could be substantially increased by utilizing the wood available from land clearings for various projects such as coffee plantations, tea estates, and irrigation schemes.

5.10.4 Constraints

The shortage of trained professionals is a major constraint to the development of forestry. FaWCDA staff includes only 20 professionals, who are unable to cope with all its functions. Some technical assistance and training have been provided by UNDP/FAO and SIDA. These efforts need to be maintained until the requisite capability is built up.

Another major weakness is in basic information. There is a lack of data on growth rates of timber species, past plantings, forest inventory, wood extraction and cutting rates, yields, wood consumption rates and the use-properties of many of the presently-used species. The inadequate data base makes a reliable assessment of the present situation difficult and constrains both planning and management of the forestry sector. As a result, reafforestation is very much an ad hoc affair. Much of it is on land which is under the control of the PA's and is therefore dependent on getting the agreement of the peasants as to what land and how much they are prepared to give up for reforestation. Not knowing in advance how much land will be acquired complicates the planning of nursery production. There is also the problem that land so acquired must be seen to be used at once for reafforestation, or the PA's will understandably require that it be returned to them. This leads to planting being accomplished with whatever species are available as seedlings, regardless of their appropriateness to the management objectives.

An even more fundamental problem in forestry planning is that objectives are not always clearly established for reforestation:

Is the purpose to supplement the production of industrial timbers, to produce fuel and poles for the peasants, to protect land against erosion, or to meet multiple-use objectives? Decisions tend to be left to the Regional forest officers (many of whom do not have formal forestry training), who often rely on the well-known and available eucalypts, which are well suited for production of fuelwood and poles, but not much else. Until all the users of forest tree seeds are able to identify more accurately what species they need, and in what quantities, it will not be possible for the FaWCDA seed centre, built up with the support of UNDP/FAO, to define and tackle the seed demands in their full dimension.

Despite the decision in 1978 to coordinate their rehabilitation programmes more closely, FaWCDA and SWCD, two growing agencies under the control of the MOA, are still competing in reforestation for soil conservation. When cooperation exists at field level it is often confined to the selection of separate work sites, rather than extended to jointly planned and integrated activities within a common site. As FaWCDA is exclusively focused on reforestation, this can lead to an excess of the afforestation component in the rehabilitation of catchment areas. A closer coordination would result in a more efficient use of the available resources for staff, vehicles, food storage facilities and nurseries.

The lack of training and forestry professionals, the lack of data and planning, and the limited availability of seed quantities and species have resulted in excessive dependence on eucalypts. Both Eucalyptus globulus and E. camaldulensis are excellent species for general use in Ethiopia as they fulfill admirably the basic fuelwood and small timber needs of the people. E. saligna has proved equally valuable. However, eucalypt species are not generally well suited for planting to protect against erosion, especially when planted at a spacing which suppresses ground cover, or in areas where their leaf litter is collected for fuel use.

The reforestation programme needs strengthening and broadening of its technical base. The present focus on planting trees for fuelwood and poles and/or the almost exclusive use of the eucalyptus species was a sensible way to start but not necessarily to continue, now that reforestation experience has grown. Indeed, in order to diminish the cost to the peasants of setting aside land for tree growing, it is desirable to use trees that produce other benefits than soely fuelwood and poles. This can be achieved by employing either multipurpose trees which produce fruits, nuts, leaves, gums, or food of commercial value, and/or trees which can be grown intercropped with crops or pasture. There are indigenous species of great value, such as Acacia albida, on which enough research has been done in other countries to warrant their large-scale use locally. At the same time, exotic multipurpose species need to be explored. It is interesting to note that the most neglected forest system is sylvo-pastoralism, and from the point of view of the agricultural sub-sector the most neglected agricultural system is forage production. It is remarkable that livestock plays such a dominant part in the rural economy, yet animal nutrition has been so neglected in the development of forestry and cropping alike. This is important because reforestation is on land that was previously grazed. The issue of how to compensate for the pasture foregone may to a large extent require solutions outside forestry: pasture enrichment, cultivation of pasture crops, etc. However, at least partial solutions might be found through sylvipasture systems: tree species which produce arboreal forage as well as wood, planting espacements which enable grass cover to coexist with the trees, etc.

It is reported that planting success rates are as low as 60 to 70 percent after two years - due, among other things, to the use of undersized, naked planting stock, untimely site preparation, inadequate post-planting care, and grazing and termite damage. There is a need to differentiate spacing and planting procedures and to identify optimal timetables for operations. In addition, many of the already established demonstration and peasant nurseries are sub-standard and need to be upgraded or eliminated. With an increased dependence on bare-root planting rather than poly-pot planting, necessitated by the expansion in the annual size of the programme, it is feared that survival rates will drop further.

A major constraint to the operation of forestry programmes is the lack of mobility of the staff. FaWDCA headquarters in Addis Ababa is unable to exercise effective field control as staff often have no means of travelling to the various regions assigned to them. Their services are thus underutilized. Similarly, the FaWDCA staff stationed in the Regions are rendered ineffective by lack of transport facilities. There is an urgent need to provide suitable vehicles (4-wheel drive/motorcycles/horses/mules) to various levels of forestry staff.

Finally, in addition to the need for training to support a more nearly adequate forestry extension staff aimed primarily at developing community forestry through the PA's, there is obviously a need to support the sector by the allocation of more budgetary resources.

PART II

THE DEGRADATION OF RESOURCES AND AN EVALUATION OF ACTIONS TO COMBAT IT

Chapter 6

DEGRADATION: CAUSES, EXTENT, RATE AND FUTURE SITUATION

6.1 DEFINITIONS AND TYPES

The Earth's surface is continually being evolved by nature. Generally, nature endeavours to reduce elevated land to the level of the sea. The Ethiopian Highlands are an ancient and conspicuously uplifted part of the Earth's surface, which by virtue of their location, have constantly been assailed by normal erosive forces, in part generated by climatic phenomena originating from the surrounding desert, sea or forested lowlands (section 2.3). Moreover, the Highlands have a long history of tectonic instability which has split the Highlands into two parts divided by the Rift Valley and resulted in the steep slopes and rugged countryside of the eastern and western escarpments of the Highlands (section 2.4). To the extent that these processes of natural evolution give rise to erosion, it is called geological, natural or normal erosion and is distinguished from accelerated erosion induced by man through his activities of deforestation, raising crops and livestock, mining and construction.

Accelerated erosion is a form of degradation, broadly defined as a deterioration in the quality of the environment for man, vegetation, animals and aquatic life. Degradation may take many widely varying forms, ranging from atmospheric and ocean pollution to land degradation. This study is addressed to the most serious form of environmental degradation recognized in the Ethiopian Highlands - the degradation of land and water resources caused by soil degradation.

Soil is an extremely slowly renewable natural resource, the maintenance of which is crucial to support life, since the production of most food and clothing and much energy and housing depend on it. Soil is a delicate but highly varied composition of mineral particles, organic matter and living organisms in dynamic equilibrium. This variability reflects primarily the parent material from which the soil was formed over very long periods of time (section 6.4.1), and the environment in which the soil has developed. If the soil's environment is changed (for example by man's removal of vegetation covering the soil), the delicate composition of the soil is upset. This can be compensated for by careful use and management (for example by the addition of organic matter), but all too often it is not, and a process of degradation begins.

The loss in productivity of the soil is not necessarily continuous, and it may take place over a short period between two states of ecological equilibrium. There are many different processes of soil degradation, often interacting, which have been grouped into six broad categories (see box) by FAO/UNEP/UNESCO (1979). In essence, accelerated degradation results wherever man attempts to use land beyond its capability and suitability. Soil degradation other than geological erosion is essentially a human problem in both cause and effect. The next section identifies the most common types of soil degradation in the Highlands and quantifies their extent and severity by zone. Section 6.3 analyses the causes and nature of the processes involved, and section 6.4 presents estimates of the rate of degradation over time in different parts of the highlands. The last section of the chapter attempts to look to the future if present trends of degradation continue.

6.2 EXTENT, SEVERITY AND TYPES IN THE HIGHLANDS

6.2.1 Scope of assessment

An assessment of degradation, as it has been defined in section 6.1, should involve estimates of the extent to which the productivity of soils has been permanently lowered. This requires both an understanding of the relations between quantities and characteristics of soils and their effects on yields (of crops, grasses and trees) and data on losses of soil quantities and nutrients. These relations are not yet fully understood (Stocking, 1984), and the data to quantify them are lacking, and for these reasons alone any assessment of degradation is necessarily rather subjective. Nevertheless, an attempt to quantify the productivity losses associated with losses in soil quantities and qualities is made in Chapter 7; this section is confined to an assessment of degradation in terms of the soil losses concerned.

Any assessment requires a benchmark against which deterioration can be assessed. In the absence of any suitable absolute benchmark, soil degradation has to be assessed in relative terms. This amounts to a comparison of the severity of degradation (in terms of soil losses) in different parts of the Highlands and of the different types of soil degradation.

The severity of soil degradation (i.e., the significance of accumulated soil losses up to the present time) depends largely on the remaining soil depth and the fertility of that soil. These two factors are reviewed respectively in the following two sub-sections concerned respectively with the erosion of soil (depth) and with forms of degradation other than erosion. The severity of degradation is of course also affected by the normal processes of geological erosion and soil formation. However, these are dynamic but slow processes and are concerned with the situation or state of degradation as it is today in the Ethiopian Highlands.

BROAD CATEGORIES OF SOIL DEGRADATION

1. Water erosion is the dislodging and transportation of soil particles by water. Several different kinds of water erosion are widely recognized:

   Sheet (or inter-rill) erosion is the more or less uniform removal of soil from the whole land surface and is often not very noticeable. Sheet erosion is caused by splash erosion: the soil particles dislodged and transported short distances by the impact of raindrops, and the movement of dislodged particles by runoff (water not immediately absorbed into the soil) as it moves down a slope.

   Rill erosion develops from sheet erosion. Where there is a concentration of water into streamlets down slopes, rills or channels a few centimeters deep are formed, usually small enough to be removed by cultivation.

   Gulley erosion is the widening and deepening of channels, so that they become too large to be crossed in normal cultivation. Gulleys are active until stabilized by vegetation growing on their sides.

   Bank erosion is the scouring of banks of rivers and streams and contrasts with bed erosion giving rise to deepening of channels.

   Tunnel erosion or sub-surface gulleying or piping is the result of water eroding soil below the surface.

   Land slips or slides are mass movements of soil, usually occurring on steep slopes after intense and/or prolonged storms.

2. Wind erosion includes both the removal and deposition of soil particles by wind and the abrasive effects of moving particles as they are transported.

3. Excess of salts includes salinization and sodication (also known as alkalinization).

4. Chemical degradation includes processes affecting the chemical properties of soil such as the leaching of bases (i.e., the removal of materials in soluble form) and build-up of toxicities other than those due to excess salt.

5. Physical degradation refers to adverse changes in soil physical properties, including porosity (the volume percentage of the total bulk not occupied by solid particles), permeability (the ease with which water penetrates the soil), bulk density (the weight relative to volume of soil) and structural stability (the stability of the arrangement of soil particles).

6. Biological degradation is the decline of biological activity in and on the soil.

6.2.2 Accelerated erosion

Soil water holding capacity and plant rooting depth are two major characteristics which contribute to soil productivity. Both depend partly on soil depth, and in the absence of any other suitable indicators of the pattern of the existing state (not the rate) of erosion in the Highlands, remaining soil depth is used for this purpose. Soil depth varies enormously even within confined areas, and current depth reflects rates of soil formation (section 6.4.1) as well as erosion. Nevertheless, from the soil depth data collected by the LUPRD and others it is possible to discern broad patterns of major variations in estimated 1985 soil depth in the Highlands (Figure 6.1). Having noted the existence of wide intra-area variations, it is nevertheless also evident that differences in "average" soil depth between zones and altitudinal belts (table 6.1) are remarkably large and also appear to conform to an explainable pattern. The greatest areas of deep soils are generally within the longer growing period areas of the HPP and HPC zones. Conversely, the shallowest soils are in the LPC zone, averaging 59 cm compared to 84 cm in the HPC zone and 112 cm in the HPP zone.

Table 6.1

ESTIMATED AVERAGE SOIL DEPTH BY ZONE AND ALTITUDINAL BELT IN 1985 (cm)

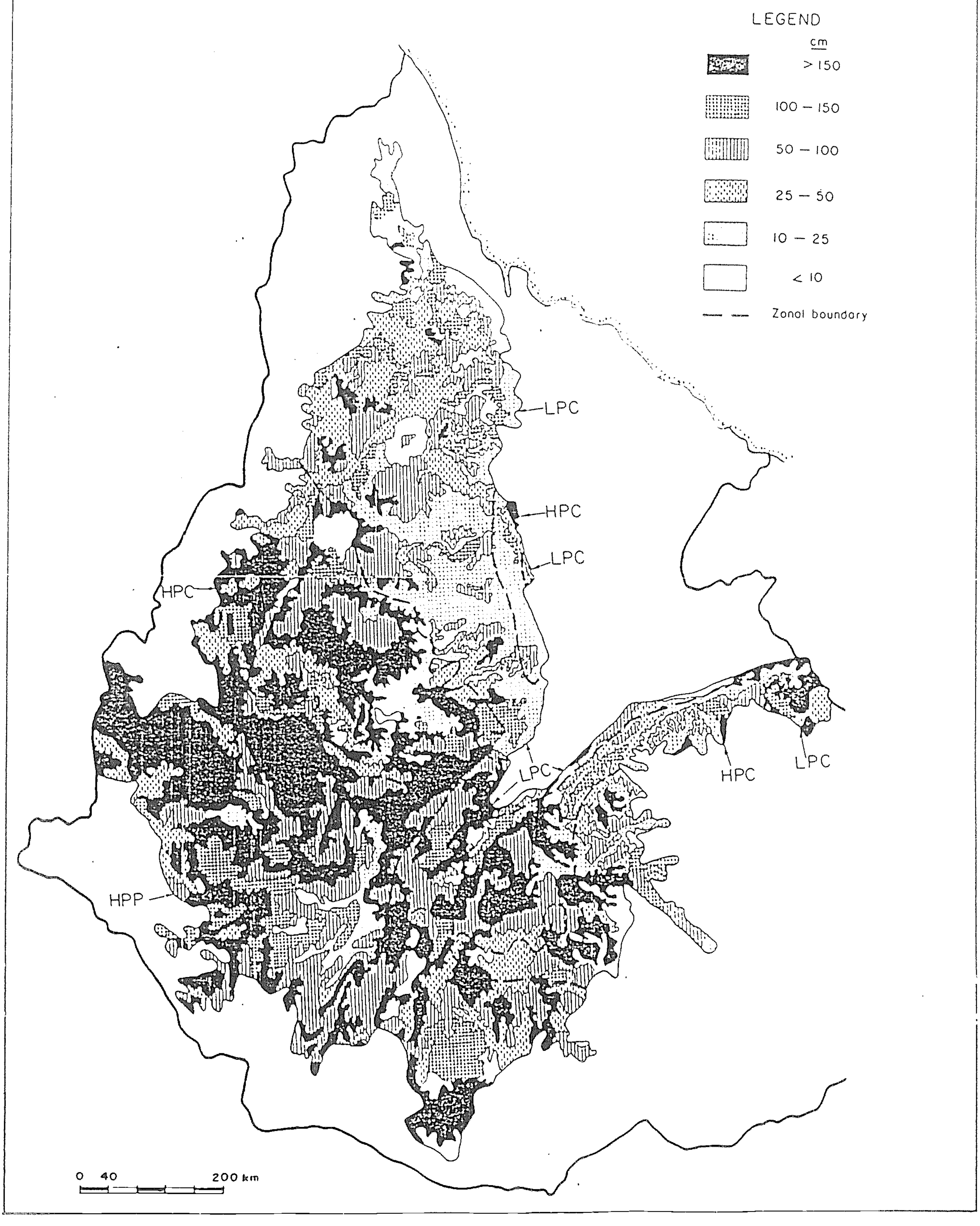
Zones	Altitudinal belt (000 masl)					
	<1.5	1.5 to 2.0	2.0 to 2.5	2.5 to 3.0	>3.0	Total
LPC	67	49	68	67	46	59
HPC	50	87	102	83	57	84
HPP	97	124	120	94	55	112

Source: calculated from table A6.1.

Another general pattern is that shallower soils also occur at the highest altitudes (i.e., above 3 000 masl) in all 3 zones. Soils tend to be progressively deeper at lower altitudes, down to 2 000 masl in the LPC and HPC zones and down to 1 500 masl in the HPP zone. The shallower soils at the higher altitudes as well as those going northwards (HPC and LPC zones) can be construed as reflecting both the accumulated results of accelerated erosion over centuries and geological erosion over thousands of years, and lower rates of soil formation (section 6.4.1). Twelve percent of the land area of the LPC zone is covered by soils of less than 10 cm depth (the minimum considered necessary to sustain cropping) compared to only one percent in the HPC

Figure 6.1

ESTIMATED SOIL DEPTH IN 1985



zone and practically none in the HPP zone. A further 40 percent of the land area of the LPC zone is covered by soils of between 10 and 50 cm depth, compared to 37 percent of the HPC zone and only 14 percent of the HPP zone. Around half of the HPP zone is covered with soils deeper than 150 cm compared to 29 percent in the HPC zone and only 9 percent in the LPC zone. Overall, about one-third of the Highlands has soil less than 50 cm deep and just less than a third has soils deeper than 150 cm.

Soil depth and geomorphological maps and data compiled by the LUPRD, have been used together with extensive field trips to estimate - admittedly on a more subjective basis - areas of existing accelerated erosion, according to severity, and to demarcate these very approximately on a map (Figure 6.2) and quantify them in table 6.2. From these estimates it is concluded that about half of the Highland's land area (about 27 million hectares) is significantly eroded, and over one-fourth, or 14 million hectares, are seriously eroded. It is estimated that over 2 million hectares of former or present farm lands have reached the "point of no return" in the sense that it is now unlikely that they will be able to sustain economic crop production in the future. Much of this is already bare rock (see table A6.1). The other half of the Highlands is as yet without significant accelerated erosion, but over half of this is at future risk because of the inherent erodible nature of its soils and the likely spread of cropping in these areas (see section 6.5). Only the balance of some 10 million hectares, or some 20 percent of the total land area of the Highlands, can be considered to be fairly free from the risks of serious accelerated erosion (EHRS WP 3).

Almost 60 percent of the severest erosion is in the LPC zone - in fact half of the total land area of this zone is considered already seriously eroded, with only a quarter of the LPC land area having little or no accelerated erosion. For example, Virgo and Munro (1977) drew attention to the severity of the situation in the north almost ten years ago. Accelerated erosion is next most serious in the HPC zone and particularly in the middle altitudinal belt (2 000-2 500 masl), where over a third of the total land area is seriously eroded. In the HPC zone as a whole, 30 percent of the total land area is seriously eroded and another 30 percent shows signs of moderate erosion.

By far the most important types of accelerated erosion in all zones and altitudinal belts are sheet and rill erosion (EHRS WP 3). Sheet erosion is often unobserved and contrasts with gulley erosion which often appears spectacular. The coverage of gulley erosion in terms of land area, however, is much less significant. Gulley erosion is most pronounced in accumulated soils and those derived from granite. After comparing 1965 and 1974 aerial photography, Virgo and Munro concluded that gulleys were encroaching at an average rate of 5-10 meters per annum in the Mekele plateau of Tigray. Although the direct effects of

Fig. 6.2

ESTIMATED SEVERITY OF EROSION IN 1985

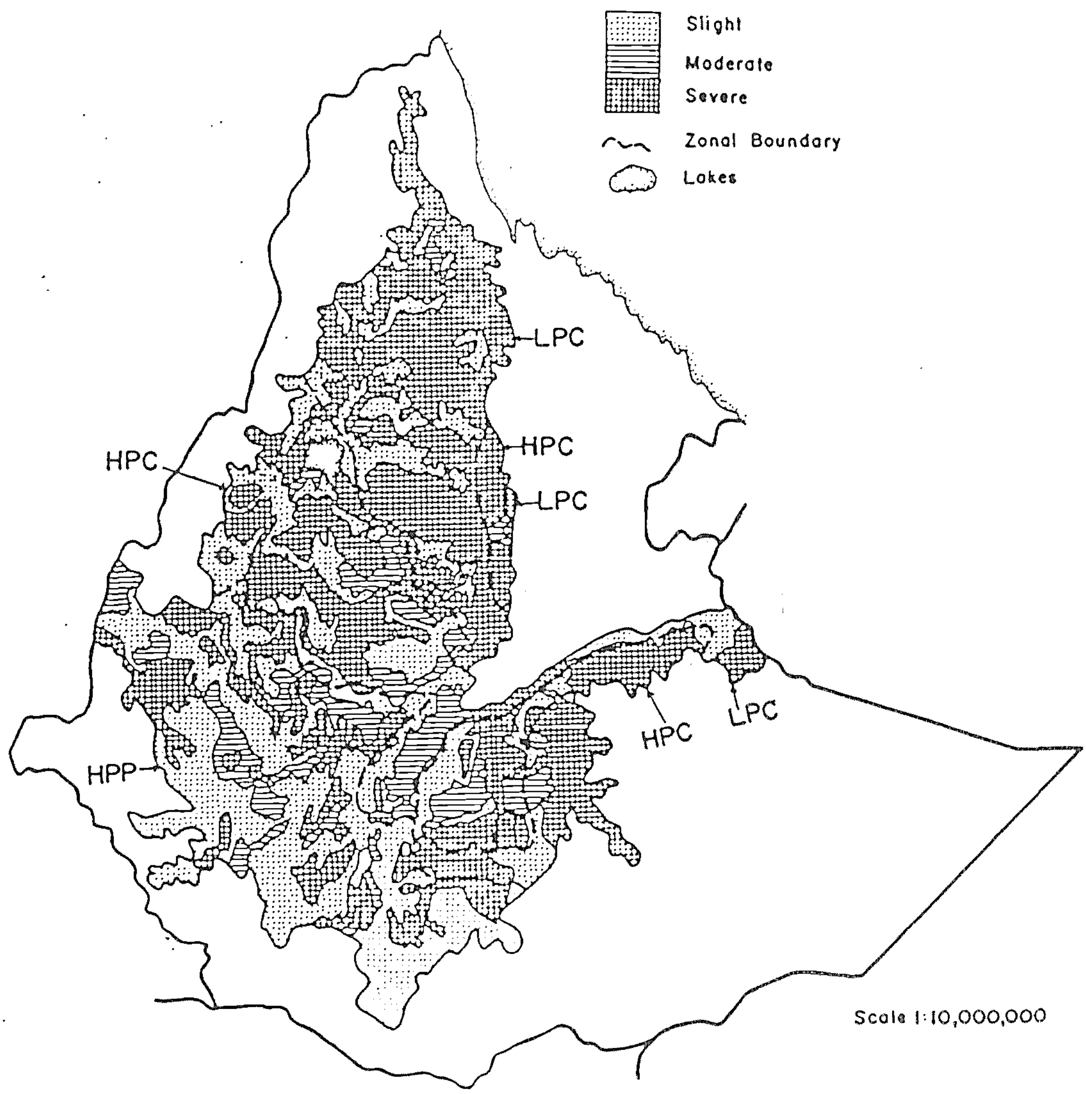


Table 6.2

ESTIMATED SEVERITY AND EXTENT OF EROSION BY ZONE AND ALTITUDINAL BELT IN 1985
Extent of accelerated erosion; percent of total area, and km^2

Zone/masl	Soil Parent Material	Most serious		Serious		Moderate		Little or none		Erosion Comments
		000 km^2	(%)	000 km^2	(%)	000 km^2	(%)	000 km^2	(%)	
LPC										
2500-3000	Basalts below Tekeze River	16	(21)	21	(28)	20	(26)	19	(25)	Severe sheet, rill and gulley, especially on cambisols and phaeozems. Surface crusting of ploughed soils. Seasonal accumulation of wind-blown salt crystals in Mekele plateau.
2000-2500	Basalts (50%) Siliceous, esp. in the North, calcareous (5%)	15	(25)	14	(24)	15	(26)	15	(25)	Severest (sheet, rill, gulley) on siliceous soils, esp. granite. Unstable soils and very erosive storms. Rock weathering results in coarse and sharp particles. High leaching of clay and minerals, so low fertility, low organic content in soils.
1500-2000	Siliceous (20%)	6	(33)	4	(25)	3	(15)	5	(27)	Soils more fertile and moist at lower end of catenary system. Erosive storms. Crusting, esp. on granite and sandstone soils in dry areas of north lacking vegetative cover (also in W. Hararghe). Low organic content of soil. Lower erosion rates as many erodible materials already eroded from long history of erosion. Climax thick broadleafed forest cover results in higher organic content of soils.
LPC Sub-total		36	(24)	39	(26)	37	(25)	38	(25)	
HPC										
2500-3000	Siliceous (10%) volcanic (90%)	5	(13)	6	(17)	11	(30)	14	(40)	
2000-2500	Basalts and calcareous (85%), siliceous (15%), esp. in E and W.	12	(18)	12	(19)	18	(28)	23	(35)	Vertisols erodible when dry in early rain. Fertile but hard to cultivate.
1500-2000	Basalts (35%) siliceous (15%)	1	(4)	3	(10)	14	(40)	16	(46)	Receives soil and ground water from higher slopes. Fertile soils.
HPC Sub-total		18	(13)	22	(16)	42	(32)	52	(39)	Erosion greatest in Gondar, Gojam, Shewa and Hararghe due to longer history of land use and siliceous parent materials.

Table 6.2 (cont'd)

Zone/masl	Soil Parent Material	Most serious 000 km^2	(%)	Serious 000 km^2	(%)	Moderate 000 km^2	(%)	Little or none 000 km^2	(%)	Erosion Comments
HPP										
2500-3000	Siliceous (10%) Basalts (90%)	1	(3)	2	(10)	5	(27)	11	(60)	Large areas of new land use and erosion not so common except in more densely populated areas of Shewa. Includes upper Nile gorges. High rainfall. Land slips. Gulley erosion rel. important esp. on nitosols. Gulley erosion rapid and spectacular on siliceous soils, otherwise general sheet and rill erosion.
2000-2500	Siliceous (5%) Basalts (90%)	3	(5)	7	(12)	12	(20)	37	(63)	
1500-2000	Siliceous (40%) Basalts (50%)	3	(4)	3	(5)	13	(21)	44	(70)	
HPP Sub-total		6	(4)	12	(9)	30	(21)	92	(66)	
under 1500		3	(3)	4	(4)	12	(13)	75	(80)	
over 3000	Tertiary basalts and volcanic ashes	1	(4)	5	(24)	5	(22)	11	(50)	Geological. Overgrazing. Sheet erosion pronounced in cropped areas but limited above 3500 masl.
Total Highlands		62	(12)	82	(15)	126	(23)	266	(50)	

Source: EHRS WP 3 revised.

gulleying are usually fairly small, gulleys are a symptom - usually one of the last to appear - of serious land denudation higher in the catchments concerned. Slide and tunnel erosion are not nearly as common, but can be a cause of gulleying. Slide erosion is confined mainly to the HPP zone and higher rainfall areas of the HPC zone (e.g., the Chercher Highlands) and is most frequent on nitosols and along the Rift Valley escarpments. Tunnel erosion is not common, being largely confined to soils derived from silicious materials. Stream or river bank erosion is quite common in the fluvisols of the LPC and HPC zones and results in some serious soil losses in Tigray and Eritrea Regions.

Although data are generally lacking on wind erosion, it is considered to be more widespread than previously reckoned and is more significant in the lower rainfall areas. Interestingly, wind was quoted as the second most important cause of degradation (after "over-cultivation") by farmers interviewed in the EHRS Sociological Survey (EHRS WP 4). It is fairly common during the dry months in parts of the Rift Valley (LPC), in the foothills of the Chercher and northeast escarpments (LPC) and in Tigray (LPC), especially in the eastern foothills and high plateaus and in the dry rain-shadow sector of the Tekeze river basin. However, much of the movement of soil by wind is over a short distance and liable to be reversed by changed wind directions.

In total, wind erosion and indeed all other forms of erosion combined are considered to be less significant in terms of areas affected and soils irretrievably lost, than the sheet and rill erosion caused by water.

6.2.3 Biological, physical and chemical degradation

Biological degradation adversely interacts with and aggravates accelerated soil erosion (see section 6.3). Biological degradation, on the basis of observations and data on land use practices, is considered to be both widespread and severe in the Highlands. Biological activity in or on the soil is closely correlated with the organic contents of soils, and this is declining in both absolute terms over time and relative to the obvious potential for maintaining or even improving it. The removal from fields of crop residues and dung, over-grazing and deforestation are obvious indicators of biological degradation, and biological degradation may generally be correlated with land use or abuse, its severity increasing with intensity of land use (cropping, grazing, deforestation) in the Highlands. Biological degradation not induced by man does not constitute a widespread problem because the lower temperatures and high rainfall associated with most of the Highlands inhibit humus mineralization rates. Only in the drier parts of the LPC, especially at the lower altitutdes, is there likely to be a natural decline in organic content of the soils.

Physical degradation of soils throughout the Highlands is commonly associated with biological degradation and water erosion (section 6.3). Physical degradation can also arise from excessive tillage, particularly for teff, and from regular livestock tracking and compaction, particularly between their grazing grounds and watering localities. Physical degradation has been observed in the eastern parts of Tigray Region (LPC), where in December and January the soils are exposed to strong easterly winds carrying salt-laden dust from the Danakil depression at the foot of the northeastern escarpment of the Highlands. When the first rains come (February/March) the salt acts as a deflocculant on the normally strong granular aggregates of the mainly calcareous soils, and promotes surface crusting. This seals the soil surface and reduces penetration of rainwater. Thus soils that are not normally considered very erodible become much more so in eastern Tigray and gulley formation is notorious in this area.

Serious chemical degradation is rarely found in actively eroding soils, but is more common in stable soils under conditions of high and long rainfall. In the Highlands, leaching is only common in nitosols at elevations over 2 000 masl, in fairly small parts of Kefa and Illubabor Regions with over 2 000 mm mean annual rainfall. The excessive removal of plant nutrients can result from continuous annual crops of cereals, but this has not yet resulted in marked chemical degradation in the Highlands. Most crops do not yield very heavily, and any chemical elements lost in this way seem to be partially replaced by the arrival of nutrients in the groundwater moving down the landscape, distributing minerals released from weathering rocks above. Without the existence of such a replenishing process, it is hard indeed to account for the continuing chemical fertility of most Highland soils after so many centuries of food production. The geographic location and elevation of the Ethiopian Highlands, and their climatic and soil environment, ensures that in most areas mineral nutrients become available from rock weathering at a rate that is more than adequate to balance the inevitable losses caused by normal leaching. All that is necessary to make these mineral elements assimilable by plant roots is a supply of moisture and an efficient soil organic cycle. It is the loss of organic content (biological degradation) which degrades both the physical structure of soil and its ability to supply stored nutrients to plant roots. This appears most serious in the LPC zone. A preliminary analysis (EHRS WP 23) on the extent and severity of chemical degradation in the Highlands indicates that, apart from the hazards arising from loss of organic matter, the most serious hazards of chemical degradation relate to phosphate deficiency, but even here responses to phosphatic fertilizer are far from dramatic. Also, indigenous forage legume species are remarkably abundant in the temperate altitudes and are quite well-modulated so that phosphate (and nitrogen) deficiency may only become serious when fallow periods are short or non-existent, when legumes are not included in the farming system, and when fertilizers are not used and crop residues and dung removed.

The excessive accumulation of soluble salts has been reported in several valley-bottom soils of the Rift area. These appear to be quite local in distribution and possibly correlated with former minera-lized spring activity. Neither salinization nor alkalization of soil is of general significance in the Highlands.

Criteria, methods and sources of data for assessing and monitoring biological, physical and chemical degradation are proposed in FAO/UNEP 1983 and FAO/UNEP/UNESCO 1979. Although scientific data are generally lacking, the consensus from this study as well as from other informed opinion (e.g., Brown, 1973; Hurni, 1984; and others) is that sheet and rill erosion and inter-related biological degradation are by far the most important forms of soil degradation in the Highlands, both in their area coverage and in their impact on reducing soil productivity.

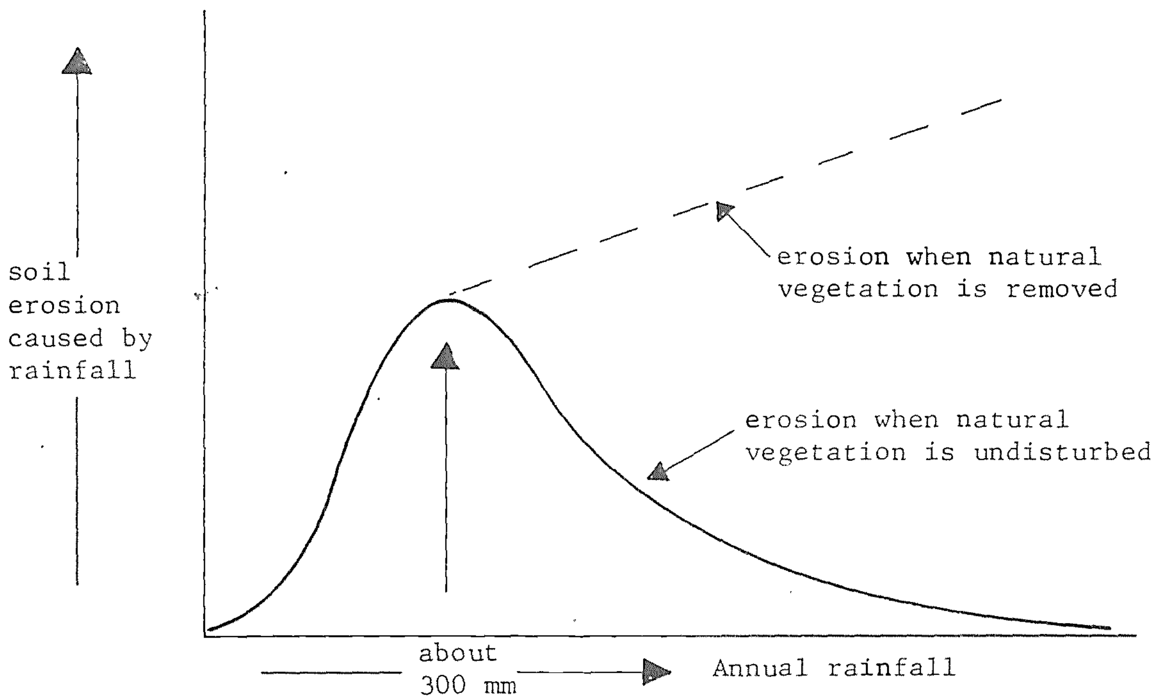
6.3 CAUSES AND PROCESSES

6.3.1 Understanding the problem and its origins

Conservation, if it is to have lasting effect, has to be related to the causes and processes of degradation, and not just the visible symptoms of erosion. By the time symptoms are visible it is often too late to tackle the underlying causes. This said, it is also important not to ignore symptoms, and action against them can give more immedi-ate results than actions against causes, which may yield results only after a longer period. This section summarizes the underlying proces-ses and causes of accelerated water erosion, the most significant form of soil degradation in the Highlands, as identified in section 6.2. More detailed explanations of the causes and processes involved, as well as those of wind erosion and those of physical and biological de-gradation, in the context of the Highlands, are given in EHRS WP

Under natural conditions, free from the effect of human activity, soil is usually covered by vegetation. Leaves and branches guard it from the force of the rain and from drying effects of the sun and wind. Dead leaves and fallen twigs form a layer of litter which further pro-tects the soil and fosters a large population of macro- and micro-organ-isms. Roots, on and below the surface, open up the soil, but also bind it together. Vegetation also dissipates the impact of flowing run-off by absorbing flow forces that would otherwise be expended on the soil, reducing effective slope steepness by causing run-off to meander as it flows downslope, and increasing the roughness of the soil surface. Vegetation decreases the volume of run-off by increasing transpiration and evaporation and therefore reduces soil moisture (directly increas-ing its capacity to absorb more rainfall) and increases soil organic content, which also increases soil's water absorptive capacity. Nature

Figure 6.3 EROSION AND THE REMOVAL OF NATURAL VEGETATION



left soil and vegetation in balance; imbalance has been caused by man's removal of vegetative cover (Figure 6.3).

The removal of vegetation, whether for cropping, fuel, construction, mining or by grazing, accelerates erosion both by leaving the soil more exposed to rain and wind and by changing characteristics of the soil itself, leaving it more susceptible to erosion.

The original natural vegetation over most of the Highlands was forest or woodland (section 2.8). This is the major reason why most Highland soils have or had a high organic matter content. Such natural vegetation was used by human hunters and food gatherers for thousands of years without giving rise to serious erosion. It was only in more recent times that humans discovered ways to plant and harvest some of their preferred food crops in one favoured location, thereby paving the way for a more settled life. Shifting and gradually more permanently settled farming spread into the northern Highlands (see section 3.2) where a major civilization developed around Axum. Farm implements were developed and use became widespread: the wooden hoe may have been used in the Highlands some 4 000 years ago, and the plough 2 000 years ago. The growth of population has resulted in accelerating deforestation and the spread of cultivation and grazing to newer and frequently more marginal areas. The progression from forestlands to grasslands to croplands has steadily reduced the density of vegetative cover protecting the soil. It is not coincidental that the LPC zone is the most devegetated and the most seriously eroded (following its longer history of settled farming, high population density and shorter growing periods). Fundamentally, accelerated erosion may be regarded as the result of the incorrect use of land, and the principle abuse is failure to recognize the protective role of vegetative cover. Once man has exposed the soil, it is susceptible to risks of accelerated erosion (the processes of which are described in the next sub-section) and the pattern and severity of which depend on the factors described in section 6.3.4.

6.3.2 Processes of soil erosion

Erosion of soil occurs in three stages:

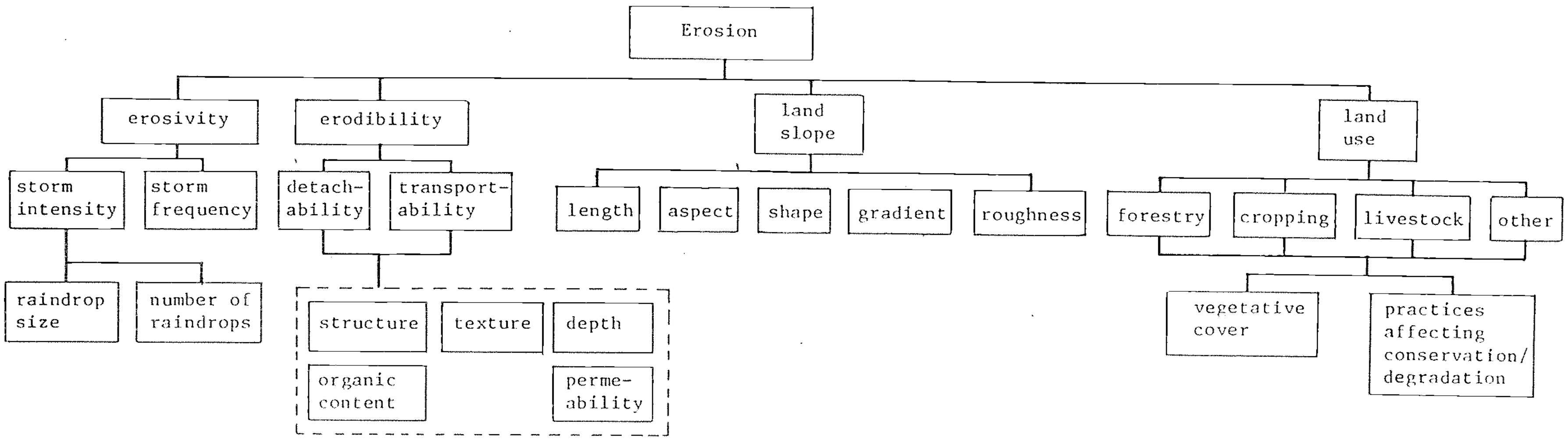
(a) detachment of individual soil grains;

(b) transportation of detached grains over the land surface; and

(c) deposition of grains being transported as sediment on a new site.

Two major agents are active in water erosion: falling raindrops and running water (run-off). When raindrops fall on the soil, they break

Figure 6.4 FACTORS CONTRIBUTING TO EROSION BY WATER



up soil aggregates and splash finer particles outwards. On sloping land, more than half of the splashed particles and water moves downhill, and many of the small particles (often clay) seal up pores in the soil surface. Other fine particles are carried downwards into the soil's B horizon. As soil pores fill up, the soil's water absorptive capacity decreases and more of the rainfall moves down slope as run-off. As the soil becomes progressively shallower, it becomes more easily saturated, and both soil detachment and transport are easier and run-off greater. Increased run-off has increased strength to detach and transport soil particles while the cohesion of the soil itself is being reduced by erosion taking away the finer particles. Thus the total depth of soil is reduced more and more quickly and easily.

The deposition site's distance from the site of detachment depends on the size and weight of the detached particle and the velocity of run-off, with the finest particles travelling the greatest distances. Most detached particles are deposited at the foot of slopes or in nearby flood plains. From comparison of sediment loads in rivers and soil movement rates on test sites, Hurni (personal communication) has calculated that on average around 10 percent of the detached soil particles are transported to rivers and taken out of production irretrievably in the Highlands as a whole. Deposits tend to be finer textured and higher in organic matter than the original soil because of the sorting action of the erosion process. For these reasons, and because soil depth is being increased, productivity may be enhanced in lowerland sediment-receiving areas. Conversely, productivity as well as soil depth are decreased in the upland wet erosion areas.

6.3.3 Causes of water erosion

The causes of accelerated erosion by water may be grouped under four categories: rainfall erosivity; soil erodibility; slope of land; and use of land (Figure 6.4). By far the most important of these factors is land use, followed by land slope, erodibility and erosivity.

Erosivity is the potential capacity of rainfall to cause erosion, and it depends essentially on the intensity, duration and frequency of rainfall. Rainfall in the Highlands is generally concentrated into fairly short seasons (section 2.5), and its intensity is often enhanced by strong winds. Short and very intense storms characterize the Highlands, and SCRP data indicate that between 50 and 80 percent of annual soil losses occur during the five most intense storms in a year. Hail is very erosive, and common at altitudes over 2 500 masl, but otherwise rainfall erosivity tends to increase at the lower altitudes. Erosivity has been found by the SCRP to be as great during the short belg rains as it is during the longer krempt rains - an important finding, as croplands have less vegetative cover at the belg rains.

Soil erodibility (or its vulnerability to erosion) generally increases as organic content decreases; soil texture becomes finer and less permeable, structure becomes poor, and depth and fertility decrease. Sub-soils are ususally more erodible than top soils, and erodibility is less when soils are dry. Highland soils derived from siliceous parent materials such as granite are generally more erodible than those derived from basaltic, calcareous or volcanic rocks. The major soil types in the Highlands regarded as being the most erodible are luvisols and cambisols (the latter because they are new and more unstable); nitosols, vertisols and some phaeozems and acrisols are less erodible.

Erosion tends to increase with slope length and gradient, as these increase the velocity and volume of the run-off. Slopes in the Highlands are steep by most standards, averaging between 20 and 25 percent (section 2.5). The shape of slopes also affects erosion: there is a greater predominance of convex slopes in the LPC zone, and these are generally more erodible than concave slopes.

The way in which the land is used affects erosion through its effects on vegetation cover, soil erodibility and the deliberate practice of conservation measures. The latter, apart from fallowing, are remarkably absent from most land use in the Highlands (Chapter 8). Recent studies suggest that once vegetative cover is reduced below 30 percent, the acceleration of erosion is rapid. Forestlands usually provide more than this cover, but it has been observed that grasslands in the LPC barely provide this cover, even during the rainy season

Croplands usually provide less than 30 percent cover at critical times (i.e., when the most erosive rains fall). However, it is not so much cropping, *per se*, as the system of cropping which gives rise to most erosion. Perennial crops can provide good year-round cover (tea is best) while cropping on flat lands may not give rise to much erosion at all. However, in the Highlands, perennials are largely confined to the HPP zone, while annual cropping is generally undertaken on slopes, because the flatter valleys are more susceptible to waterlogging and the valley soils are heavier and more difficult to plough with the maresha.

The greatest erosion hazard on croplands occurs when soils are exposed prior to planting and during early plant growth. SCRP data indicates that 80 percent of annual soil losses occur during the ploughing months and in the first month after planting. Ploughing is particularly damaging if it is up and down slopes as opposed to along contours. Some of the cereals grown in the Highlands require a fine seed bed, and this requires several ploughings, in all directions (teff may receive up to six). It is not surprising, therefore, that SCRP data indicate that erosion is greatest from fields planted with teff. Maize is probably the least erosive of the Highlands cereals, while pulses are even less erosive. SCRP data suggest that soil losses under grass are only a small fraction of those under crops, but that crop soil losses depend essentially on the extent of plant cover and soil disturbance during the rainy season.

Other Highland farming practices which promote erosion include the removal of dung and most crop residues from fields for fuel and/or feed.

The concentration of livestock herds into shrinking and less-productive grasslands (section 5.6) increases overgrazing and accelerates degradation by the decline in vegetative cover and organic content build-up in soils, by changing grass/legume species compositions and by soil compaction by trampling (Figure 6.5). The situation is most severe in the semi-arid grasslands of the LPC. But as with cropping, it is not livestock, per se, but the systems of livestock and grassland management which result in accelerated erosion. Good management is often constrained more by socio-economic factors than technical considerations (section 5.6).

Although livestock overgrazing (and deforestation) contribute to erosion, undoubtedly the most important general and continuing cause is the inappropriate system of cropping. It is therefore hardly surprising that the LPC zone, with its long history of population settlement (and correspondent land abuse) and current high population density (sections 3.1, 3.4) is the most degraded zone. Conversely, the HPP, with its large areas of relatively recent population settlement, is the least eroded zone. However, other factors have also contributed to this geographical pattern of erosion: a much larger proportion of the soils are derived from siliceous parent materials in the LPC zone (especially in the north); the LPC zone's lower rainfall is concentrated into two short and highly erosive seasons with consequent shorter growing periods; the lower rates of soil formation in the LPC zone and its greater predominance of convex slopes and lands exposed to wind as well as water erosion (section 6.4.1).

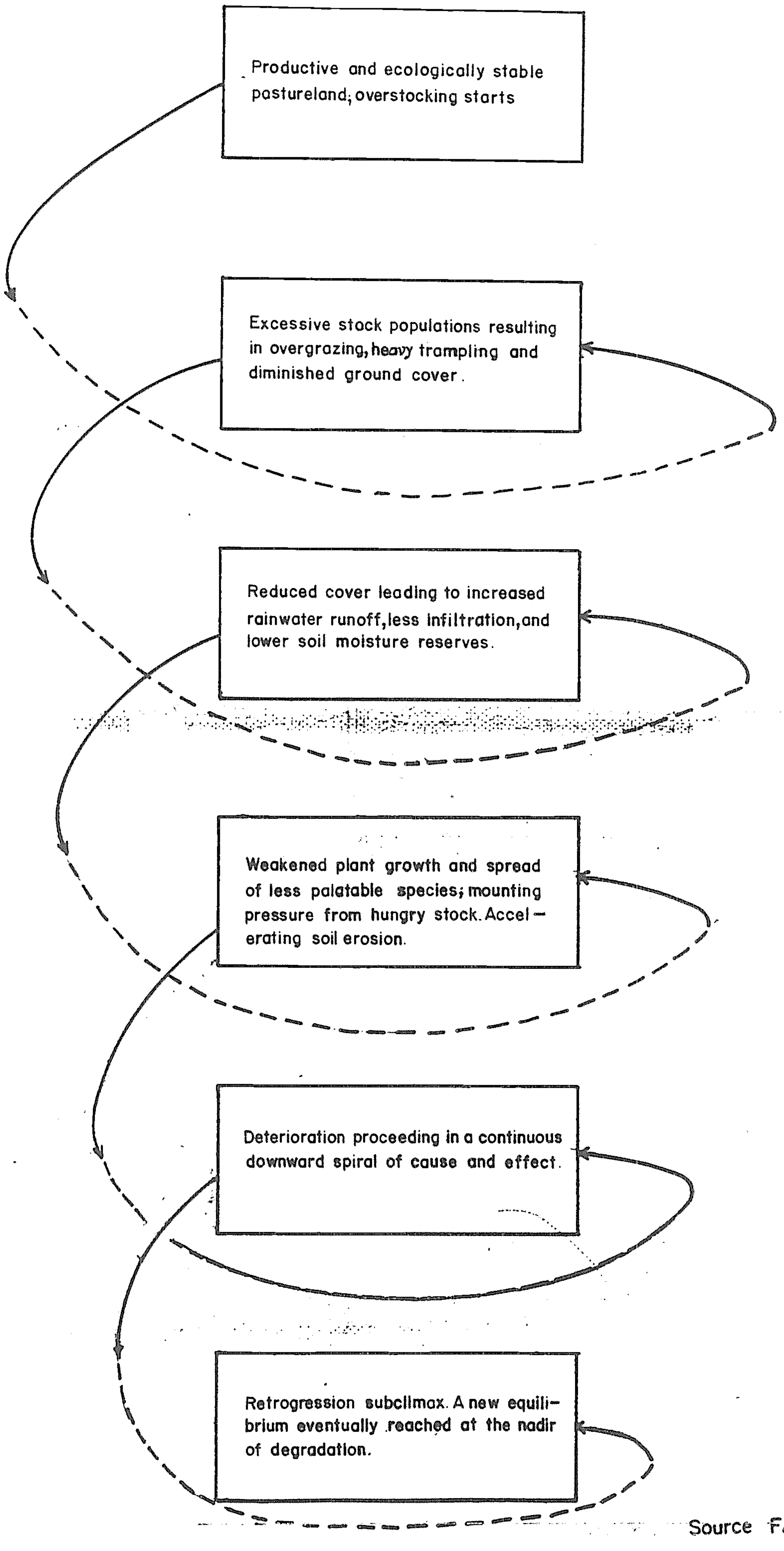
6.3.4 Socio-economic considerations

Degradation of land results from its use by man beyond its capability or suitability. When land is abused, the severity, extent and rates of degradation will be determined largely by the system of land use as well as by rainfall erosivity, soil erodibility, and land slope. The use of land reflects not only - and not even primarily - the physical characteristics of the land, but the underlying socio-economic character of the Highlands. An understanding of Ethiopia's degradation problem would not be complete without reference to the underlying socio-economic context within which all the physical factors interact.

There are many socio-economic conditions which contribute to degradation through inappropriate land use and most of these can be grouped under four headings: knowledge; resources; motivation; and organizational and policy arrangements.

Fig 6·5 The Vicious Spiral of degradation of grasslands in the LPC

The spiral may be reversed by improving the cover of acceptable plants. The longer countermeasures are delayed the more difficult and costly this becomes.



Source FAO (1980/c)

(a) Lack of knowledge - In much of the Highlands there is, among both peasants and local officials, an awareness of the degradation problem (see section 8.1), but not of the underlying causes. Similarly, at the level of national government the problem is recognized, but understanding of the basic causes appears to be too limited - except possibly among those in the Ministry of Agriculture most directly concerned. Even here, awareness of solutions seems to be more or less confined to structural methods of conservation and reafforestation (Chapter 8). There appears to be little awareness at any level that land abuse is the major cause of the problem and that long-lasting and nationwide solutions have to be achieved through improved land use. Thus, for example, the Ministry of Agriculture has recently commissioned the preparation of a large animal health project which, if approved and successfully implemented, would increase the number of livestock over what it would have been without the project, and so put even more pressure on the overgrazed grasslands of the Highlands.

(b) Lack of resources - The lack of land resources results in excessive population pressure, increasing cultivation intensities, deforestation and overgrazing, which puts the ecosystem at, or well beyond, its carrying capacity at the level of inputs and technology currently being practised. The lack of inputs and financial and/or management resources prevents individual peasants, groups (e.g., PA's) or the Government from carrying out work or practising methods which would solve or prevent the problem on the scale and intensity now required.

(c) Lack of motivation - If the farmer has complete security of tenure and therefore thinks of his land as a personal asset, to be preserved, improved, and passed on to his descendants, he has a strong incentive to improve the soil, drain, plant trees, terrace the hillsides, etc. But if his tenure is temporary, partial, circumscribed, or at risk, then his incentive is reduced, or may often become a disincentive (or an incentive to "mine" the land). In the Highlands today the peasants do not have sufficient incentive to improve and conserve their land.

(d) Lack of appropriate planning, policy and organizational arrangements - The inappropriate use of land is being prolonged and in some cases even encouraged by inappropriate and occasionally conflicting policies (e.g., animal health, agricultural research) and inefficient organizational arrangements.

Such socio-economic factors constrain conservation activities as much as they contribute to degradation through the abuse of land, and they are considered at greater length in Chapter 8.

6.4 RATES OF EROSION

6.4.1 Soil formation rates

In evaluating the long-term impact of soil erosion, it is desirable to make some provision for soil formation. Indications of soil formation rates are also useful to approximate rates of soil erosion which can be tolerated and the rate at which degraded areas could be reclaimed by natural soil regeneration unaided by man.

Soil at a given site is formed by three processes:

(a) the deposition of sediment by runoff erosion from a higher site (and/or by wind erosion). This is most important in Highland valleys, depressions and at the foot of concave slopes;

(b) the natural weathering of rock beneath the soil;

(c) the formation of soil at the surface by decaying organic and inorganic materials caused by both natural processes and by cropping.

The deposition of sediment involves substantially larger quantities than the formation of soil *in situ*. It is estimated that 90 percent of total soil erosion, or some 1 700 million tons of soil, is deposited annually in the lower lying areas of the Highlands. Soil formation in higher areas is confined to *in situ* formation.

There appears to be little agreement among soil scientists on the time required to form soil *in situ* naturally. Internationally, estimates vary widely: from less than 2 years to over 750 years to form 1 cm (Boul *et al.*, 1973), with the most common estimates lying in the range of 100 to 400 years, or between 0.8 and 3 tons per ha/per annum. It is, however, agreed that soil forms at a much faster rate under farming: Bennett (1939) indicated that tillage operations probably increase the rate of topsoil renewal to around 11 tons/ha/p.a. All these rates are considerably lower than the soil formation rates tentatively calculated for the Highlands (from 2 to 22 tons/ha/p.a.) from data on temperature, rainfall, length of growing period, soil units (and, by inference, parent materials), soil depth, slope gradient, land cover and use (EHRS WP 2). Although the method used for this analysis is still being developed in light of field verifications (Hurni, personal communication), it is considered to provide a reasonable indicator of relative rates of soil formation in the Highlands. Soil formation rates increase from low levels to the north of Asmara (LPC) to high levels in Welega and Kefa (HPP) and thereafter fall, toward the border with Kenya. In the east-to-west direction, rates are highest in Arsi, Kefa and Welega. These patterns generally reflect temperature and rainfall: increases in these tend to increase vegetation, biological activity in and on the soil, and thus the rate of soil formation. Similarly, the highest rates of soil formation generally fall within the 1 500 to 2 500 masl altitudinal belts. Semi-arid conditions limit rates at lower altitudes, while low temperatures reduce rates at higher altitudes.

6.4.2 Current erosion rates

Current rates of erosion reflect both geological erosion and accelerated erosion. Natural erosion rates vary greatly with parent material, relief vegetation and climate. Generally, rates up to one t/ha/p.a. may approximate average rates of geological erosion (Troeh, 1980); McDougall *et al*. (1975) have calculated a geological rate of erosion over the upper catchment of the Blue Nile and Tekeze rivers at 0.25 t/ha/p.a.

Estimates of accelerated erosion rates for the Highlands vary enormously. 1/ Measurements recorded by the SCRP from their field plots vary from zero on grasslands to over 200 tons/ha/p.a. on steep slopes planted with teff. For the Highlands as a whole, estimates of annual soil losses vary from less than a billion tons p.a. in the early 1960's 2/ to around one billion tons p.a. in the mid-1970's (World Bank, 1973 and FAO, 1984a), and over a billion tons yearly in the late 1970's (World Bank, 1980b), and dramatically up to three billion tons p.a. more recently. 3/

1/ All rates quoted in this section relate to erosion accelerated by water. There is no data on which to estimate wind erosion rates; in any case these are recognized by all authorities on the subject as being of significance only in certain parts of the Highlands (section 6.2.2).

2/ Annual rates of soil loss in the Highlands were predicted by Fournier (1962) to average 10 to 20 tons/ha.

3/ Berhanu Debele, in the preface of the EHRS Inception Report.

Calculations of Gross and Net Soil Losses

(millions of tons)

Estimated total gross soil loss = 1 900 =	80% on croplands = 1 520	90% redeposited on land = 1 368	Croplands (22%)=301 Grasslands (63%)=862 Forestlands (15%)=205
	+	+	
		10% to rivers = 152 10% to rivers = 38	190 to rivers and net losses forever
	20% on grasslands= 380 =	90% redeposited on land = 342	Croplands (22%)= 75 Grasslands (63%)=215 Forestlands (15%)= 51

Therefore, net soil loss from croplands (totalling 11.7 million ha) = 1 520 gross loss, less 376 redeposited as sediment on croplands = 1 144. Total net soil losses to rivers are 190. Of the balance, 1 077 are deposited on grasslands and 256 on forestlands.

The wide range of estimates quoted above is indicative of the difficulties - conceptual, methodological and statistical - inherent in making such estimates, and the considerable variability of erosion rates over both time and place. In the light of very limited and necessarily site-specific "hard" data on erosion rates in the Highlands, and the limited use which can be made of remote sensing techniques and data use has been made of erosion rates calculated for Highland areas, at the scale 1:2 000 000 by the LUPRD with the assistance of a GOE/FAO/UNDP project, using an FAO method derived from the Universal Soil Loss Equation (USLE). This method is described in LUPRD/UNDP/FAO 1984 and probably overestimates erosion rates in absolute terms. However, it is considered that the applications of the method do provide reasonable indications of relative rates of erosion in different parts of the Highlands, and permit the identification of areas in which soil losses should give rise to most concern.

Bearing in mind the stated limitations of both data and methodology, it is tentatively estimated from the LUPRD data and calculations that some 1 900 million tons of soil are being eroded annually in the Highlands. This is equivalent to an average of 35 tons for every hectare in the Highlands. However, most losses are from croplands (section 6.3), totalling an estimated 22 percent of the land area of the Highlands (section 5.1). If it is assumed that 80 percent of the total estimated gross soil losses are from croplands (most of the remaining 20 percent would be from overgrazed grasslands and a little from waste and other lands) 1/, then gross soil losses would average around 130 tons/ha of cropland. If it is further assumed that 90 percent of the eroded soil is redeposited evenly per hectare of forest, grass and croplands (the other 10 percent representing net soil losses entering rivers), then net soil losses per hectare of cropland would average around 100 tons per annum. (These calculations are shown in the box.) Thus, after making allowance for eroded soil from higher lands being redeposited on croplands downhill, it is estimated that the Highlands are losing a total of some 1 100 million tons of cropland soils per annum. Most of this is being deposited as sediment on grass and forestlands, but the part that is carried into rivers is lost forever from Highlands cropping. Rivers are thus probably carrying away from the Highlands some 190 million tons of soil (mainly cropland) every year.

The rates of erosion estimated in this exercise appear high in comparison to rates estimated by other studies for other countries.

1/ This assumption has been made in light of the much lower soil losses from grass plots recorded by the SCRP, allowing for overgrazing of some grasslands and taking into account the grasslands area of the Highlands.

However, recorded "gross" soil losses on cultivated SCRP plots (deliberately selected as being representative), average over 100 tons/ha/p.a., which may be compared to the above "gross" estimate of around 130 tons/ha/p.a. Similarly, recorded river suspended sediment rates in the Highlands (by SCRP and others, e.g., McDougall, 1975), suggest annual "net" soil losses of up to 5 tons/ha/p.a. of total land 1/. If such net losses represent 10 percent of total gross losses, the latter would vary up to 50 t/ha/p.a. and possibly average around 25 t/ha/p.a. compared to 35 tons estimated here, and equivalent, on the same assumptions, to up to 200 tons per ha of cropland p.a. compared to 130 tons estimated here. Such comparisons suggest that the over-estimation implicit in the method used is probably not more than 30 percent. Thus, even if the calculated erosion rates are reduced by 30 percent, they would still be high - at around 25 tons per ha p.a. of total land and around 90 tons per ha of cropland per annum, in comparison to rates calculated for other countries. This reflects the fact that most cultivation in the Highlands is on slopes which are very steep (probably averaging over 20 percent) in comparison to slopes (usually below 6 percent) on croplands in countries for which such calculations have been made (e.g., USA, Australia) and that cultivation in the Highlands may involve up to six ploughings, some at angles to contours, and leave the ground with very little cover during periods of very erosive rain (section 6.3.3).

Of greater reliability than the calculated absolute erosion rates are the indications of relative erosion rates between different areas of the Highlands. Figure 6.6, derived from the above-described 1:2 000 000 map prepared by the LUPRD, shows relative rates of erosion. A clear pattern of relative rates of soil loss is evident (see also table 6.3). While current rates of erosion are generally higher in the HPC zone than in the other two zones, the generalized picture hides significant variations, especially within the LPC zone. The highest rates of erosion appear to be in Welo, Gondar and parts of Tigray (LPC zone) and parts of Gojam and Shewa in the HPC zone. Conversely, present erosion rates appear to be lowest in the HPP zone, in parts of the Hararghe Highlands and in Eritrea. The lower current erosion rates in Eritrea and at the higher altitudes in all 3 zones (table 6.3) probably indicate the relative lack of materials left to erode (see also table 6.1, reflecting higher past erosion rates) and/or erosion having continued for longer periods in these areas and/or low soil formation rates.

1/ Thus, for example, FAO (1965b) quotes recorded sediment loads which average 3.5 t/ha/p.a. at Debre Sina and well over 1 t/ha/p.a. at Debre Zeyt, Sheno, Megezes, Ankober and Kombolcha in the Awash river basin. Degradation in this study was more generally estimated at 102 t/ha/p.a. from the eastern slopes and 0.8 t/ha/p.a. from the southern slopes of the central plateau.

Table 6.3

ESTIMATED RELATIVE RATES OF CURRENT ANNUAL SOIL LOSS BY ZONE AND ALTITUDINAL BELT

(percentages of estimated rates for the total Highlands)

masl	tons/ha/p.a.		
	LPC	HPC	HPP
2 500 to 3 000	75	65	50
2 000 to 2 500	140	170	135
1 500 to 2 000	75	100	90
Total	95	115	90

Source: EHRS estimates based on LUPRD/UNDP/FAO 1984.

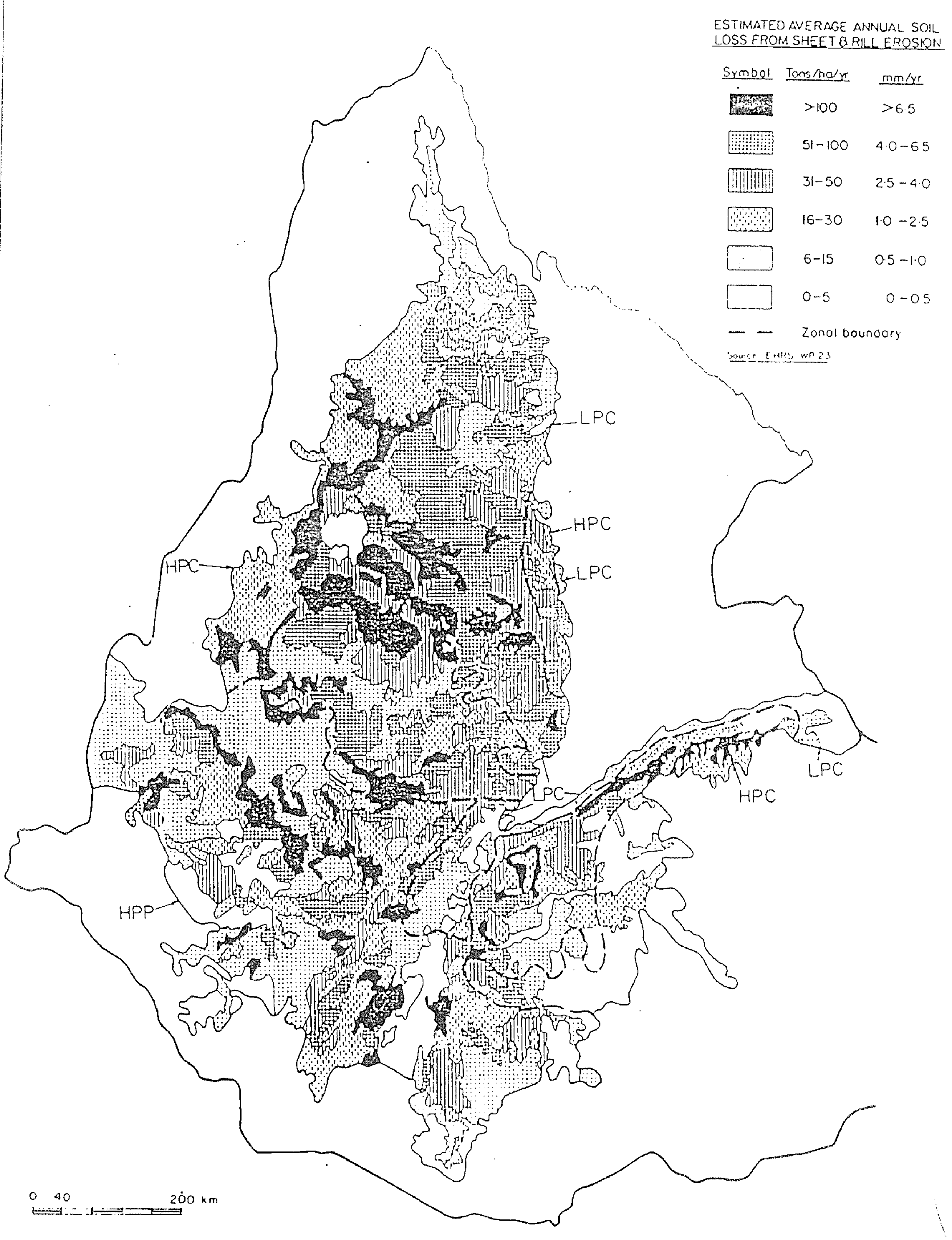
6.4.3 Changes in erosion rates over time

The actual processes of water erosion normally accelerate rates of erosion over time. The deposition of eroded sediment "almost always leads to a reduction in the permeability of soil where it is deposited, as the fine particles settle into water-conducting pores of the soil profile". (Greenland and Lal, 1977.) It is usually the most productive soil horizon that is lost by erosion. Reductions in soil productivity result in thinner vegetative cover, giving rise to greater erosion. The progressive selective removal of the lighter particles and organic materials from the soil by erosion, leaving behind the coarser silt and sand, will make the soil increasingly more erodible. Furthermore, most sub-soils are already heavier and inherently less permeable than top soils because of their structure and texture, so that run-off increases.

In addition to these technical reaons for accelerating erosion, there are socio-economic reasons. The population growth rate is likely to increase as medical services improve and reach more areas and cultivation is expanded into even more erosive slopes, with fallow periods further reduced. In most of the Highlands the current rates of erosion estimated in section 6.4.4 are accelerating, and the degradation of the Highlands will worsen at an ever-increasing rate. Only in some of the already most severely degraded areas of the Highlands (e.g., north of the Tekeze river in the LPC) are erosion rates likely to decline as the amount of soil left to erode is less.

Figure 6.6

ESTIMATED CURRENT AVERAGE ANNUAL RATES OF SOIL LOSS



6.5 EROSION HAZARDS AND THE FUTURE SITUATION

6.5.1 Soil loss tolerances

Man's removal of natural vegetation to use the land almost inevitably implies some acceleration of erosion over the very slow rates of geological erosion. But while it is not possible to prevent erosion, it is both possible and necessary to reduce erosion losses to rates which can be tolerated. Soil loss tolerance (known as T-values in soil science) is the maximum level of soil erosion that will permit crop productivity to be sustained at economic levels indefinitely. A soil's tolerance to losses can be assessed by reference to the present effective soil depth, which governs the ability of a soil to provide adequate anchorage, and to store sufficient quantities of available water to meet the plant water requirements between successive rainstorms without suffering from water stress. Thus for similar soils and for a specified erosion rate, a deep soil will possess a greater tolerance to erosion than a shallow soil, i.e., a much longer time would elapse before the deeper soil becomes unproductive than would be the case for the shallow soil. Other soil properties which influence its tolerance to erosion are its infiltration rate, susceptibility to sealing or crusting, permeability, root penetrability and drainage characteristics. Variations in these characteristics within the soil profile, as well as the depth of the profile, will influence the effects of soil losses on its productivity.

In quantifying tolerable soil losses, several other factors are also normally considered, including anticipated soil formation rates and the impact of downstream sedimentation. Tolerance limits for these different criteria do not necessarily coincide. Furthermore, because of the difficulties involved in estimating, at least in absolute terms, soil formation rates (section 6.4.1) and the effects of soil losses on productivity (Chapter 7), it is in practice very difficult to quantify soil loss tolerance in absolute terms. Indeed, in the USA, where both methodology and data availability have been most developed for calculating T-values, a large number have been calculated reflecting the large variability over time and place of factors on which they depend, and even so there is much scientific disagreement.

Because of such conceptual and methodological uncertainties, as well as the present weak data base for calculating T-values in Ethiopia, it is considered that these could not and should not form the basis for quantifiable conservation targets, at least at this stage and for the Highlands as a whole. They might have such a role in limited specific locations for which an adequate data base exists, but even then conservation objectives involving judgements with respect to the costs and benefits to be borne by different generations, should be determined by reference to social and political criteria. In light of such considerations, no attempt has been made to calculate T-values. Rather, the tolerance of soils to further erosion has been assessed solely by reference to estimated current (1985) soil depths and rates of soil loss and formation, and the resulting map indicates, in approximate terms, the physical risks or hazards to soil productivity implied by further erosion. Figure 6.7 clearly indicates the zero to very low tolerance of most LPC zone soils to further erosion. Particularly serious is the situation in Eritrea, Welo, Tigray, northern Gondar, and the eastern Highlands. Similarly, the high hazards associated with further erosion are also indicated for some of the Rift Valley escarpment/border areas and large pockets in Gojam and smaller pockets elsewhere in the HPC and HPP zones. Apart from such exceptions, the risks to soil productivity implied by further erosion are markedly lower in the HPC and HPP zones.

Table 6.4

ESTIMATED SUSCEPTIBILITY TO EROSION BY ZONE AND ALTITUDINAL BELT

Zone/masl	High		Moderate		Slight	
	000 km^2	%*	000 km^2	%*	000 km^2	%*
LPC						
1500-2000	11	68	3	17	3	15
2000-2500	33	57	12	21	13	22
2500-3000	46	62	8	11	20	27
HPC						
1500-2000	10	29	13	38	11	33
2000-2500	28	44	20	31	16	25
2500-3000	12	34	10	28	13	38
HPP						
1500-2000	18	28	19	30	26	42
2000-2500	35	60	11	19	12	21
2500-3000	10	54	3	18	5	28
<1500	60	66	14	16	16	18
>3000	13	62	4	21	4	17
Total	277	54	118	21	140	25

* Percent of land in altitudinal belt.

Source: EHRS WP 3 revised.

Figure 6.7

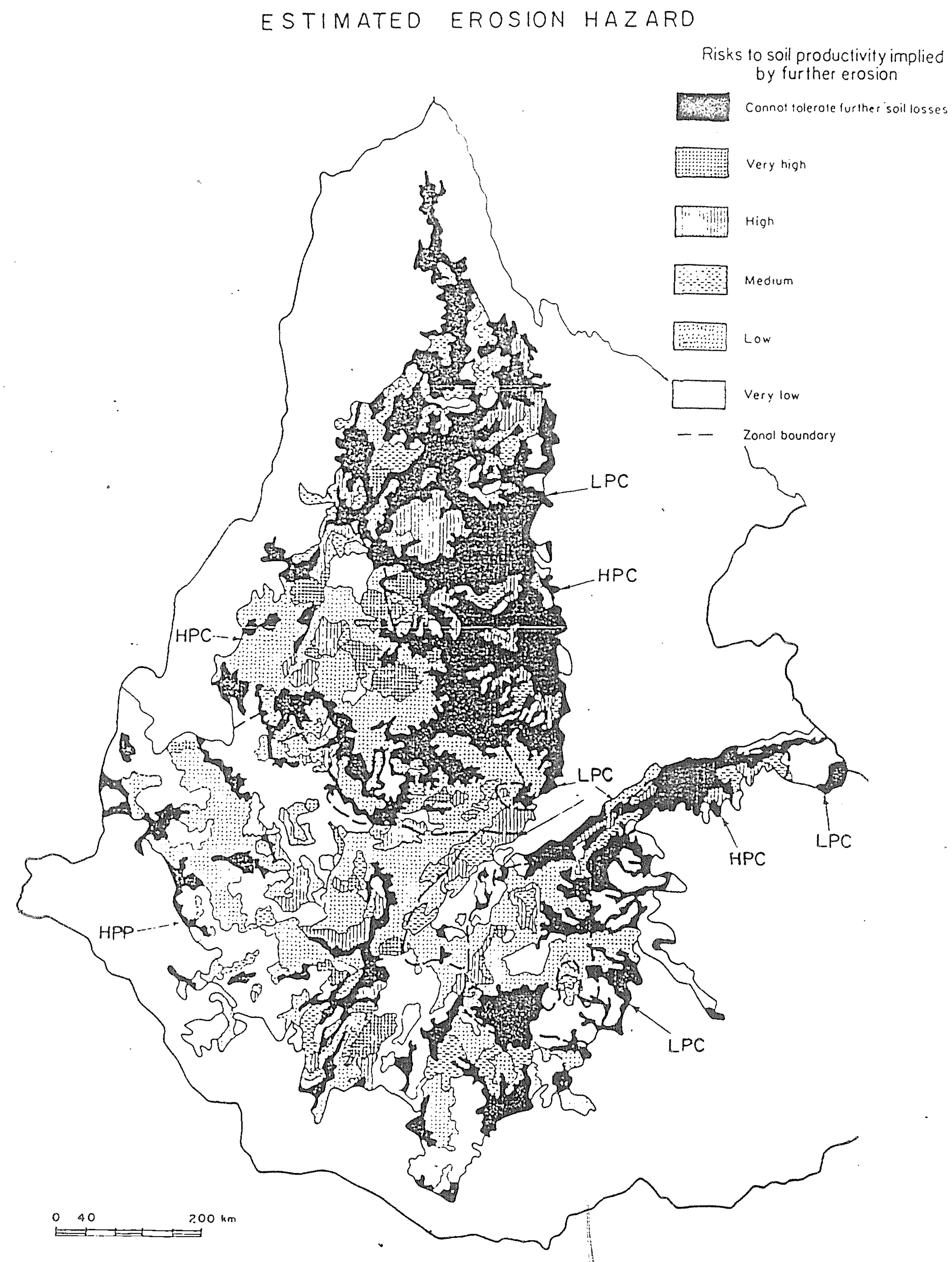

ESTIMATED EROSION HAZARD
Risks to soil productivity implied by further erosion
Cannot tolerate further soil losses
Very high
High
Medium
Low
Very low
Zonal boundary
LPC
HPC
HPC
LPC
HPC
LPC
HPP
LPC
0 40 200 km

Table 6.5

ESTIMATED REDUCTIONS IN AVERAGE SOIL DEPTH CAUSED BY CONTINUED EROSION 1985 to 2010

	LPC	HPC	HPP	Total Highlands
Estimated average soil depth (cm)				
1985	59	84	112	86
2010	52	76	105	79
Reduction in average soil depth				
(cm)	7	8	7	7
(% of 1985 depth)	12	10	6	8

Source: EHRS estimates from LUPRD data and calculations.

Table 6.6

ESTIMATED LAND AREAS IN SOIL DEPTH CLASSES BY ZONE IN 1985 AND 2010 (% of total land area)

Soil depth class (cm)	LPC		HPC		HPP		Total	
	1985	2010	1985	2010	1985	2010	1985	2010
> 150	9	9	29	29	50	49	30	30
100-150	11	11	13	12	13	11	12	11
50-100	28	23	20	11	23	18	24	18
25-50	19	14	19	16	10	8	16	13
10-25	21	7	18	18	4	7	14	10
0-10	10	24	1	7	0	3	3	11
rock	2	12	0	7	0	4	1	7
Total	100	100	100	100	100	100	100	100

Source: EHRS estimates from LUPRD data and calculations.

6.5.2 Land susceptible to further erosion

In the future, both the extent and rate of erosion will be influenced not only by the present situation and rates of erosion (sections 6.2 and 6.4) but also by estimates of the land areas at risk. The susceptibility of land areas within each zone in the Highlands to further accelerated erosion has been assessed, admittedly rather subjectively (EHRS WP 3), on the basis of soil erodibility and land use considerations and is classified summarily in table 6.4.

It was concluded in section 6.2 (see table 6.2) that about half of the Highlands, or 265 000 km^2, as yet have little or no erosion. Table 6.4 indicates that not more than 140 000 km^2 is likely to be practicably free from the threat of erosion, and if all of this lies in areas showing little or no signs of erosion at present, it suggests that almost half of the area of the Highlands which is now without much erosion is at risk, if cropping or grazing are intensified in these areas without adequate conservation measures.

6.5.3 The future situation

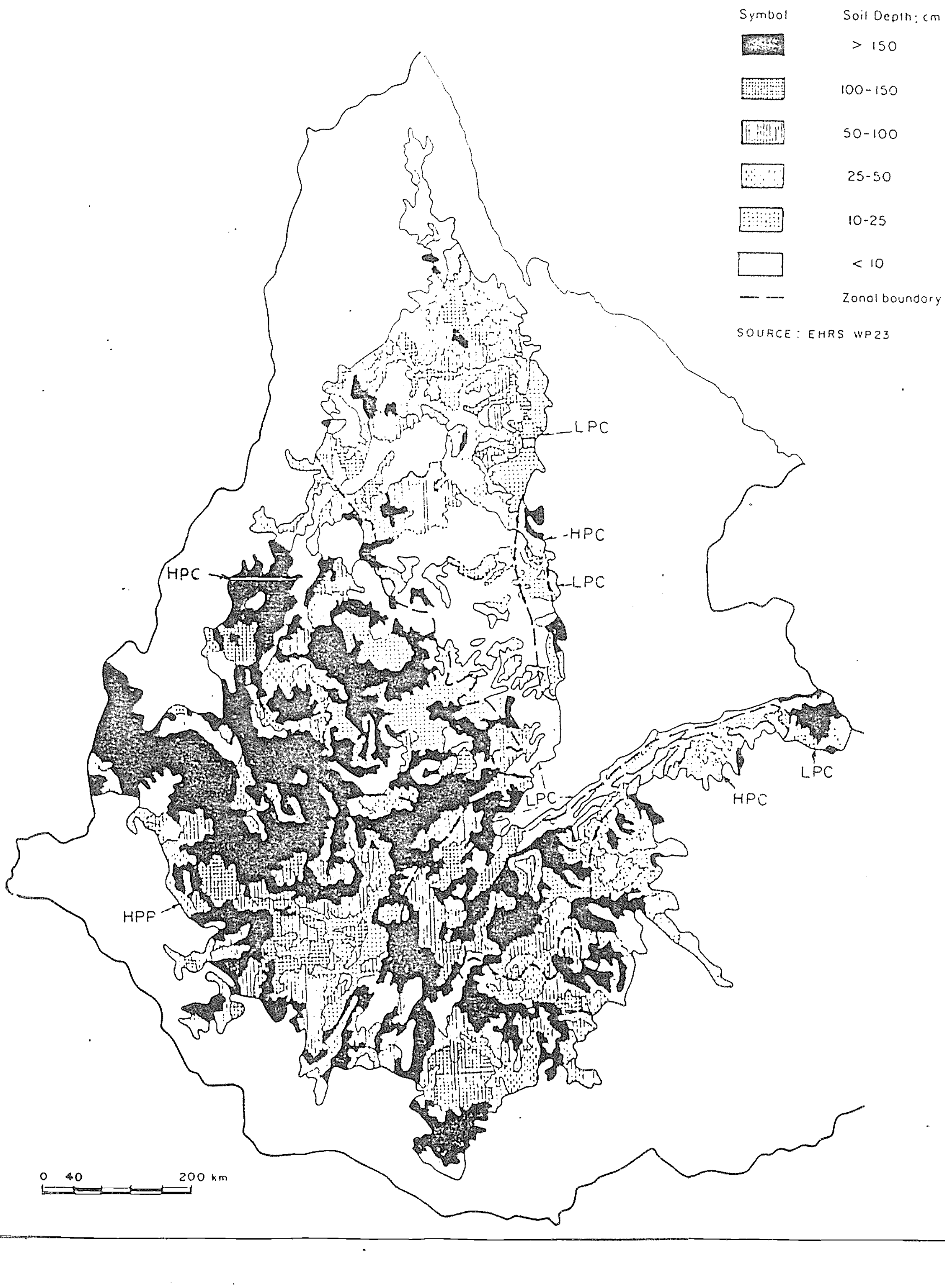
Population growth as well as the processes of erosion themselves are likely to accelerate further rates of erosion, and if present trends continue, most of the Highlands are likely to degrade at an ever accelerating rate (section 6.4.3). Notwithstanding this likelihood, soil depth in the year 2010 has been projected from 1985 depths, based on continuation of present rates of erosion, in order not to present an exaggerated or alarmist picture of the future (Figure 6.8). Bearing in mind large variations in soil depth within zones (section 6.2), table 6.5 summarizes the estimated reductions in average soil depth - indicating a likely 12 percent fall in the LPC zone from the existing shallow soils, so that by 2010 average soil depth may be only around 50 cm compared to over twice this depth in the HPP zone, on average.

It is estimated that around 100 000 km^2, or 18 percent of the area of the Highlands would be bare rock (7%) or have less than 10 cm solid depth (11%), by 2010, compared to an estimated 4 percent under these categories in 1985 (table 6.6). Most seriously affected would be the LPC zone with over a third of its land area, mainly in the higher altitudes, no longer capable of sustaining cropping. With the exception of a few pockets of deeper soils (mainly in Tigray, Gondar and Hararghe), the rest of the LPC zone would be covered by shallow soils.

In short, if present trends continue, in the Highlands as a whole, in addition to the present 20 000 sq km incapable of sustaining arable cropping, a further 76 000 sq km is likely to become similarly degraded by 2010, with substantially more lands moving into the same category later in the twenty-first century. The implications of these threatened future soil losses, if present trends continue, are reviewed in Chapter 7.

Figure 6. 8

ESTIMATED SOIL DEPTH IN 2010



Chapter 7

EFFECTS AND COSTS OF DEGRADATION

7.1 OVERVIEW OF EFFECTS

The last chapter concluded by reviewing the effects of degradation in terms of physical soil losses. This chapter attempts to look beyond the physical soil losses by reviewing their impact in social, economic and financial terms - to individuals, zones of the Highlands, and to the national economy. Precise quantification of many of the effects of degradation is not possible because of conceptual problems as well as lack of data. Conceptually, it is difficult to develop an adequate method for valuing human lives, a nation's land, and costs and benefits accuring to different generations. 1/ Even those costs which are conceptually more easy to identify and quantify may in fact be estimated only with difficulty because of inadequate data and/or quantitative relations between key factors which are not yet fully understood, e.g., soil and yield losses. Notwithstanding such difficulties, this chapter is intended to review the effects of degradation, indicate rough orders of magnitude of some of the more quantifiable costs of degradation, indicating where and why degradation costs most, and how costs are likely to change over time, and estimate the number of people affected - and by how much. In short, this chapter assesses the magnitude of the degradation problem in social and economic terms.

Although soil degradation has been defined (section 6.1) in terms of its reduced longer-term productivity, it has many other harmful effects (but few positive ones) including ecological deterioration, human and physical capital deterioration and agricultural production losses. These effects are felt variously over both time and place, by both individuals and the community, giving rise to both social and economic costs. The effects of degradation may be broadly grouped into two main categories:

1/ There are conceptual problems in using the normal economic analytical tool of discounting to value at progressively lower levels the costs and benefits occurring in the future. Costs of degradation increase over the indefinite future. Use of opportunity costs and discount rates applicable today gives disproportionate weight to the present generation and relatively little weight to future generations of Ethiopians.

(a) on-site effects or effects felt principally at the site at which soil is being degraded, e.g., the shift of land to less productive uses, the direct decrease in areas under cultivation, direct decrease in yields or production intensities and carrying capacities;

(b) "downstream" or ecological effects outside the immediate site of soil degradation and generally felt more widely, e.g., sedimentation, deterioration in water flow and drainage regimes, and other changes affecting the stability and fragility of the environment.

While the quantities of soil being lost from the Highlands are large (Chapter 6), the losses in soil productivity are usually even greater because erosion generally takes away the most productive parts of the soil (section 7.2.1). Reduced soil productivity means less biomass and less vegetative cover to the soil, less return of organic matter, thus accelerating erosion as well as biological and physical degradation of the soil in a downward vicious spiral. If such losses go beyond critical limits, irreversible damage and permanent losses in productivity can be caused, e.g., land going to rock, fields dissected by gulleys.

Degradation gradually makes the land more susceptible to the effects of drought and flooding. The joint GOE/WB mission on the 1973/74 Ethiopian famine concluded that:

"the disaster could not be entirely blamed upon natural causes, notably an exceptionally severe drought; but was largely brought about by a combination of bad land use and increasing human and animal populations. It is, and has been for many years, apparent that practically all land that can be cultivated is cultivated..... The combination of all these adverse factors, which together add up to long continued bad land use, is the primary cause of the disaster..... It thus comes about that a greater and greater proportion of the total human population is attempting to survive in fundamentally unsuitable areas; and when a drought strikes, a much greater number of people are affected than would be the case if land use was soundly planned and such undesirable practices controlled."
(GOE/WB, 1974)

The causes of the famine are complex and interrelated. Degradation has been an important factor in increasing vulnerability to crop failure, but degradation itself, and stagnant technique need some explanation. Pricing and taxation policies which reduce incentive - or better, which inhibit motivation from emerging - have contributed to maintaining an exploitive and unproductive agriculture. Such policies have been a continuing part of a pattern of neglect which has produced an agriculture with no reserves - of stored crops, of soil moisture, or motivation - with which to face the threat of crop failure.

Soil degradation damages water and drainage regimes by reducing rainfall infiltration and increasing run-off. The resulting flooding and sedimentation can cause damage in lower-lying areas. Sediments pollute water in streams, rivers and lakes and accumulate in bottom lands, in stream channels and in reservoirs. Reservoir capacity, effective life and value are reduced. Flooding is increased in both frequency and extent. People and animals have to travel longer distances to collect water as catchment storage capacity is reduced.

Many of the above effects, both on-site and downstream effects, have in turn harmful secondary effects (e.g., reduced agricultural production reduces incomes from agricultural marketing, transport and storage, etc.). Thus degradation initiates negative "multiplier" effects on the national economy. Because many of the effects of soil degradation occur over long periods, they are often not readily observed and/or the effects are hidden by offsetting increases in productivity caused by technological or other developments which might be occuring at the same time. The pace of degradation might be relatively invisible, but it is steady, and if allowed to continue will threaten the livelihood of millions of Ethiopians and the achievement of important national objectives such as the alleviation of poverty, economic growth, food security. It is hoped that this chapter, by drawing attention to the magnitude of the effects of degradation, will be instrumental in attracting effort and resources for avoiding degradation in the future.

7.2 ON-SITE EFFECTS

7.2.1 Reduced soil productivity

Soil erosion reduces soil productivity principally by adversely affecting soil nutrients, infiltration of water and air into the soil, soil water-holding capacity, soil tilth and the surface configuration of the soil. The extent to which soil losses affect its productivity depends on many factors, important among which are land use type and land use management, and the decline in the capacity of the soil to support plant growth. Erosion generally removes the more fertile portions of the soil so that the productivity of what remains is lower. 1/ Organic matter is more highly concentrated

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1/ It has been crudely calculated that the replacement of some of the eroded nutrients from croplands would require over 30 000 tons of DAP fertilizer annually, at an annual cost of over US$7 million.

in top soils than in sub-soils, and erosion thus decreases the overall proportion of organic matter (section 6.3 and EHRS WP 23).

Whereas commonly held views have traditionally attributed the plant yield reductions caused by erosion mainly to soil nutrient and organic matter losses, in recent years more attention has been focused on the relation between erosion-induced yield reductions and remaining soil depth. For example, the USA National Soil Erosion - Soil Productivity Research Planning Committee concluded in 1981 that "erosion reduces productivity first and foremost through loss of plant-available soil water capacity", a conclusion reflecting a growing consensus in the relevant scientific literature. Erosion reduces the water-holding capacity of soil both by reducing its depth and by changing the soil water-holding characteristics - the latter by directly removing the top soil (which is generally more permeable than heavier sub-soils) and by selectively removing the small particles (section 6.3).

The water storage capacity of most plants is small, relative to water loss and uptake (Hsiao et al., 1980), and therefore water deficiency generally has a quick stress reaction for the plant. Some plants are more susceptible to drought stress than others, and some periods in the growth cycle may be more adversely affected than others 1/. Once effective rooting depth is reduced, plants become more susceptible to dry periods, particularly if they occur at a time when the plant is especially sensitive, e.g., at flowering. As effective soil depth is reduced plant yields/growth require a more regular rainfall and infiltration to keep the more shallow profile moist. For the above reasons, in lower rainfall areas (such as the LPC zone) yields may be reduced by moisture constraints in a typical rainfall year as well as by more crop failures in years of below-average rainfall. Thus erosion reduces average annual crop yields by:

(a) reduced average yields per crop season;

(b) increased frequency of crop failure;

(c) reduced crop seasons (cropping intensity) per annum.

Erosion not only threatens long-term productivity of land; it also reduces productivity in the shorter term. Effects of erosion accelerate over time, as the processes are self-accumulating (see

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1/ An attempt to quantify these plant-soil-water-root depth effects on yields has been made by Stocking and Pain (1983). They conclude that generally grains are more tolerant of soil moisture deficiencies than pulses which, in turn, are more tolerant than vegetables. However, there are wide variations; for example, sorghum has a much higher tolerance to moisture deficiency than maize.

section 6.4). Lower soil productivity means less plant growth, less organic matter returned to soil, etc. Less permeable sub-soils means more run-off, more erosion, further reducing soil water holding capacity, etc. (Stocking, 1984).

Despite the validity of these conclusions, quantifying the effects of plant yields is difficult because the processes are highly variable, they are not yet fully understood, and generally data are lacking.

Much research has been carried out on erosion per se, but there has been little on the relations between erosion and plant yields. Over 85 percent of the documented experimental work has been undertaken in the USA and most of the remainder in Australia (Stocking, 1984), and almost all of this takes the form of field plot trials, so that findings are necessarily site-specific and may depend on the method of experiment.

It is difficult, therefore, to estimate closely the reductions in yields in the Highlands cause by erosion, or to extrapolate from findings made for other countries. In section 7.4 analyses have had to be based on some guess-timates. Sensitivity tests were applied to see how sensitive findings are to alternative assumptions. To provide a comparative context, some of the soil-loss and productivity findings of studies for other countries are presented. FAO (1983g) quotes a wide range of quantitative estimates:

> "Ibadan, Nigeria: a 50% loss in productivity of maize and cowpeas resulted from removal of 3 mm of topsoil from a forest soil with a total depth of 15 cm. This amount of loss was calculated to occur in 10 years under existing practices. - Angonia, Mozambique: a 50% productivity loss was estimated to correspond to a soil loss of 10 cm. - Central USA: a 50% loss in productivity of maize was associated with a soil loss of 25 cm."

Site-specific studies in the USA have found that yields of barley, wheat and maize fall by 40 to 60 percent when soil depth is reduced from 15/30 cm to 0/15 cm (Huat, 1974). Other US studies suggest that maize yileds fall by 1.2 percent p.a. and pasture yields by 0.6 percent p.a. as a result of sheet erosion on only 6 percent slopes. Marsh (1981) has concluded from Australian studies that 1 mm soil loss reduces yields by 3 to 8 percent, and 8 mm loss causes yield reductions of 10 to 25 percent. These studies considered soils on slopes of 10 percent or less, in temperate regions. In the tropics, yield declines tend to be higher. In the Ethiopian Highlands, much cropping is on slopes much steeper than these - probably averaging 20 percent - and small seed cereals (teff, wheat, barley, sorghum) require finer seedbeds and therefore more ploughings than maize. It is in this context that rough estimates of yield reductions have been made for each zone, corresponding to the previously calculated rates of soil loss (section 6.4) and are reflected in table 7.1. The assumed crop and grass yield reductions for the three zones are roughly proportional to the percentage reductions in average soil depth and correspond to the broad geographical picture of projected soil water holding-capacity in the year 2010 as presented in Figure 7.1.

Table 7.1

ESTIMATED ANNUAL SOIL LOSSES AND CORRESPONDING YIELD REDUCTIONS IN THE HIGHLANDS BY ZONE

Zone	Average annual soil loss as % of 1985 soil depth	Average annual yield decline (% from 1985 level)					
		Used for main analysis		Range used for sensitivity tests			
				Low		High	
		crops	grass	crops	grass	crops	grass
LPC	0.5	3	1	1	0.5	5	2
HPC	0.4	2	0.5	0.5	0.25	3	1
HPP	0.2	1	0	0.25	0	1.5	0.25
Total Highlands 1/	0.3	2.2	0.6	0.6	0.3	3.4	1.1

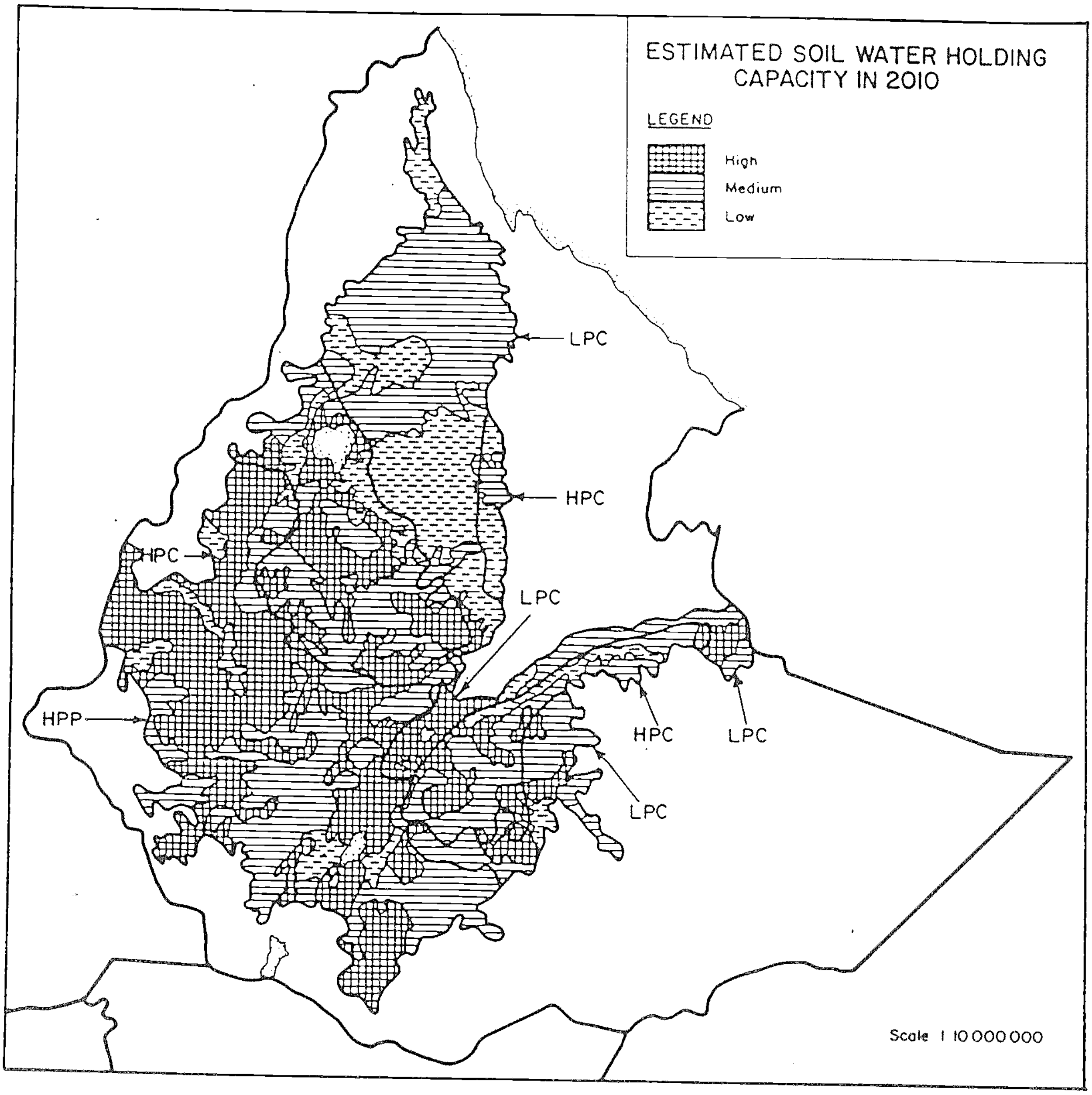
1/ Average weighted by respective land areas.

Source: EHRS estimates.

7.2.2 Changes in land use

In addition to lowering soil productivity, degradation also affects the proportions of land used for cropping, pastures and forests as well as the intensity of their use. The effects of severe gulleying are very visible; less visible but more significant in the Highlands as a whole (section 6.2) is the gradual loss of cultivable land due to sheet and rill erosion. In the cost analyses (section 7.4), it is assumed that when soil depth on croplands is reduced to 10 cm or below, the land reverts to pasture.

Fig. 7.1


ESTIMATED SOIL WATER HOLDING CAPACITY IN 2010
LEGEND
High
Medium
Low
LPC
HPC
HPC
LPC
HPP
HPC
LPC
LPC
Scale 1 10 000 000

7.3 DOWNSTREAM EFFECTS

Erosion has several important effects other than on the land on which it occurs. These 'downstream effects' arise primarily from the deposition of sediment carried by run-off, the associated increase in the frequency and severity of flooding and losses in water resources. As erosion accelerates (Chapter 6), so sedimentation will give rise to more problems. This section reviews some of the major problems normally associated with sedimentation. 1/

The deposit of sediments may have both positive and negative effects. Because sediments often have a high nutrient content, sedimentation can be beneficial in increasing land productivity. Much land in Egypt might never have been developed if it were not for sediment deposits coming from the Ethiopian Highlands. However, within Ethiopia, it is considered that any farming benefits accrued from deposition of sediment are insignificant and short-lived. Top soil sediment is sooner or later covered by less fertile sub-soil sediment, and almost always the deposition of sediment leads to a reduction in the permeability of soil whereon it is deposited, as the fine particles settle into the water-conducting pores of the soil profile (see section 6.3). Although only as low as ten percent of the soil may be totally lost, these fine particles are probably the most fertile and valuable part. Sedimentation can also damage vegetation.

With increased run-off, less rain soaks into the soil to recharge the groundwater resources; springs dry up, and perennial streams and rivers flow only during the rainy season. In the EHRS Sociological Survey, people complained about having to spend more time and energy in collecting water from more distant sources. Respondents in the EHRS Sociological Survey also complained about the deteriorating quality of water.

An important negative effect of sedimentation is the silting up of water reservoirs. Technologies are available to dispose of sediments, but costs are high. The silt in the water results in

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1/ It is confirmed by the authorities concerned (WARDA, SWCD) that the sediment content of the Highland rivers is generally increasing. However, data to indicate even approximate increases over a number of years are not at present available. Although data on suspended sediment loads carried by major Highland rivers have been recorded for many years in some cases, the data have generally not been aggregated so that they can be readily compared, except for those periods covered by specific studies, mainly in the 1960s and early 1970 (i.e., FAO, 1965; Bureau of Reclamation, 1964; National Water Resources Commission, 1973).

greater wear and tear on hydroelectric turbines. These are important considerations for Ethiopia, with its hydroelectric power resources (section 4.7).

Quantification of many of these downstream effects is difficult, given the lack of data on sedimentation and the limited time and resources available for the EHRS. These effects and costs, however, are nonetheless important. In some areas of the Highlands, the downstream costs of degradation might be more significant than the on-farm costs.

7.4 ESTIMATED COSTS

7.4.1 National and zonal level

This section presents some very tentative estimates of costs of degradation to the national economy, to different parts of the Highlands, and at farm level. (No attempt has been made to estimate downstream effects.) Thus the cost estimates reflect the value of reduced agricultural production resulting from the effects of erosion. The estimates should be veiwed as broadly indicative of costs, because of both the weak data base and the need for further methodological development. 1/ The reductions in crop and livestock production are based on the assumed effects of erosion in reducing yields (section 7.2.1) and areas (section 7.2.2) of croplands and grasslands respectively, differentiating between the major patterns of land use and farming described in Part 1 (Annex 4). These effects were derived from comparison of two scenarios over periods of 25 and 50 years:

1/ The methodological weaknesses are explained in detail in EHRS WP 12. They derive essentially from the limited understanding of relations between soil losses and yield reductions and the difficulties inherent in projecting soil losses. The analysis is therefore pioneering, and its results and limitations should be viewed in this light. Partly for such reasons sensitivity tests were applied to assess how sensitive results were to different assumptions and guestimates. As more information becomes available and knowledge of degradation processes and their economic effects is improved, methods for costing those effects can be refined accordingly. In the meantime, and bearing in mind these qualifications, it is considered that the analysis does present some useful first indications of some of the major costs of degradation, nationally, by zone and for individual farmers in different areas.

Table 7.2

ESTIMATED COST OF DEGRADATION: 1985-2010

(E.B. millions)

Zones	Altitude '00 masl	CROP LAND			GRAZING LAND			TOTAL	
		Cost of lost crop land	Cost of lower crop yields	Total cost of lost crop production	Cost of lost grazing land	Cost of lower grass yields	Total cost of lost production	Crop and grazing	% of total
LPC	15-20	554	1 308	1 862	32	740	772	2 634	17
	20-25	819	779	1 598	141	544	685	2 283	15
	25-30	518	207	755	63	130	193	948	6
Sub-total		1 921	2 294	4 215	236	1 414	1 650	5 865	38
HPC	15-20	604	758	1 362	76	283	359	1 721	11
	20-25	611	1 223	1 834	184	601	785	2 619	17
	25-30	230	608	838	63	325	388	1 226	8
Sub-total		1 445	2 589	4 034	323	1 209	1 532	5 566	36
HPP	15-20	1 111	1 187	2 298	48	0	48	2 346	16
	20-25	609	411	1 020	120	0	120	1 140	8
	25-30	163	143	306	38	0	38	344	2
Sub-total		1 883	1 741	3 624	206	0	206	3 830	26
Sub-totals by altitude	15-20	2 269	3 253	5 522	156	1 023	1 179	6 701	44
	20-25	2 039	2 413	4 452	445	1 145	1 590	6 042	40
	25-30	941	958	1 899	164	455	619	2 518	16
Total		5 249	6 624	11 873	765	2 623	3 388	15 261	100

Source: Estimated by EHRS Team.

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(a) continuation of present average soil productivity levels, and

(b) reduced soil productivity caused by continuation of calculated present rates of erosion (section 6.4).

To separate the direct effects of erosion, both scenarios assume that technology and all other factors affecting productivity levels do not vary between the two scenarios. It is assumed that population growth (projected in section 3.4) will result in proportionate increases in the total area cropped (i.e., average farm sizes remain constant), either by shortening fallow periods or by cultivating former grasslands until these are exhausted. Further population growth would then result in diminishing farm sizes (this only occurs within 25 years in the highest altitudinal belt within the LPC zone).

Table 7.2 indicates that degradation is estimated to cost Ethiopia over E.B. 15 000 million over the next 25 years, or an annual average of E.B. 600 million. This is equivalent to 14 percent of the contribution of agriculture to GDP in 1982/83. Because the annual costs increase (from an estimated E.B. 59 million in 1986 to over E.B. 1 800 million by the year 2035 - reflecting the accumulation of more and more degraded lands), costs over a 50-year period would average almost four times as much. Around 80 percent of the losses are attributed to reduced crop production (of which 45 percent would be due to areas going out of crop production and 55 percent due to lower crop yields) and the balance from reduced livestock production. Losses would be greatest in the LPC zone (38%) and least in the HPP zone (26%). It is further estimated that national grain production would be reduced by as much as 2 percent p.a. on average. In the early 1980s this would be equivalent to a loss of over 120 000 tons of cereals annually, but the losses would increase substantially over time.

When losses are related to the hectares of land used for cropping and grazing, respectively (table 7.3), degradation costs per hectare cropped would be greater in the HPP zone than in other zones because of the relatively high value of crop yields there.

When future degradation costs are discounted 1/, the present value of degradation costs over the next 25 years has been calculated at E.B. 4 200 million, or on an average annual basis still

1/ A discount rate of 9 percent was used, being the present interest rate for agricultural loans in Ethiopia; this is considered to approximate the opportunity cost of capital. See also footnote under section 7.1 indicating conceptual problems inherent in applying discounting to costs of degradation.

over two percent of GDP in 1982/83. The present value of degradation costs over 50 years is calculated at E.B. 5 800 million.

Table 7.3

AVERAGE ANNUAL COSTS OF DEGRADATION PER HECTARE CROPPED AND GRAZED

Zone	Cost (E.B.) per ha/p.a.	
	Cropping	Grazing
HPP	44	3
HPC	31	21
LPC	29	25

Source: EHRS estimates.

The sensitivity tests showed that total degradation costs vary with changes in critical assumptions, as follows:

Table 7.4

PERCENTAGE CHANGES TO ESTIMATED COSTS OF DEGRADATION WITH ALTERNATIVE ASSUMPTIONS

Assumptions				Percentage difference to the estimate of degradation costs (over 25 years, undiscounted)
- Yields	% of fall p.a.:			
	HPP	HPC	LPC	
Crops	5	3	2	+15
	3	2	1	0
	1	0.5	0.25	-23
Grass	2	1	0.25	+15
	1	0.5	0	0
	0.5	0.25	0	- 8
- Labour inputs valued at E.B. 1 instead of E.B. 2 per man-day				+28
- Soil losses occur at half calculated rates				-18

Thus, even if erosion rates are reduced by 50 percent from those estimated, and the ratios of soil losses to yield reduction are reduced by up to a quarter of those estimated, it is calculated that degradation would still cost over E.B. 9 000 million over the next 25 years, or an average of over E.B. 360 million p.a. This is still equivalent to over 8 percent of agriculture's contribution to the GDP in 1982/83.

7.4.2 Per capita income at farm level

Farm incomes are estimated to fall in all the nine sub-zones as a result of continued unchecked erosion, and by around 30 percent on average in the Highlands as a whole. Most critical is the situation in the LPC zone, where average per capita incomes could fall by over 50 percent in 25 years - partly reflecting the increasing areas no longer able to support cropping. The situation would be better in the HPC and HPP zones, with projected decreases in per capita income of 26 and 15 percent, respectively.

In practice, the effects of degradation in reducing per capita incomes probably would be partially offset by yield improvements associated with technological and other development, resettlement of population to less degraded areas (Chapter 9), food aid and the development of non-agricultural sources of income. However, although such developments might mask the costs of degradation, they would not negate them. Degradation would still be costing both Ethiopia as a whole - and the Ethiopian peasants - reductions in wealth and development which they can ill afford.

In these analyses care has been taken to avoid over-dramatisation or exaggeration of the costs of degradation by basing the analysis on conservative assumptions. For example:

- that rates of soil loss remain constant. In practice, without conservation measures, these are likely to accelerate (section 6.4);

- that agricultural productivity levels remain constant. In practice it is likely that yields could be increased so that the reductions caused by degradation would be greater than assumed; and

- that AMC "producer prices" adequately reflect crop values. Actual market prices are 20 to 30 percent higher.

In addition, downstream effects (section 7.3) and many social effects have not been costed. For these reasons the above calculated costs of degradation, if present trends continue, may be considered conservative.

7.5 NUMBERS OF PERSONS AFFECTED AND SOCIAL COSTS

Most areas of the Highlands are losing soil, and if these losses continue unchecked, then practically all of the Highlands population would sooner or later be adversely affected by degradation. Most rural incomes will be reduced by degradation. The people likely to be most seriously affected first are those already farming on shallow soils, where further soil losses in the next few years will result in the soils becoming too shallow to support cropping (i.e., 10 cm or below in the analyses) and subsequently too shallow even to support pastures for grazing livestock.

It has been estimated (section 6.5) that by the year 2010 some 38 000 km of the Highlands would be down to bare rock and a further 60 000 sq km would have a soil depth of 10 cm or below. The most extensive of such areas will be in the LPC zone, where over a third of the land area would be so classified, compared to 14 percent in the HPC zone and four percent in the HPP zone. If rural population density within each zone were evenly distributed over the whole land area, this would imply that a total of almost 10 million persons would in 2010 have to derive their food and income from sources other than cropping their own lands. They would have to be absorbed elsewhere in the economy.

Table 7.5

POPULATION LIKELY TO BE AFFECTED BY LANDS BECOMING UNABLE TO SUSTAIN CROPPING BY 2010

(millions)

masl	HPP	HPC	LPC	Total Highlands
Below 1 500	0.01	0.01	0.02	0.04
1 500-2 000	0.7	0.8	1.5	3.0
2 000-2 500	0.6	1.0	2.5	4.1
2 500-3 000	0.3	0.4	1.4	2.1
Above 3 000	0.1	0.1	0.2	0.4
Total	1.71	2.31	5.62	9.64

Source: EHRS team estimates.

Table 7.5 shows that almost 60 percent of the persons thus affected would be in the LPC zone, reflecting basically the long history of higher population density and the already shallow soils and low soil formation rates in the LPC zone. In practice, most of these people would probably have to move to other areas (Chapter 9) or farm sizes per capita would have to shrink still more. But this too would only hasten the demise of such areas. A longer lasting solution has to be found. Soil is and will for the foreseeable future be the basis for food production. Will there be enough of it to feed twice as many people just one generation from now? If present trends continue unchecked, today's children may be likely to see over a third of the Highlands become incapable of supporting cropping in their lifetime. This disturbing scenario has to be viewed against likely increases in population growth, which may result in trebling of the Highlands population in the same period. If present trends continue, it is likely that nature will impose its own socio-ecological checks by increasingly frequent and severe famine. In human terms alone, Ethiopia has to avoid this scenario. The changing of present trends is the purpose of Part III of this report.

Chapter 8

EVALUATION OF ACTIONS TO COMBAT DEGRADATION

8.1 AWARENESS OF THE PROBLEM AND ITS SOLUTIONS

In their efforts to secure food and other needs, Ethiopians over the centuries have taken little account of the needs of future generations. Ethiopian agriculture has developed in such a way as to threaten its future capacity to sustain development and support life. In the socio-economic systems of most of Ethiopia's past the conservation of resources has been neglected. Only in the last decade or so has the Ethiopian Government initiated significant actions to combat resource degradation. The new socio-economic order and the quickening pace of degradation itself are increasing Ethiopian awareness of resource degradation. It is unfortunate that most degradation occurs so gradually and subtly that its effects are easily overlooked until long after preventive action should have been taken, but better late than never.

Awareness of the degradation problem in Ethiopia and elsewhere has been enhanced by various international initiatives in the last decade or so: for example, the 1972 UN Conference on the Environment, the establishment of the UN Environmental Programme (UNEP), the World Conservation Strategy launched by the International Union for Conservation of Nature in cooperation with FAO and UNEP, and many meetings on desertification, degradation and drought. These increases in meetings, conferences and symposia have been matched by increases in the numbers of books, journals, studies, missions and technicians working on conservation. There appears to be growing recognition of the severity of global degradation, and Ethiopia is often cited as one of the countries most seriously affected. As a result of this international attention, the processes of soil degradation are now better understood, and the effectiveness of many technical solutions has been proven. In spite of this knowledge, not enough is being done to combat degradation, basically for the reasons already indicated summarily in section 6.3.4.

While the expansion of activities in conservation by the GOE (section 8.2) indicates the growing awareness of the problem, the limited coverage of such activities (one percent of the total Highlands area) and their narrow focus suggests that proper understanding of the problem, processes and solutions of soil degradation, as well as its severity, is still lacking in most sections of government. Thus, for example, conservation still tends to be viewed primarily in terms of bunding, terracing and reafforestation and as a responsibility of one or two government departments. There is as yet little official recognition that the conservation of resources should be an underlying theme of all institutions and departments concerned with land use and that the way in which land is used is ultimately much more important in conservation than structural works such as terracing. There remains a wide gap at government level between awareness of the problem and the magnitude and scope of actions to combat it. One of the purposes of this report is to close that gap by making action proposals for consideration by Ethiopian planners, decision-makers and politicians, backed by information and informed judgements concerning the extent and severity of the problem, estimates of costs and benefits of combatting the problem and identification of priorities. But implementation of the proposed actions will require resources, and in this respect awareness and understanding of the problem has to be fostered among external agencies able and willing to assist the Government in its endeavours, and even more importantly, among the people of Ethiopia.

International funding agencies have generally been hesitant to support large conservation programmes because of lack of interest at political and economic planning levels in the agencies concerned and in national governments, often because of the difficulties inherent in attempts to quantify benefits and economic rates of return from such programmes, because of long gestation periods and because support on a meaningful scale requires a long-term commitment of substantial funds.

Popular awareness of the degradation problem is clearly indicated by the EHRS Sociological Survey. Eighty-nine percent of the 1 000 peasants interviewed indicated that the land was being degraded, while 79 percent replied that the rate of degradation was already serious and accelerating. Over three-quarters of the peasants interviewed thought that people needed to be made more aware of the problem. Inadequate individual awareness was considered by the interviewed peasants to be by far the most important factor limiting spontaneous popular participation in conservation activities. While farmers' present awareness reflects recognition of symptoms (e.g., declining crop yields, availability of livestock feed, fuelwood, water, gulleys, etc.), farmers in the same survey showed little understanding of the underlying causes but said they wanted to learn about solutions. By far the most important factor cited in contributing to success of conservation activities was education. In proposing priority actions to further conservation and increase peasant participation, education was considered most important by far (40% of the respondents), followed by the provision of food for work (21%), material aid (shovels, axes, etc.)(13%), and demonstrations (10%). Thus the EHRS sociologists concluded that the peasants "want to know what to do (about degradation) and to be given material help with which to carry out these actions" (EHRS WP 4, p. 73).

Some awareness of conservation needs and techniques may be inferred from the very limited evidence of physical structures used in the past. Examples, however, are few and limited, and the well known terracing in Konso is more for conservation and use of water than for soil conservation, per se. This is not to undervalue this important island of local knowledge in water conservation.

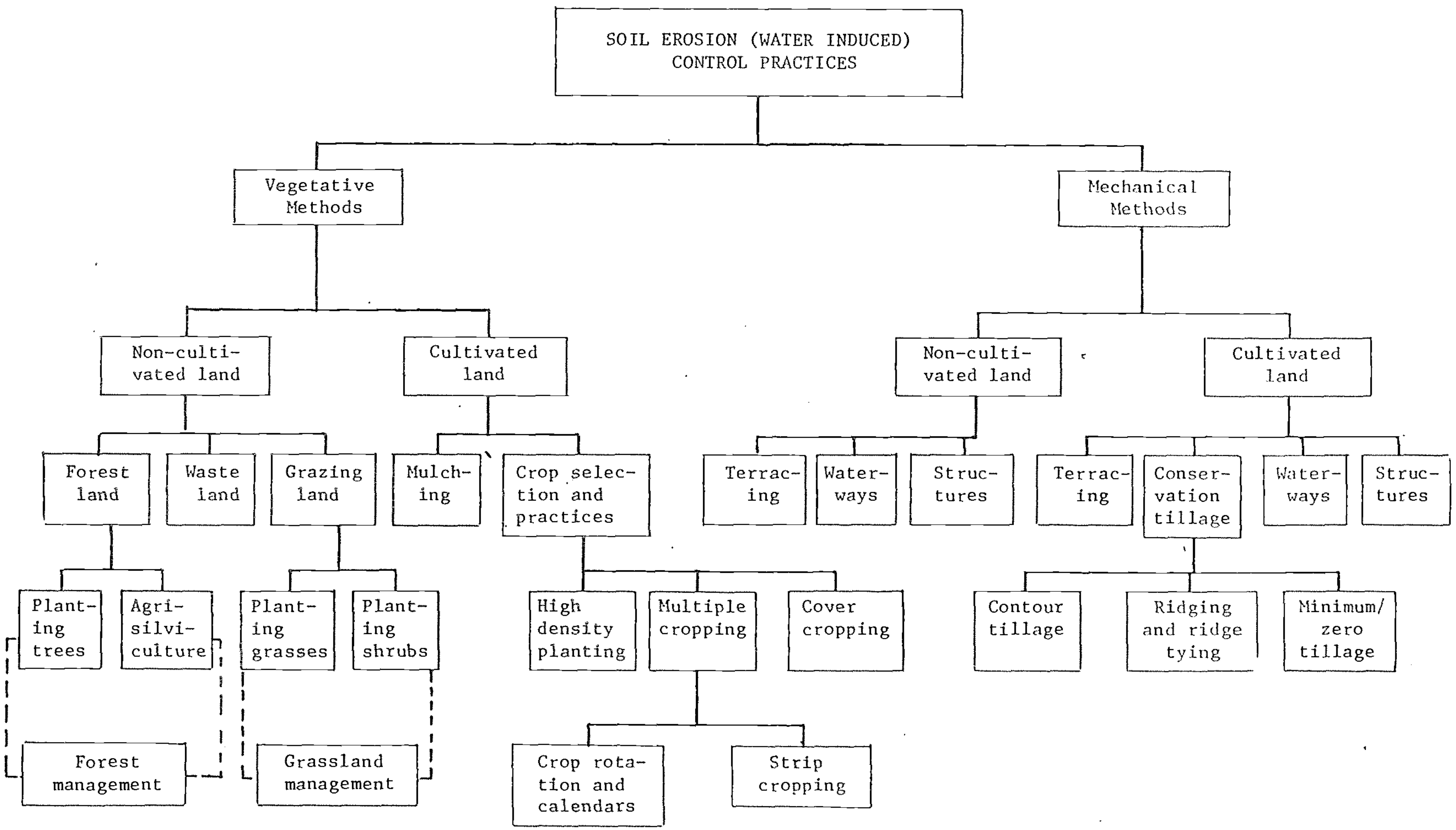
Knowledge of solutions is not enough; there must also be motivation to apply that knowledge. Returns from conservation are not easily discernable, especially where conserving the soil merely preserves the status quo of productive potential that would otherwise be eroded away only very slowly. Lowered potential is too easily overlooked, as it may be masked by weather variations, new crop varieties, fertilizers, etc. Direct benefits from structural measures are likely to be noticeable in the short run only where they conserve otherwise deficient moisture. This has been found among peasants in semi-arid areas of Kenya (EHRS WP 13) and might also apply in the LPC zone. Even those who are aware of some of the methods of conservation - and who would benefit therefrom - may be reluctant, on cost-benefit considerations, to undertake such measures. When there is insecurity of land tenure (see section 3.5) there is concern that if resources are spent in conserving their soil of today, this may be wasted if tomorrow they are allocated different plots without compensation for the resources previously spent on conservation. Costs are incurred by the present land user to give benefits to some future land users who may or may not be related to the present land users. Conservation offers a rather uncertain long-run return for peasants who have necessarily to be primarily concerned with their more immediate needs for food and income.

To conclude, it is apparent that it is not so much awareness of the problem as an understanding of the processes of degradation, the extent and severity of the problem and the basic principles of conservation that need to be increased among both rural people and government decision-makers alike. And most importantly, there has to be adequate motivation for people to conserve their land. Conservation is not just bunding and reforestation (see inset on basic principles of conservation):

> "Conservation needs are much wider than just the application of soil conservation techniques but require a general policy by which soil conservation becomes an integral part of wide land use, and receives support within a social and economic environment which is conducive to the maintenance and improvement of the soil capital" (Dudal, 1981).

Understanding is the first stage to building spontaneous desire to tackle the problem. Education is the basis for understanding. Unfortunately, there is at present too little data about soil degradation, the basic principles and practical techniques of conservation in

Figure 8.1 GROUPING OF CONSERVATION METHODS



THE BASIC PRINCIPLES OF CONSERVATION

The basic principles of combatting erosion 1/ stem from the underlying processes and factors contributing to erosion (section 6.3):

(a) reduce rainfall impact on the soil (reducing soil detachment);
(b) reduce run-off volume and velocity (reducing soil detachment and sediment transport); and
(c) increase soil resistance to erosion (reducing soil detachment).

(a) Rainfall impact is reduced by conservation practices providing a cover over the soil, e.g., vegetation, plant, residues, or mulches. Soil detachment and surface sealing is also reduced approximately proportionately to the percentage of cover. Furthermore, some covers intercept at least parts of most large drops, reducing them to smaller, less erosive droplets.

(b) Reducing run-off. Conservation practices that increase infiltration or leave the soil surface so rough that it can pond major quantities of potential run-off, may reduce erosion appreciably. Large amounts of vegetation or mulches reduce soil-surface sealing and maintain higher infiltration rates. Tillage methods that leave the surface rough and cloddy may provide much surface storage potential. Contour farming with ridged crop rows at small row gradients reduces run-off velocity on upland slopes. Graded terraces also do this by having channels of slight gradients so that the run-off is carried slowly around the slope, rather than allowing it to flow downslope. In contrast, contour strip cropping slows the downslope flow in densely vegetated strips so that much of the sediment carried from the erodible strips is deposited before the run-off continues downslope. Conservation practices that maintain dense vegetation or anchored mulches are usually very effective in absorbing the scour force of run-off. Conservation tillage systems dissipate both raindrop and run-off effects, which is why they are so effective on short to moderate slopes.

(c) Increase soil's resistance to erosion. Growing vegetation and vegetative residues increase organic matter content in the soil and make it less erodible (section 6.3). Conservation measures that reduce land slopes make soil less susceptible to erosion as also does a cover over the soil.

In the Highlands, among the factors contributing to erosion which appear to be most controllable in the shorter term are land use practices (and the vegetative cover implied), and slope length and gradient. This inherent erodibility of soil can be reduced only over a long time. Improved land use practices can be closely correlated with improved farming, from which both conservation and high productivity stem. Conservation measures are described as vegetative or structural (see Figure 8.1). Vegetative methods (such as mulching, cover crops, reafforestation and any other practice through which erosion is reduced through vegetation) are effective in respect to all three of the principles listed above. Structural methods (such as terracing, bunding, drains) are effective in reducing run-off and have only limited effect in increasing soil resistance to erosion. In any given erosion situation, either soil detachment or sediment transport constrains the rate of erosion and retarding the slower of these two processes is usually the best way to reduce erosion. In the Highlands, detachment usually exceeds run-off carrying capacity on crop lands (section 6.3), and therefore particular emphasis is being given to reducing run-off by structural measures. But both vegetative and structural measures have feasibility limits, and usually both are necessary in varying degrees in an effective conservation programme, the exact mixture depending on land form, erosivity, erodibility and land use.

1/ This relates to water erosion: similar principles may be derived for wind erosion.

the normal curricula of primary and secondary schools in Ethiopia. This omission becomes all the more significant with the spread of education to rural areas (see section 4.8). Today's rural children are tomorrow's farmers. Conservation has to feature more prominently in all levels of education in order to change attitudes with respect to use of the land and its conservation for Ethiopia's development. Such education has to be accompanied by appropriate incentives and means for conservation. These crucial issues are the subject of specific proposals in Part III.

8.2 OVERVIEW OF CONSERVATION PRINCIPLES AND PROGRAMMES

Conservation activity in Ethiopia was very localized and not very significant before the mid-1970s. The 1973/74 drought drew the attention of people, Government and outside agencies to the degradation problem (section 1.2.1), and conservation soon became a priority of the new Government. The 1975 Land Reform Proclamation, and the subsequent formation of the PA's, demarcated areas of responsibility and provided the means of mobilizing labour resources for larger-scale activity. This was begun in the mid-1970s and subsequently with FFW by the World Food Programme (WFP). Practically all conservation measures undertaken in Ethiopia have been concentrated in the Highlands. They have been implemented by labour-intensive methods, and the number of man/days is therefore a reasonably reliable indicator of the growth in total activity and the relative effort put into different activities. From table 8.1 it can be seen that the total man/days put into conservation activities has more than trebled in the last 5 years and has averaged around 35 million p.a. in recent years. This is equivalent to around 5 man/days p.a. for every family in the Highlands. The FFW programme has been undertaken in the seriously degraded and most accessible (usually along the main roads) food deficit areas (mainly in the LPC and lower rainfall parts of the HPC zones). However, "voluntary" conservation works have been organized through the PA's in degraded areas in food surplus areas of the Highlands. Voluntary and wage-paid labour accounted for around two-thirds of the total labour inputs into conservation in the 1970s. The size of the programme expanded much more quickly than the capacity of the institutions concerned to pay wage labour for conservation works, so that by 1982/83 96 percent of the activities were being carried out by FFW and voluntary PA labour.

Other quantitative indicators of the rapid expansion of the conservation programme are given in table 8.1. It is estimated that around US$250 million has been spent on the programme since 1978/79. The major emphasis has been on structural as opposed to vegetative measures of conservation (see inset and Figure 8.1). Structural measures have accounted for more than three-quarters of the recorded labour inputs into conservation in recent years. Around 90 percent of the activity on structural measures has been concentrated on terracing and bunding, totalling over 830 000 km 1/ by the end of 1982/83, the former on hillsides for reafforestation and the latter on sloping croplands (table 8.2). Thus although achievements up to 1982/83 have also been impressive in other structural conservation measures, including diversion canals (540 km), these latter measures have taken less than 10 percent of labour spent on structural measures.

Table 8.1

SUMMARY INDICATORS OF THE CONSERVATION PROGRAMME 1976/77 TO 1983/84

	Unit	1976/77	77/78	78/79	79/80	80/81	81/82	82/83	Total 5/
Man-days 1/	Mill.	<10	<10	17	33	33	36	38	156
Expenditure 2/	EB mill.	<40	<40	52	94	95	113	121	475
Terraces & bunds 3/	000 km	8	5	118	147	188	174	196	836
Trees planted 4/	mill.	<30	<30	36	74	87	151	124	472
Total area conserved	000 ha.	7	4	98	122	157	145	163	697 6/

1/ Includes FFW and wage-paid labour organized through SWCD and FaWCDA, and voluntary labour provided by PA's.

2/ Includes estimated total expenditures (including those financed by WFP and other external agencies) of SWCD and FaWCDA and imputed cost of PA voluntary labour valued at EB 2.00 per man/day, all at 1983 prices.

3/ Includes FFW work by FaWCDA and SWCD and voluntary PA work.

4/ Estimates assuming that all tree planting is on terraced land and that bunding/terracing averages 1.2 km per ha.

5/ 1978/79 to 1982/83 only.

6/ 1976/77 to 1982/83.

Source: EHRS estimates based on SWCD and FaWCDA data.

1/ Estimates on achievements are derived from labour input data and productivity work norms. Because some labour inputs are spent on re-doing previously poor work, the achievement estimates may be too high, perhaps by 10 percent or so.

Table 8.2

MAJOR CONSERVATION ACTIVITIES AS INDICATED BY LABOUR INPUTS 1978/79 TO 1982/83 1/

(millions of man-days)

	Structural measures					Reafforestation			
	Hill-side terra-cing	Bunding		Others	Sub-total	Seed-ling produc-tion	Other reaffo-resta-tion works 2/	Sub-total	Total
		soil	stone						
1978/79	4.9	5.9	1.6	1.4	13.8	1.3	1.9	3.2	17.0
1979/80	19.3	1.1	3.4	2.7	26.5	2.3	3.9	6.2	32.7
1980/81	12.4	6.1	4.9	2.5	25.9	2.3	4.8	7.1	33.0
1981/82	10.4	5.0	6.3	2.1	23.8	2.7	9.1	11.8	35.6
1982/83	17.6	4.4	5.1	1.5	28.6	2.5	6.8	9.3	37.9
Total	64.9	22.4	21.3	10.0	118.6	11.1	26.5	37.6	156.2

1/ Includes SWCD and FaWCDA initiated FFW activities as well as PA recorded voluntary activities.

2/ Includes mainly hole digging and planting, with some weeding.

Source: SWCD and FaWCDA

Vegetative measures have generally been confined to reafforestation, and to some closure of degraded hillsides to grazing or cropping to allow natural vegetation to regenerate. Hillside closure, totalling over 37 000 ha in 1982/83, is not labour-intensive, requiring only guards to keep people and grazing animals away. On the other hand, raising seedlings and planting trees are labour-intensive and have taken almost a quarter of total labour inputs into conservation in recent years. As a result, over 470 million trees were planted from 1978/79 to 1982/83, or well over 10 trees per Highland family p.a. on average. 1/

The total Highlands area thus conserved now exceeds 700 000 ha 1/.

1/ The footnote on the previous page applies. Further comments on achievements, tree survival rates, etc. are made in the appropriate sections of this chapter.

However, the potential conservation roles of cropping patterns, practices and calendars, of perennial grasses and legumes and agro-forestry, have been neglected until recently. Similarly, integrated catchment planning has only been given attention recently.

As the scale of activity increased, institutional arrangements for the organization and supervision of PA work were improved by upgrading the MOA's Soil and Water Division to Departmental status (SWCD) in 1981 and the establishment of the Forestry and Wildlife Conservation Development Authority (FaWCDA) in 1980 under the MOA. These two agencies are responsible, with the PA's, for most conservation activity in the Highlands. From table 8.3 it can be seen that PA's - in addition to providing all the FFW labour organized by SWCD and FaWCDA - have also provided some 38 percent of the labour inputs into conservation in the form of voluntary labour. In this respect the PA's are the most important institution involved in Ethiopia's conservation programme. Of the other two agencies, more labour inputs have generally been organized by SWCD. FaWCDA's conservation activities are generally confined to hillside terracing with reafforestation and hillside closure. Both SWCD and FaWCDA have expanded rapidly in the 1980s, but inevitably both still face organizational, operational and budgetary constraints (section 8.3). It is for this reason that the Government in 1982 drew up a list of 35 catchments in 8 regions for priority conservation activity (see table A8.1).

Legislation has generally not yet been used to regulate land use, but occasionally disciplinary measures are taken against peasants who destroy bunds and trees and graze closed hillsides. Much effort has been put into educating and training PA leaders and SWCD and FaWCDA staff to mobilize, organize and supervise conservation activities.

Table 8.3

LABOUR INPUTS INTO CONSERVATION BY INSTITUTION: 1975/79 TO 1982/83

(millions of man-days)

Agency	1978/79	1979/80	1980/81	1981/82	1982/83	Total
SWCD	4	13	9	13	14	52
FaWCDA	7	10	12	8	11	43
PA (voluntary only)	6	10	12	15	13	55
Total	17	33	33	36	38	150

Source: FaWCDA and SWCD

8.3 ORGANIZATION, FUNDING AND EXTERNAL ASSISTANCE

8.3.1 The Peasant Associations (PA's)

Conservation activities within the boundary of a PA (and over 85 percent of the land area within the Highlands falls within PA boundaries - the main exception being urban areas, State Farms, new settlements and forests of over 40 ha, which are under the jurisdiction of FaWCDA) 1/ can only be undertaken with the agreement of that PA. The establishment, powers, functions, organization and working of PA's were reviewed in section 3.6. The usual process for the execution of conservation activities is for FaWCDA or SWCD officials to draw up workplans for specific (sub-) catchment areas in accordance with certain targets set by the central authorities. These are then submitted to the Awraja or Wereda representatives of the PA's and passed down to individual PA's, where the proposals are discussed with the officials of the two Departments as well as the Awraja or Wereda representatives of the MOA. SWCD and FaWCDA personnel normally advise the PA to call a general assembly of all PA members to discuss conservation proposals and their implementation. The PA decides whether to accept conservation targets proposed by SWCD and FaWCDA personnel, and decides how to execute the work, selecting people to participate in the work. PA's also select some of their members for training in conservation, administration and work supervision. The PA's usually divide themselves into work teams. The layout of conservation works and the supervision of work teams is undertaken by trained PA leaders. Work teams usually work one or two days a week, depending on the demands of normal agricultural activities, and most conservation activities are deliberately phased to take place in the less busy periods of the agricultural calendar (see Figure 8.2). Work norms for major conservation activities are given in table A8.2.

The mobilization of peasants through the PA's has led to over 35 million man-days of work per annum on conservation activities, of which around 40 percent are voluntary. The rapid spread of conservation activities along the major roads of the Highlands (particularly the LPC zone and eastern and northern areas of the HPC zone) can be attributed to the response of the PA's and their members. The EHRS Sociological Survey found that 79 percent of the respondents had participated in conservation activities for an average of 18 days p.a. The PA's have proven to be an efficient mechanism for the mass mobilization and coordination of labour for public works. Even more importantly in the longer term, the PA's provide the means for genuine

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1/ Of the Highlands area of 536 000 km^2, 638 km^2 are under settlements, 1 676 km^2 are under State Farms, 41 000 km^2 are under forests (FaWCDA) and 26 800 km^2 are urban.

Figure 8.2 TYPICAL MONTHLY TIME SCHEDULE OF MAJOR CONSERVATION ACTIVITIES

Type of Activity	J	F	M	A	M	J	J	A	S	O	N	D
Bunds	----	----	----								----	----
Hillside terraces	----	----	----	----	----				----	----	----	----
Check dams	----	----	----	----							----	----
Nursery-seedlings	----	----	----	----	----	----	----	----	----	----	----	----
Digging pits for seedlings					----	----						
Planting seedlings						----	----	----				
Dam construction	----	----	----							----	----	----
Hillside closure	----	----	----	----	----	----	----	----	----	----	----	----

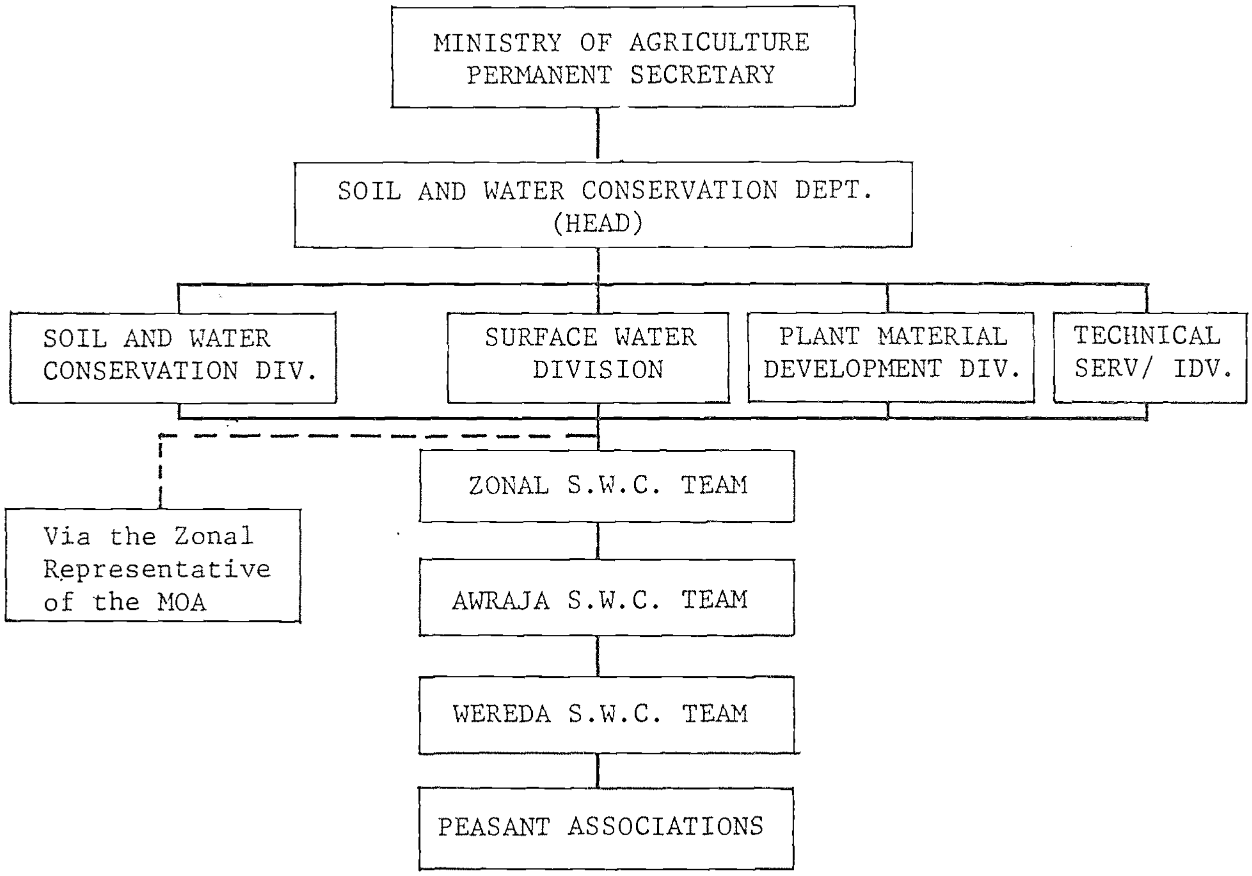
Source: SWCD.

development with grassroots participation, and it is important that this opportunity not be misused by attempts to maximize short-run work achievements by coercion. It is perhaps inevitable, given the national and regional priorities being assigned to the achievement of conservation targets, that in some areas PA members have to contribute "voluntary" (and non-paid) work of up to one or two days per week to conservation activities, and there are penalties such as fines or imprisonment for not so contributing. The EHRS Sociological Survey found that peasants were far more appreciative of conservation activities the greater their voluntary participation, and the lower the level of coercion. Fortunately, coercion is limited (22 percent of the respondents in the EHRS Sociological Survey said they had been coerced rather than persuaded to do conservation work) and genuine voluntary conservation work is increasing (table 8.3).

In addition to the provision of labour (including on-site planning, supervision and coordination) PA's contribute to conservation by providing shelter and food for visiting SWCD and FaWCDA personnel, constructing centres for local training, collecting funds for the purchase of materials and their transportation, constructing storage sheds, and recruiting and paying guards for patrolling closed hillsides.

The mobilization of the necessary labour and the high achievement of the conservation programme to date could not have been done without the PA's. Generally, wherever the PA's have taken on responsibility for achieving certain objectives they have proved successful. It would therefore seem desirable to try to increase their involvement and to encourage the PA's to participate even more fully in the whole

Figure 8.3 ORGANIZATION OF SOIL AND WATER CONSERVATION DEPARTMENT



process of design, planning and management of conservation works. Ultimately, real erosion control can be achieved and maintained only by the PA's themselves; the role of food-for-work should be limited to initiating and stimulating the process in selected areas only. Proposals are made in Part III.

8.3.2 The Soil and Water Conservation Department (SWCD)

The SWCD is one of six technical departments of the MOA (see Figure 5.3), and the head of the SWCD is responsible to the Permanent Secretary of the MOA. 1/ The objectives of the SWCD are:

(1) to create awareness among and instruct Ethiopians on degradation hazards and the need for conservation action;

(2) to plan, organize, execute, supervise and monitor the conservation and rehabilitation of lands and the small-scale use of water by the application of suitable techniques within an integrated approach to agricultural development.

The SWCD consists of four divisions (see Figure 8.3) with each head reporting to the departmental head. Every Regional Office of the MOA has a SWCD team. The teams are generally strongest in the seven priority Regions (table A8.1). Indicative work targets are set annually by headquarters and allocated to each Region. Within the Region, work sites are selected by the Awraja Soil Conservation Specialist, the local rural Development Agents (DA's) and PA leaders. The DA's are responsible for organizing the PA's, training their representatives and supervising and monitoring work generally. The Government's target is to have one DA for every four PA's, but the present ratio is about half this.

The numbers, qualifications and deployment of SWCD staff are listed in table A8.3, together with the transport at their disposal. The total number of staff has increased rapidly - from 88 in 1980 to 288 in 1984 - and most particularly in the field. The transport constraints faced by both SWCD and FaWCDA were partly relieved in 1981/82 by a UNCDF grant of US$1.9 million, as well as by UNDP/FAO projects (see below). However, transport constraints are still important at field levels in preventing DA's from visiting their PA's.

SWCD's budget (table A8.4) has increased rapidly in recent years to reach over E.B. 35 million in 1981/82. Around 75 percent of SWCD's budget has been provided by the WFP, with most of the rest coming from

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1/ Changes in the organizational structure of the MOA were officially announced while this draft was being prepared. The final version of this report will reflect the new organizational structure.

the World Bank/IDA and IFAD (i.e., Minimum Package Project II), SIDA, and FAO/UNDP. The Government contributes less than 5 percent. This budget excludes the salaries of regional SWCD staff - around E.B. 1.2-million p.a. - which are funded from MOA's regional budgets.

On-going projects being funded partially by external assistance include (apart from WFP assistance which is reviewed separately in section 8.3.6) 1/:

- UNDP/FAO/UNSO project ETH/81/003 "Assistance to Soil and Water Conservation Programme Phase II" (section 8.5). This US$2.8-million four-year project became operational on 1 January 1982, following ETH/77/005, also a UNDP-funded and FAO-executed project. The project provides a comprehensive internal and external training programme, technical support through the provision of 180 man-months by five internationally recruited staff (one training specialist, three watershed management advisers and one silvipasture specialist) in aspects of simple sub-watershed planning and the design and construction of erosion control works. The project also assists in the implementation of the WFP/FFW Programme;

- University of Berne/UNU "Soil Conservation Research Project" (section 8.5). This US$1.5 project became operational in 1981, and has a total of six research sites and 108 man-months of technical assistance; the project has recently been extended to the end of 1986;

- SIDA-funded Borkena Catchment Project. This US$1 million project began in mid-1982 and is assisting with non-food inputs in one priority catchment. Initially a one-year project, extension for a further two years has already been agreed;

- IDA/IFAD/SIDA Second Minimum Package Programme (MPP II). This two-year programme is providing budgetary assistance to SWCD as well as the other departments of the MOA, to strengthen the institutional and technical capacity of the Government in rural development. MPP II budgeted some US$4 million for soil and water conservation. The major inputs were for additional staff, staff training, vehicles, buildings and equipment. The Peasant Agricultural Development Programme (PADEP) will absorb the programme and decentralize it (section 5.8.4).

- FAO is also contributing financially to a short-term project of the College of Agriculture on "Training and Evaluation of the Soil and Water Conservation Programme" (section 8.5.1);

1/ Progress and/or evaluation reports are available for most of these projects.

- EEC is providing food aid, worth US$94 million, administered by WFP for conservation activities by SWCD and FaWCDA in Eritrea and Tigray for three years, beginning in 1984. Similarly, Australia is providing food and some technical assistance, at a total cost (to Australia) of US$6 million, for Gamo Gofa and Shewa regions, also for three years;

- In addition to the Borkena project, SIDA is also assisting SWCD activities through its Arsi Regional Development Assistance (section 5.8.4).

8.3.3 The Forestry and Wildlife Conservation Development Authority (FaWCDA)

The objectives, organization, functions, staffing and achievements of FaWCDA, as they relate generally to forestry, were reviewed in section 5.10. FaWCDA's conservation activities concentrate on reforestation and this includes hillside terracing, hole digging, the raising and distribution of seedlings and closure of overgrazed hillsides for natural revegetation. However, FaWCDA also undertakes some other conservation activities, including the construction of check dams and gulley plugging. The State Forest Development and Community Forest Development Departments of FaWCDA undertake these activities by working through the PA's. The organization of FaWCDA's conservation activities in this respect is very similar to that of the SWCD (section 8.3.2).

The two abovementioned FaWCDA Departments have an annual budget averaging almost E.B. 20 million (most of this is allocated to the State Forestry Department), much of which comes from external sources including WFP, SIDA and West Germany (see table A8.4). External assistance to FaWCDA was reviewed in section 5.10. Because these two departments in FaWCDA undertake several activities other than conservation - but do not keep separate activity accounts - it is difficult to estimate the proportion of FaWCDA's expenditures which are allocated to conservation activities.

8.3.4 Other agencies

Although over 99 percent of field level conservation activity in the Highlands is undertaken by the PA's in conjunction with SWCD and/or FaWCDA, there are a number of other agencies which have been involved (some more in the past than today) in conservation activities, including the Relief and Rehabilitation Commission (RRC), various regional projects - e.g., Ardu Development Unit, Wollaita Agricultural Development Unit (section 5.8) - and non-governmental organizations (NGO's), including mission churches and voluntary relief organizations such as the International Red Cross, Oxfam, etc. Very little centralized information is available on the scope of the activities of the NGO's, but their conservation activities are relatively insignificant in terms of total area covered, but significant in specific localities.

The RRC was established primarily to provide relief to victims of the 1973/74 drought and to resettle people from the most vulnerable areas. The primary resettlement functions and achievements of RRC, together with its organization and staffing, are reviewed in Chapter 9. RRC undertakes conservation activities in two ways:

(i) programmes as an integral part of rural development in resettled areas. These programmes form part of an overall strategy to promote agricultural and rural development in both degraded drought-susceptible and resettled areas. RRC consequently adopts conservation techniques as an integral part of its development strategy;

(ii) programmes as a means of reclaiming, rehabilitating and developing drought-stricken areas. Examples of these site-specific projects are the Sirinka Catchment Rehabilitation Pilot Project (section 8.4), the Golina-Hormat Catchment Reclamation Project, and the Kobo-Alamata Integrated Rural Development Project. Summary details of these latter projects are given in table A8.5. All the above-quoted projects are located in the northeastern Highlands.

8.3.5 Inter-agency coordination

There is some overlap between the activities of SWCD and FaWCDA with respect to both afforestation and terracing. These activities are organized by both organizations, sometimes on adjacent hills. Accordingly, it has been argued that all reforestation activities other than those on farm land should be carried out under FaWCDA's auspices, and SWCD should concentrate on its other important functions, given its limited staff and resources (Wenner, 1982). But this would require increased coordination between SWCD and FaWCDA. Because of the complementary nature of the field activities of FaWCDA and the SWCD and the need for integrated watershed development, the decision was made in 1978 to increase the coordination of their field activities, and to concentrate these activities in selected catchment areas. Closer coordination also offers the possibility to more effectively utilize available field staff, transport, food storage facilities and nurseries. Thus ultimately both agencies report to the Minister of Agriculture, who has on several occasions issued guidelines for coordination of the two agencies.

A working relationship has been established between the two agencies at headquarters level, particularly in relation to the identification of work sites, and in the preparation of work plans. An attempt has also been made to standardize the work norms being used by each agency (table A8.2). The agencies have also cooperated in training of field staff. However, coordination within the regions varies, and is largely dependent on personal relations of the field staff concerned. Such coordination has in some areas been constrained by rivalry and/or bureaucratic considerations, with the result that co-operation at field level often means the division of different work sites between the two agencies, rather than coordination of activities. Another reason for sometimes poor coordination between the two agencies relates to conceptual differences in viewing conservation. FaWCDA is necessarily much more concertned with timber production and SWCD with farming.

It is partly to further strengthen coordination between the two essential conservation areas of farming and forestry that it is proposed, as part of the pending reorganization of the MOA (section 5.8) 1/ that FaWCDA's activities be undertaken from within the MOA, in the "vice-Ministry" housing the SWCD.

There has been little success in integrating agricultural research (section 5.8) and the other technical work of the MOA with conservation, certainly at the national and regional levels. At the PA level, the SWCD activities are more likely to be integrated with the activities of the other MOA technical departments, because all these departments are now represented by the same Development Agent. A forestry input is lacking in this multi-disciplinary approach because FaWCDA works outside of this structure. FaWCDA plans to recruit Wereda level agents, who would be responsible for organizing field activities with PA's. These agents would perform a similar role to that of the exisitng MOA Development Agents.

8.3.6 The World Food Programme (WFP)

Between 1972 and 1975, WFP approved five projects to provide food to drought-stricken people in the Regions of Tigray, Eritrea, Welo and Hararghe, with a total commitment of 25 109 tons of wheat and sorghum, costing some US$7.4 million. These projects were basically demonstration and pilot projects. No regional coordination was allowed for, although this might have enhanced their overall impact. Following the nationalization of rural land in 1975 and the Government's increased awareness of the need for conservation, the projects were consolidated in 1977 into a single project for terracing and reforestation. To this project WFP committed 19 652 tons of wheat and edible oil, with a total cost to WFP of US$5.9 million. Concurrently another project, "Protection and rehabilitation of agricultural lands", was approved in 1976 to provide 85 300 tons of wheat and vegetable oil at a total cost to WFP of US$19.9 million for four years. In November 1978, a WFP/FAO evaluation mission recommended the consolidation of both projects in order to increase collaboration between the two executing agencies (then the Ministry of Agriculture and the Forest and Wildlife Development Authority).

1/ See footnote under section 8.3.2.

A new combined project was approved to continue the activities initiated under both projects, but with a greater emphasis on land-use planning and catchment-oriented planning and implementation of watershed protection measures. Under this project, WFP provides the MOA with cereals, vegetable oil and a 50 percent subsidy for food transport, storage and handling costs (in the form of extra cereals, which may be sold locally) for food-for-work rations for conservation work by SWCD and FaWCDA. These agencies in turn enter into FFW contracts with the PA's as already described.

The project commenced in July 1980 with the aim of providing food for 45 million man-days of work over four years. Owing to continuing shortages of grain in the project areas, the Government sought and received permission from WFP in 1980 to accelerate the pace of project activities and to complete the project targets in two years instead of four. The project has subsequently been extended up to 1986, so that the total project cost is now around US$185 million. The continuing objective of the WFP project is to provide a base for future agricultural productivity on degraded land, currently used for food crops, grazing or reforestation, by applying suitable soil and water retention techniques of vegetative and structural conservation. Major emphasis was given in the first project to earth-moving conservation measures, including terracing, bunding and check dams, which together account for around 80 percent of targeted man-days. In the extended project reforestation activities were given relatively more emphasis (23 percent man-days).

The food ration at the same time helps to improve inadequate diets of families in food deficit areas. The ration presently stands at 3 kilogrammes of wheat and 120 grammes of oil per man-day. This ration was first established for relief and rehabilitation projects following the 1973/74 drought, and was intended to cover the essential dietary energy requirements (1900 Cal. per capita per day) on the assumption that no other food was available. This latter assumption may clearly be questioned with respect to FFW activities where the work is undertaken primarily by persons coming from farming families. The fact that the project has never experienced a shortage of labour (instead, the number of applicants has exceeded the number of persons required, while the project has also attracted urban unemployed), suggests that the ration may be too high. Experience in the Sirinka project also suggests this (SPCRP 1984). Work opportunities under the project are generally offered by the PA's first to the poorest and those producing insufficient food to feed themselves, although this is not a contractual requirement of any of the agencies involved. The PA's also apparently try to spread the opportunities for work as widely as possible among their membership.

Work norms in terms of man-days have been agreed for each activity (see table A8.2). No revisions of these work norms have taken place since 1972 with the exception of reductions in the norm for reforestation and forage plantation. The achievement reports submitted by

SWCD and FaWCDA use the agreed work norms for calculation of the number of days worked. Actual days worked are not recorded nor is it possible therefore to evaluate the adequacy of the work norm. In addition, achievement reports of SWCD include all conservation activities undertaken whether these are achieved with voluntary labour or under the FFW programme. The contracts with PA's specify quantities of food to be paid upon completion of certain works. The number of workdays used to complete the work is of no concern to, and therefore not collected by, DA's. The PA team leaders keep a record of attendance as the basis for distributing the grain received as payment. These records could be collected by DA's and analysed in order to obtain an adequate picture of actual labour use as well as of the continuing applicability of the work norms. Work norms are also insufficiently specified with respect to height and width of terraces, diameter and depth of pits, width and strength of roads, etc.

The WFP project has already been the subject of evaluations in September 1980, November 1981 and November 1982 (see Annex 3). These evaluations in many cases relate to the conservation programme as a whole and reference is made to the WFP missions' findings and recommendations in the remaining sections of this chapter, as well as in some subsequent chapters. None of these evaluation missions has found any evidence of corruption or favouritism in the distribution of food. There have sometimes been delays in the arrival of food, but all workers interviewed confirmed eventual receipt of their rations. The missions have thus generally endorsed and praised the apprently effective organization and implementation of conservation work. The questions of the possible disincentive effects of the food-for-work programme and the issues relating to the quality of work carried out under this programme are addressed in sections 8.3.7 and 8.6, respectively.

8.3.7 Food-for-Work (FFW)

The previous sections have indicated the importance of the FFW programme in initiating widespread conservation activities. Quite apart from the increase in the total volume of food aid to Ethiopia in recent years, the proportion of that aid allocated to the FFW programme (table A8.6) has increased substantially. Furthermore, Canada, Australia and the EEC are now joining WFP in providing food aid for FFW.

The impact of the FFW programme has been considerable. For instance, WFP has estimated that nearly half a million families are benefitting from the project. Where food is distributed, the food received represents on average 10-20 percent of the total annual calorie intake. WFP has calculated that FFW employment is roughly equivalent to 115 000 full-time jobs, or equal to total employment in the manufacturing sector. Some doubt has been expressed as to whether this employment simply substitutes for unpaid voluntary PA work. The nature of voluntary PA work is decided by the PA's themselves and includes such activities as cultivation of the land of sick or absent members, construction of schools, health centres, roads, etc. as well as conservation works. Despite the rapid growth of FFW conservation, the total voluntary man-days put into conservation has continued to increase. FFW is important in providing work and food during slack seasons of the year.

In view of the high and still growing importance of FFW in conservation, WFP and FAO (1982) undertook a special study on its impact and, in particular, its possible effects in providing disincentives for grain production by:

(a) labour disincentives, which occur if FFW employment reduces the availability of labour for farming;

(b) price disincentives, which occur if the supply of FFW rations causes local grain prices to fall; and

(c) policy disincentives, which occur if FFW supplies cause lower priority and resources to be given to food production.

(a) Labour disincentives

A disincentive to farm labour could occur if farmers were persuaded to join FFW to the detriment of their own food production. However, the applicants for FFW consistently exceed the available supply of FFW rations. In areas covered by FFW, many households do not produce sufficient for their consumption and for sale to meet cash obligations. There is also under-employment, certainly seasonal and possible permanent, and a lack of alternative, temporary employment opportunities which are as convenient or as profitable as FFW. Labour disincentive might also occur if farmers estimate the value of the FFW ration to be greater than the returns accruing from food production on their own fields. But the market value of the FFW ration, at around E.B. 2 per man-day is considerably less than the average man-day returns calculated for the six average farm models of the HPP and HPC zones (see Annex 4, Farm Models), though about the same as the average man-day returns from crop production of the three average farm models of the LPC zone. Furthermore, in planning work schedules, FFW activities are reduced during the periods when the farm labour requirements are highest (compare Figure 8.2 with the cropping calendars given in Annex 4). Only a quarter of the farm labour employed under the programme is generally used from July to December, usually the peak period for agricultural production. Many FFW participants interviewed by successive WFP evaluation missions at different sites claimed that their relatives were perfectly able to cope with labour demands on their own usually small farms, while it was also thought possible to complete the required farm work in the afternoons after the FFW was finished. Moreover, FFW is usually limited to a maximum of three months p.a. per individual (the average being around 55 days) and farmers are unlikely to abandon their farms for such short-run gains which are unlikely to recur in the future. Thus all the FFW participants interviewed (by the EHRS team in its field trips as well as by others) confirm that they consider FFW as an additional rather than a competing activity to farming. Even so, many of them still have to seek further sources of income (usually livestock or wood/ dung sales).

A third form of labour disincentive could occur if the rewards from FFW are greater than average local wages for employed labour. This is unlikely to be important in the agricultural sector because FFW only employs participants for short periods and then during the agricultural slack seasons. Secondly, although there remain differences in family land holdings in terms of both size and quality, few farmers have more land than they can cope with themselves, and private on-farm employment is not generally common. While State Farms employ seasonal labour in, or adjacent to, some FFW areas (e.g., Chiffra and Dubti in Welo), they draw this labour from far afield, and it is unlikely that localized FFW activities primarily during agircultural slack periods have a major effect on the supply of labour to these farms. From limited inquiries in small towns in FFW areas, it appears that when FFW activities are at maximum intensity, town employers tend to postpone the hiring of labour rather than increase the wage rate to try to attract people away from FFW. It is therefore unlikely that FFW has pushed up local wage rates, even though the cash value of the FFW ration is competitive. It appears that rural underemployment is high enough to provide a surplus of people seeking temporary employment.

On the available evidence, it is therefore concluded that the labour demand of FFW has not been sufficient to cause a significant disincentive to local food production. For the future, there is clearly scope for further increasing the intensity of activities in priority areas; but the WFP impact study mission thought it would probably be unwise to increase the level of activity in the catchments where FFW has already been most concentrated. The possibility of disincentive effects occurring in these areas could be reduced by spreading the work schedules over a longer period, which would have the additional advantage of allowing the PA's to target FFW opportunities still more specifically to the most needy families and provide more opportunities for SWCD and FaWCDA staff to supervise the technical standards of the work.

(b) Price disincentives

At least 80 percent of the net output of cereals from the peasant sector is consumed domestically, does not pass through any market, and would not be subject to any price disincentive effect. In the cereal deficit areas, this figure will be even higher, probably well over 90 percent. The effects of any price disincentives on production in FFW areas would therefore relate primarily to the 10 percent of production which is marketed. After reviewing available information on market prices in several regions, the WFP/FAO mission concluded that the prices of wheat fall slightly (10 to 15 percent) in some local markets in FFW areas immediately following the distribution of FFW rations. But these falls tend to be temporary, and are localized and not observable beyond the area of immediate distribution or in central markets. It was observed that the prices of other cereals are not affected to any discernable extent, and the free market prices of all cereals in all FFW areas are high and have generally been rising over the years. Thus any price-led disincentive to production of wheat or other cereals resulting from FFW supplies is likely to have been localized and to be very small or insignificant. It was concluded that FFW rations do not significantly affect decisions to produce food crops because overall food shortages, as reflected by high prices, encourage peasants to maximize crop production, both for subsistence and for sale. Any price disincentives outside FFW areas would arise through prices in central markets. The fluctuations in national production due to climatic factors can easily reach 10 percent between one year and the next, and the effect of this on the wider market overwhelms any possible effects of FFW supplies, which represent less than two percent of national production of cereals and pulses. In any case, from analysis of quarterly prices for major cereals in selected regional markets, it appears that cereal prices outside project areas have not been affected significantly.

(c) Policy disincentives

A policy disincentive would occur if FFW in some way were to discourage the Government from investing in food production or if FFW supplies were to compete for transport, storage and other infrastructural investment relevant to agricultural development. Conversely, it is possible that FFW has increased the total allocation of resources to the agricultural sector. Two-thirds of the total costs in FFW schemes (i.e., WFP Project 2488) are spent on items other than the food itself, such as transport, storage, administration, and WFP is now subsidizing these costs to the extent of 50 percent. FFW supplies an additional resource which would not otherwise be available. Also, any reduction in AMC purchases caused by diverting transport/storage resources to FFW could be interpreted as an incentive to food production because the free market price is far higher than the AMC procurement price. The Government's allocation of resources to the agricultural sector has remained high in recent years. The sector is accorded first priority in the TYPP, and further increases in the resources allocated to agriculture are planned for the years ahead. It is therefore concluded that it is unlikely that there have been any significant policy disincentive effects from the FFW activities.

(d) Other effects

The WFP/FAO mission also considered possibilities that the FFW supplies may have displaced commercial imports. The main determinant of Ethiopia's commercial food imports is its foreign exchange availability and after reviewing the Government allocation procedures concerned, the mission concluded that foreign exchange allocations for grain imports were unlikely to be significantly affected by food aid.

Another possible effect is the potential influence on food consumption preferences. Apart from preparing traditional wheat-based foods, some people make a form of injera by mixing wheat with other grains. Food-aid wheat is a well-accepted commodity, and is far more welcome to recipients than maize would be. There is, therefore, the risk that food aid will promote a long-term change in rural consumer preferences. But to the extent that this reduces preference for the relatively low yielding and "erosive" teff, this may be desirable. A switch to more drought-resistant crops in the LPC zone would be even more preferable, but WFP receives relatively little sorghum or millet for it to seek to encourage or foster the development of tastes for these crops.

In conclusion, it is considered that food aid used in the FFW programme in the Highlands has permitted conservation activities to be initiated on a scale that otherwise would not have been possible, and so far with few disincentive side effects on agricultural production. FFW should continue to be used in this catalyst role. Proposals concerned with the continuation of FFW are made in Part III.

8.4 THE SIRINKA PILOT CATCHMENT REHABILITATION PROJECT (SPCRP) 1/

Among the actions undertaken by the GOE in the wake of the 1973/74 drought was the formulation in 1975, with World Bank assistance, of the Sirinka Pilot Catchment Rehabilitation Project (SPCRP). The SPCRP covers some 360 km^2 of variously degraded lands on the northeast escarpment. It was originally conceived as a pilot project to indicate the technical and economic feasibility and replicability of alternative catchment rehabilitation, conservation and land productivity - improvement measures that could be sustained

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1/ The GOE/FAO Agreement for the EHRS called explicitly for account to be taken of the experiences of the Sirinka project. For further information on the history, plans and achievements of the SPCRP, see the document compiled by the project itself (SPCRP 1984). An independent review of the SPCRP's achievements and their relevance to the EHRS is presented in EHRS WP 21.

in the long-run and would provide some protection from the effects of future drought. 1/ In view of its intended pilot nature, the SPCRP was deliberately located in a sub-catchment extending in unbroken ecological succession from montane grassland at 3 500 m, receiving some 1 600 mm annual rainfall, to semi-arid acacia woodland at 1 400 m or less, receiving 600 mm of rainfall. The land use systems within the SPCRP area were considered representative of much broader areas in northern Ethiopia. It was hoped that SPCRP would establish a firm data base from its testing and practical experience in alternative methods of conservation and rehabilitation to plan much larger scale development.

For a variety of reasons, the SPCRP did not become operational until 1978. During this delay, some accounts suggest that the nature and objectives of the project were re-oriented (SPCRP 1984), but if this was so, there appears never to have been any formal agreement

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1/ These objectives are inferred by the pilot nature of the project explicit in its title, the IDA Appraisal Report, the GOE/IDA Credit Agreement, and official GOE correspondence on the project. The SPCRP was financed, along with nine other sub-projects, as part of the "Drought Areas Rehabilitation Project" which was agreed by the GOE and IDA on 26 June 1974. The formal Credit Agreement (IDA Credit 485 ET) makes no mention of the SPCRP, but in its annex relating to ten sub-projects to be funded, it mentions (p. 12) a "Pilot Settlement Project in Wollo" with a budgetary provision of US$1 050 000, and (p. 16) "preparation and implementation of one or two integrated pilot settlement projects, in the Wollo Province covering approximately 25 000-30 000 ha and including afforestation, soil conservation, minor irrigation, land reorganization, extension, credit, marketing, research, nutrition, and some employment-oriented non-agricultural activities". Official GOE correspondence on the project implies that the main objectives of the SPCRP were described more fully in the IDA Appriasal Report (No. 444a ET of 7-6-74), paragraphs 3.34 and 3.35 of which state: "The proposed project would support an integrated pilot sub-project which will provide valuable experience in planning the long-term development of the drought affected areas... The principal components of this sub-project are (i) conservation measures, (ii) water development, (iii) crop development, including credit for seed and fertilizer, storage, and marketing, (iv) surveys and planning in connection with the reorganization of land holdings, (v) agricultural trials, (vi) evaluation, (vii) minor rural industries (viii) nutritional studies and (ix) administration. Details pertaining to these components are provided in Annex 2" of the same document.

revising the objectives and nature of the project from those indicated, albeit not in much detail, in the Credit Agreement and original IDA Appraisal Report. In such circumstances, objectives were unusually ambiguous and open to varying interpretation by successive project management personnel. Thus, for example, standard but partially mechanized conservation engineering works and reafforestation were emphasized almost exclusively up to 1980, at which time a change in project management was followed by much more emphasis on agricultural cropping trials. Over its period of implementation, the SPCRP has increasingly taken on a research - rather than a pilot project - orientation, and this has a bearing on the nature of the data and findings which are relevant to this study. Thus, although SPCRP has now operated for over six years, few conclusions can be reliably drawn with respect to conservation and rehabilitation of the Highlands. This reflects both the interpretation made of the original project objectives during implementation and the fact that implementation of SPCRP has been hinderd by a number of factors, including:

(a) changes in institutional responsibility for implementation (Ministry of Agriculture vs. Relief and Rehabilitation Commission) as well as substantial changes in project direction with resulting discontinuities;

(b) almost continuous uncertainty as to project funding, particularly from the World Bank. The project has, at short notice, been extended for one year at a time;

(c) problematic management-labour relations between 1981 and 1982; and

(d) security problems curtailing some activities for varying periods since 1981.

Such factors have constrained the SPCRP in three major respects:

(i) the opportunities for systematic planning of activities on a continuing and broad multi-disciplinary scale have been limited;

(ii) the activities that have been undertaken have not been systematically costed; and

(iii) there have been few attempts to systematically monitor and evaluate the effects and benefits of activities.

Conclusions which can be drawn from the SPCRP at this stage are generally limited, partial, tentative and not quantitative (especially not based on cost-benefit analysis). Among such conclusions (not necessarily in order of importance) are the following:

(a) Overgrazed and devegetated hillsides can, within three or four years, be remarkably revegetated naturally (Olea africana restablishes very fast) at only minimal costs, paying one or two guards at E.B. 45 per month to keep livestock off. One guard can look after 100 ha. However, sustainable levels of exploitation remain to be determined together with methods of supplementing natural regeneration. This finding would seem to question the economics of protection reafforestation, especially given the low survival rates achieved in reafforestation. Out of approximately 2 million trees planted by SPCRP over six years, only ten percent survived. In some areas there have been as many as three replantings. The low survival rate is attributed to poor site selection (e.g., shallow soils), inappropriate choice of species, poor nursery and transportation techniques and insufficient weeding after planting. SPCRP is now aiming at a 60 percent survival rate.

(b) Serious questions on the value of contour trenching and/or terracing for reafforestation have been raised. These can account for two-thirds of the costs of such reafforestation, and their construction destroys much indigenous vegetation and dislodges soil, making it more vulnerable to erosion. The rugged terrain makes correct alignment of terraces very difficult, with the result that water overflows low points. SPCRP has abandoned terracing for reafforestation.

(c) Grass strips (see Figure 8.4) by themselves, even on low slopes, are not very effective in reducing run-off, but they reduce the speed of run-off and trap sediment. Farmers do not readily accept either grass strips or bunds as these take valuable space in their small holdings, and they are often consequently damaged or destroyed by subsequent ploughing.

(d) Evaluation trials with indigenous legumes prove local plant material to be adaptable and high yielding, and seeds have been collected by peasants voluntarily for their own use. Local pastures are very rich in legumes, and some of these out-yield exotic species. Pure fodder cropping is unlikely to be feasible, given the shortage of arable lands, but intercropping with cereals could be developed. Trials intermixing lablab and sorghum show promise.

(e) Dwarf varieties of sorghum (e.g., ESIP 43), maturing within 90 days at lower altitudes, with yields significantly higher than locally used varieties, may provide a means of reducing effects of droughts. The seed is now in great demand among local farmers. Certain varieties of some millet species are also showing some promise of shorter growing periods; however the question arises as to whether such "research" trials should be undertaken by a pilot project, or would be more appropriate under IAR.1/

(f) Hedges (Leucaena leucocephala) planted along contours show promise in providing feed to livestock, controlling their movement, and reducing run-off.

(g) Resettlement, even of those people who had minimal means of support within the catchment, was time-consuming in terms of the persuasion needed and was not very successful in that 56 percent of the target resettlers had returned to the catchment within two years of their resettlement.

(h) Reasonably well aligned roads across rugged country can be built using PA labour. Some 25 km were built by SPCRP, at an average cost of less than E.B. 2 500 per km.

In addition to these tentative conclusions, the SPCRP has, through its various surveys and trials, amassed a considerable amount of physical (but not so much economic and very little financial) data on cropping, conservation, pasture and forage, which should be of use in micro-level planning and project preparation for agricultural production with conservation. While some attempts have been made in the later period of the SPCRP to build farmer participation, the SPCRP has effectively been isolated from regional and Awraja MOA representatives, and the extent to which their rehabilitation activities have been or could be influenced by the SPCRP under its present organization is very limited.

Generally, not enough attention has been given to integrating conservation into agricultural production and trying to test ways of making conservation attractive and worthwhile for farmers in the different land use systems of the area. However, much potentially useful research in catchment rehabilitation is going on at the SPCRP, and it would be wasteful of investments already made if the SPCRP were brought to a premature end, before the research can usefully be concluded. Continuation of its research activities, however, is not the only or even the major reason for supporting continuation of the SPCRP. Basically the originally conceived pilot role of SPCRP remains as valuable today and important as it was in 1975, and that role has not yet been fulfilled. It is therefore proposed that SPCRP be continued but re-oriented so that it can better fulfill its intended role. This would probably involve, among other things:

1/ An FAO agricultural research mission concluded in 1983 that varietal and cultivation technique trials do not appear as well managed at SPCRP as those of the IAR (FAO, 1983b).

(a) an explicit agreement on SPCRP objectives, funding staffing and plan or work extending over several years;

(b) pilot, rather than pure research, activities being emphasized - in terms of assessing the technical, social and economic feasibility of alternative methods of catchment rehabilitation when applied by farmers at the farm level, as opposed to research plot level. Only with this pilot orientation can SPCRP be the forerunner of a larger rehabilitation project which could absorb and be based on, but not confined to, the present Sirinka Project.

(c) some research activities being handed over to IAR and the remaining research activities being oriented more specifically to catchment rehabilitation;

(d) much more attention begin given to monitoring and evaluation of SPCRP activities, including the establishment of effective cost accounting and systematic recording and analysis of impacts and benefits, involving,- most importantantly, popular participation; and

(e) development of much closer links with local MOA offices and activities.

More specific proposals for the Sirinka Pilot Project, in the context of overall conservation strategy proposals, are made in Part III.

8.5 RESEARCH, EVALUATION, EXTENSION AND TRAINING

8.5.1 Research and evaluation

Most conservation research is site-specific and has so far been largely confined to the USA and Australia. Nevertheless, some findings of such research have relevance to the more immediate needs of practical conservation policies in the Highlands. Given the magnitude of the Highlands degradation problem, there is a very obvious need for applied research to provide continuing and comprehensive support for conservation and reclamation activities, by refining the already known conservation techniques and adapting them to the various agro-ecological and socio-economic conditions of the Highlands by overcoming technical problems of implementation and by determining sustainable levels of use of crop and grasslands. Suggestions on the objectives, components, approach, methodology, organization and staffing of such research are given in Part III; this section reviews the development of conservation research in the Highlands and its present status. General agricultural and forestry research were reviewed in sections 5.8 and 5.10.4, respectively.

Conservation research in Ethiopia is being undertaken by four separate agencies:

(a) the SWCD through its Soil Conservation Research Project;
(b) the Institute of Agricultural Research;
(c) the University College of Agriculture; and
(d) the Sirinka Pilot Catchment Rehabilitation Project (section 8.4).

The major omission of any significant research in conservation from Ethiopia's Institute of Agricultural Research (IAR) was commented on in section 5.8. Out of its total staff in 1984 of 255 professionals, (145 scientists and 110 technical staff) only two assistant research officers have been assigned. Run-off plots have recently been establised at Nazareth, but the only mention of conservation-related research in IAR's programme for 1984/85 (IAR 1984) is a preliminary wind erosion study. An equally serious omission is the lack of any conservation component in the recently approved US$22 million World Bank credit for agricultural research in Ethiopia (World Bank, 1984b). Environmental research is limited to alkalinity and salinity problems in irrigated lands (less than one percent of the cropped area of Ethiopia).

Limited erosion/conservation research has also been carried out at the University's College of Agriculture at Alemaya, but so far this has been restricted to research into the effects of bunding on various crop yields (primarily soil moisture effects) in Hararghe region. The College, however, is expanding its conservation research and evaluation activities with assistance from the FAO project which became operational in 1984 (section 8.3.2). The objectives of this project, covering Welo and Shewa as well as Hararghe regions, are:

(1) to quantify productivity increases on agricultural, forest and grass lands resulting from the conservation programme;

(2) to study improved cost-effective techniques of conservation for increased agricultural production; and

(3) to train graduate students of Alemaya College of Agriculture in conservation-impact analysis.

By far the most important and extensive erosion/conservation research in Ethiopia is being undertaken by the Soil Conservation Research Project (SCRP - section 8.3.2) from within the SWCD. The major development objective of this project is:

"to provide the Ethiopian soil conservation efforts with necessary basic data for the proper implementation of soil conservation measures, to test the applied and to plan adapted measures, and to train local as well as international personnel in this field of study." (SCRP 1982). The more immediate objectives are:

"(a) to build up a National Soil Conservation Research Unit within the SWCD and to facilitate its activities in Addis Ababa and the regional research units of the project;

(b) to organize and train national personnel in the execution of soil conservation research, also providing fellowships, and on-the-job training in relation with these activities;

(c) to continue the collection of data related to soil conservation in the four existing research units of phase 1 and to implement up to three additional research units in different ecological zones of the country;

(d) to analyze incoming soil conservation data, to collect additional data and to prepare them for the use of the soil and water conservation programme in the regions; and

(e) to set up additional soil conservation observation sites in all regions and to observe them qualitatively." (SCRP 1984).

The project, with its headquarters in the SWCD in Addis Ababa, has four experimental sites in Welo (Abbo Ager station in Kori catchment); Sidamo, (Gununo station in Dombe catchment); Hararghe (Suke station in Agucho catchment); and Shewa (Andit Tid station in Huletwenz catchment). New sites are being established in Gojam and Eritrea. SCRP's work includes:

(a) soil erosion research, involving assessment (using both test plots and sediment yield measurements) of damage and of processes;

(b) hydrometric measurements from both test plots and rivers;

(c) land use and land cover monitoring;

(d) collection of socio-economic and climatic data;

(e) studies on soil formation rates, soils, agro-ecology, agro-economics and sociology; and

(f) studies on alternative conservation practices.

Details of this research, both methodology and findings, are reported in the project's regular progress reports (SCRP 1984) and in its Research Reports, and explicit reference is made to some of the findings in the appropriate sections of this report. Generally, SCRP has already made a valuable contribution to scientific understanding of the process of erosion in Ethiopia and has made a useful start in using the information gained to suggest improvements to conservation practices in the field. Data are being collected for a wide range of ecological conditions and cropping systems, and these data will be valuable for future planning as well as research and the solution of conservation problems in the field.

Questions to be raised relate not so much to the performance of the SCRP as to some of its objectives: whether conservation research should be encouraged through a new institution ("a National Soil Conservation Research Unit") as opposed to an existing institution; and whether conservation research should be separated from other agricultural research, by being placed in the SWCD. Certainly there are obvious advantages in starting such research through separately identifiable project resources and immediately orienting the research to the practical needs of conservation work in the field. However, once such research has been successfully established with the required field links, further consideration should be given to its appropriate institutional base. Several considerations suggest that conservation research should sooner or later be placed under the IAR:

- Conservation has to be fully integrated into land use and farming systems for it to be effective, sustained and replicated in the long-run (section 8.10). This calls for integration of conservation, farming and forestry research 1/;

- Conservation has to become a major criterion in all such research, but if conservation research is handled by a separate institution, the existing tendency for main-stream agricultural research to ignore degradation/conservation issues will be further encouraged. If conservation considerations feature in main-stream agricultural research, more manpower resources, sites, funds, etc. would have a bearing on conservation. The needs (sites, manpower, etc.) of conservation research may be beyond the capacity of the SWCD;

- Other institutions in addition to the SWCD - in particular the PA's and FaWCDA - are already playing major roles in conservation. Others should do so in the future (section 8.10).

1/ Unfortunately, not only does IAR fail to give explicit attention to degradation/conservation issues, but its attention is diverted from such issues by the fact that most of its sites are located on relatively flat and uneroded land.

It might therefore be better for the SWCD to concentrate its resources on implementation and possibly on monitoring and evaluation but to leave research to IAR. Despite the already considerable and still expanding size of the conservation programme, there has as yet been no systematic attempt to evaluate the effectiveness of the various works undertaken either in controlling erosion or in terms of their impact on production. The current evaluation being undertaken by the University College of Agriculture with FAO assistance, is a short-term project, lasting at most two years (even if extended), whereas the size and importance of the Highlands conservation programme calls for a permanent mechanism for continuing monitoring and regular evaluation of impact (physical, ecological, production, economic and social). Because such monitoring should provide means for improving management and implementation and because the required information would most easily be collected by the SWCD, it is considered that continuous impact monitoring should be undertaken by the SWCD. Proposals for this as well as for regular evaluation are made in Part III.

8.5.2 Extension

Extension in conservation is undertaken by both SWCD and FaWCDA, the latter mainly in reafforestation and the former mainly in structural methods. The organization, staffing and transport facilities of these organizations has already been reviewed in section 8.3; it suffices to note here that despite the rapid increase in staff of both organizations, extension is constrained by a number of factors, including:

(a) shortages of trained field level staff;

(b) inaccessibility of many PA's;

(c) shortages of appropriate transport (motorcycles or mules);

(d) periodic shortages of fuel for transport and/or feed for mules;

(e) shortages of funds for transport maintenance and operating costs and for payment of night allowances for staff;

(f) lack of effective supervision (reflecting similar shortages at progressively higher levels in both organizations) and coordination (see section 8.3.5); and

(g) lack of motivation, associated with low and frozen salary levels and other poor conditions of service (see section 5.8). DA's are paid less than E.B. 350 monthly.

The engineering and forestry biases in SWCD and FaWCDA reflect primarily the training of their staff (section 8.5.3) and the institutional terms of reference (section 8.3). This has been realized by both organizations for some time now, and has resulted in the beginnings of an integrated multi-disciplinary approach to catchment conservation and development which is being supported by watershed management advisers attached to the FAO project in the SWCD. The training activities of that project are intended to strengthen institutional capacity to undertake integrated sub-watershed development planning.

Extension activities of SWCD and FaWCDA take three major forms: (a) extension campaigns; (b) establishment of soil conservation demonstration areas; and (c) training PA representatives (section 8.5.3).

In extension campaigns, the local extension agents gather all farmers in each PA and discuss with them the causes and consequences of soil erosion and how to combat its hazards.

To date, conservation has not yet been fully integrated into general agricultural extension, and this reflects not only the institutional set-up (i.e., distinct agricultural and conservation field agents until recently), but also the lack of an extension message for vegetative techniques (section 8.7). Very little effort is aimed at tomorrow's farmers, and little use is made of field days, films, posters and radio. These topics are pursued further in Part III.

8.5.3 Training

Agricultural training and general forestry training were reviewed in sections 5.8 and 5.10.3 respectively. Such training has generally been lacking in its coverage of conservation requirements. In the middle 1970s it was recognized that the most important constraint for the successful implementation of a nationwide conservation programme was the lack of technically trained supervisors, field technicians, rural development agents and PA leaders. Training, therefore, was given high priority, and in 1977 the Government requested UNDP assistance. This request resulted in a "Soil and Water Conservation Project" (ETH/77/005) being approved and becoming operational, with FAO as the executing agency, in 1979. With the assistance of this project, the SWCD has been conducting regular in-service training in conservation for rural DA's, Regional and Awraja conservation specialists, and PA leaders as well as for HQ staff. The courses range from simple and practical seven-day courses with emphasis on field exercises in conservation techniques and reforestation, to much longer and comprehensive courses at higher levels. The duration of courses and the numbers of trainees by year are indicated in table A8.7. This training is all the more important because Ethiopia's agricultural training institutions (section 5.8) include courses in soil science, agricultural engineering and surveys, but have not had comprehensive formal courses in conservation.

One-week courses are conducted for PA leaders by Awraja specialists and DA's who have themselves participated in the training programme. Two to three literate peasants are selected from each participating PA. Costs of transportation and maintenance of the trainees are borne by the PA's. The training covers simple techniques such as the use of line levels for laying out contours, construction and maintenance of conservation structures, tree nursery and planting techniques.

Some twenty senior soil conservation technicians have participated in advanced training courses and study tours in other countries. One question which must be raised is the extent to which overseas visits are being used to improve the Ethiopian conservation programme. Such visits are appreciated and help to give status to the conservation workers, but it is not clear what benefits have been obtained. There should be a minimum requirement that staff returning from visits outside the country be asked to report fully on what they have seen and how this relates to Ethiopia and to make appropriate recommendations.

Adequate facilities for teaching conservation courses are not available at Alemaya Agricultural College and the Junior Agricultural Colleges and the SWCD has assisted in designing and running training courses in conservation.

A major constraint in adopting proper integrated watershed planning by newly trained staff is the lack of survey and planning equipment and standard manuals for conservation practices. Lack of audio-visual aids and training materials, pamphlets and handouts is generally felt in the conduct of the training courses for the DAs and PA leaders. Other constraints were listed under section 8.5.2. Some of these constraints are being met and training activities being continued through the on-going assistance of a follow-up UNDP/GOE/FAO project, ETH/81/003 (section 8.3.2). This project is also helping to tackle the engineering bias of the SWCD (section 8.7). The bias arises in part because senior staff of SWCD are largely drawn from agricultural engineering graduates. The syllabus for the agricultural engineering degree at Alemaya College has only eleven course units out of a total of 177 (six percent of the total) devoted to basic biology, plant science and soil science, during a four-year programme. This is a common problem with agricultural engineering courses. It should be tackled partly by increasing the component at the undergraduate level, but especially by offering post-graduate training to orient graduates to the special problems of soil and water conservation. The suggestion of the UNDP review mission (UNDP 1983) to have a faculty of soil and water conservation does not really answer the need, because conservation requires an interdisciplinary approach. Multidisciplinary courses or multidisciplinary departments or faculties are needed. This is pursued further in Part III.

The training activities of the various government organizations must be coordinated. Training in soil and water conservation, of necessity, will have to be a continuous programme, entailing training, retraining and follow-up training in the field. Proposals are made in Part III.

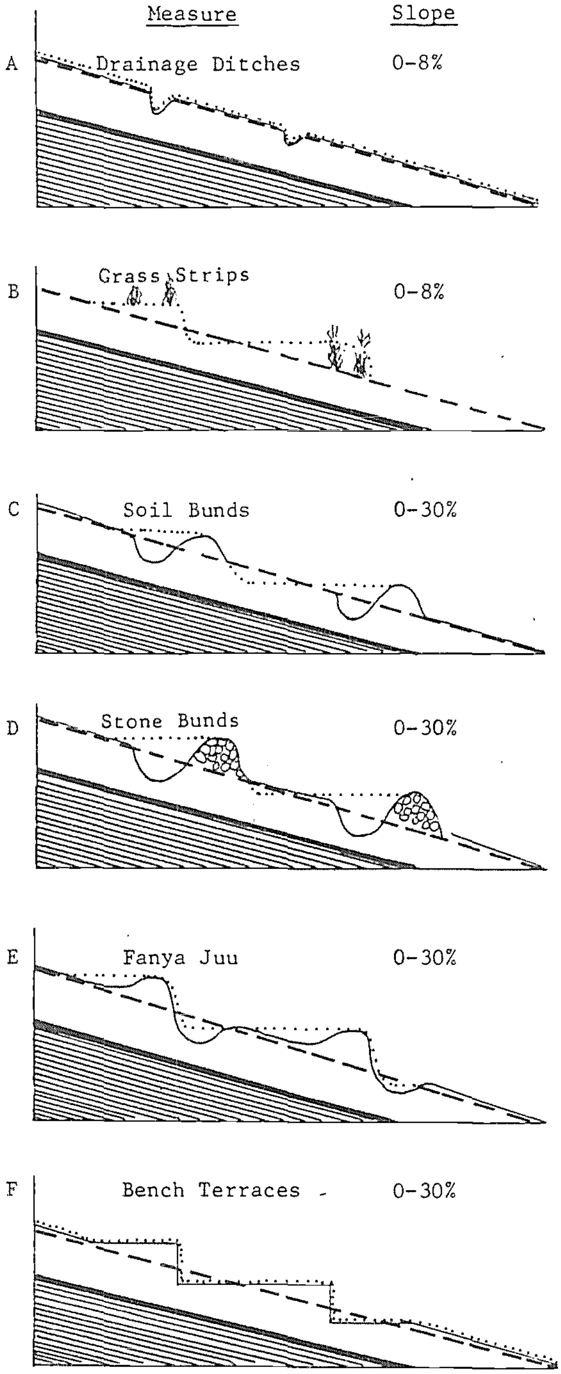
8.6 STRUCTURAL MEASURES

Structural (sometimes termed "engineering" or "mechanical") measures essentially involve the movement of earth and may be grouped into five main categories: benches (including terracing and bunding); water diversion/drainage channels; waterways or courses; check dams and tillage practices. Tillage is undertaken exclusively by farmers (they are advised to plough along the contours and not up and down slopes) while all the other measures are undertaken by the PA's, usually on the initiative of the SWCD and FaWCDA. Some terracing has developed under traditional agriculture in the Highlands of Tigray, in northern Shewa, in the Chercher Highlands and in Konso (Huffnagel 1961). In the Chercher Highlands bunds were built primarily for the cultivation of coffee and chat. In Konso - and in various places in the LPC zone - bunds were primarily for water conservation (water "harvesting") for annual crops. Many of these old bunds have developed into forward sloping (rarely level) benches. It is still possible to see contour lines and ledges on many hillslopes indicative of former terracing. How far such terracing is the result of deliberate soil movement and how far it arises from uncultivated strips of land where grass grew, weeds and residues were dumped and soil accumulated, is not clear. In general much of the traditional terracing appears to have broken down, probably due to more intensive land use and to insecurity of tenure.

Most of the structural conservation efforts of SWCD, FaWCDA and the PA's are concentrated on hillside terracing (for reafforestation), accounting for around 55 percent of the man-days spent up to mid-1983, and bunding for croplands, which has taken up around 35 percent (table 8.2). Other structural measures such as check dams, drainage ditches and waterways, have consumed around 8 percent of the man-days spent on structural measures. In total, some 120 million man-days, averaging some 5 man-days per Highlands family per year, have been put into bunding and terracing in recent years. As a result, some 836 000 km of bunds and terraces have been built to date, covering an estimated 700 000 ha. 1/

1/ The vertical distance between bunds (or the distance of bunds per ha) depends on the slope of the land and other considerations. This area estimate assumes 1.2 km per ha on average. The data probably overestimate the area treated, for reasons indicated in the text footnote following table 8.1.

Figure 8.4 MAJOR STRUCTURAL CONSERVATION MEASURES



... Slope after several years of treatment
—— Slope with initial conservation measure
Original Slope

A On gentle slopes, ditches graded along the contours and draining run-off into waterways (running down slopes into streams or rivers) may be sufficient to interrupt slope lengths and keep soil losses to tolerabable levels.

B Buffer strips of vegetative materials of .5 to 1.0 m width retard water movement, both by interrupting slope length and by gradually (because much sediment is deposited in the grass) reducing slope gradient. Eventually even bench terraces may result.

C Bunds (soil or stone) act on slopes up to 15 to 30 percent (depending on rainfall, soil type and land use) both by interrupting slope length and by reducing its gradient. With proper maintenance, this may eventually lead to terrace formation. Soil bunds are normally built by moving and compacting soil downhill.

D If large stones are plentiful on the land, these may be used to make the bunds.

E Bunds can be built by moving soil uphill. This requires more labour (about 15 percent more) but accelerates terrace formation and is more likely (because of the bigger ditch) to discourage destruction by cattle walking over bunds.

F Slopes steeper than 30 percent generally have to be conserved by bench terraces. Terraces may be established gradually by the above measures or more quickly by initial manual earth excavation along contours. Infiltration is greater and run-off lower, the more level is the terrace. In more arid areas, terraces may slope backwards (inwards) for increased water retention. In higher rainfall areas, terraces and bunds may be level while in areas where flat land may be susceptible to waterlogging, they may be graded along the contour by up to five percent, so that run-off flows into ditches or waterways.

Table 8.4

TERRACING AND BUNDING ACHIEVEMENTS BY INSTITUTION:
1976/77 to 1982/83
('000 km)

	1976/77	77/78	78/79	79/80	80/81	81/82	82/83	Total
Hillside terracing								
SWCD/FFW	8 1/	5 1/	1	45	15	25	33	132
FaWCDA/FFW	na	na	23	30	41	14	38	146
PA's (voluntary)	na	na	3	31	12	18	26	90
Sub-total	8 1/2/	5 1/2/	27	106	68	57	97	368
Soil Bunds 3/								
SWCD/FFW	na	na	27	5	20	23	28	103
PA's (voluntary)	na	na	50	9	61	43	29	194
Store Bunds								
SWCD/FFW	na	na	7	12	14	22	21	76
PA's (voluntary)	na	na	6	15	25	28	20	95
Soil and Store Bunds								
SWCD/FFW	na	na	34	17	34	45	49	178
PA's	na	na	56	23	86	71	49	289
Total	na	na	91	41	120	117	99	468
Totals:								
SWCD/FFW	8	5	35	62	49	70	82	311
FaWCDA/FFW	na	na	23	30	41	14	38	146
PA's	na	na	59	54	98	89	75	379
Total	8 2/	5 2/	118	147	188	174	196	836

1/ Includes bunding.

2/ SWCD only.

3/ Bunding for crop lands is not undertaken by FaWCDA.

Source: FaWCDA and SWCD.

Table 8.4 presents a breakdown of these achievements for each year by type of activity and by institution. Hillside terracing for reafforestation accounts for 45 percent of the total, but in the past four years more emphasis has been given to bunding for croplands. The largest achievement in hillside terracing has been that organized by FaWCDA through FFW; FaWCDA does not organize cropland bunding. Over 60 percent of the bunding has been with soil and less than 40 percent with stones. Similarly, 60 percent of the bunding has been completed by voluntary PA labour and 40 percent by PA/FFW labour organized by the SWCD. In total, over 180 000 km per year of bunds and terraces have been constructed over the past three years. Although this is an impressive achievement by any standard, remembering that the conservation programme - apart from Tigray and Eritrea - has only been underway for nine years, it has to be viewed against the magnitude of the problem. In section 6.5 it was concluded that some three-quarters of the total land area of the Highlands are seriously or moderately susceptible to erosion. It was further indicated in section 6.3 that most erosion actually occurs on croplands. Reducing the cropland bunding achievements by, say, ten percent to allow for rebuilding of bunds previously built poorly, it is estimated that around 350 000 ha of croplands may so far have been bunded. This amounts to only about six percent of the estimated present area under annual crops. Perhaps as much as half of the croplands are not very susceptible to erosion, but if the area of croplands does in fact expand with population, it would add around 300 000 ha a year. Even on the assumption that half of this expansion area is susceptible to erosion, the bunding achievements of the most recent years (around 80 000 ha p.a.) have to be doubled just to maintain the proportion of croplands bunded. The task is even more daunting when it is considered that the proportion of croplands requiring bunding has to be substantially increased if continuing erosion losses are to be avoided (and pending development of vegetative techniques of conservation - see Part III).

Given the fact that most erosion is from croplands (Chapter 6) and given the magnitude of the task to bund remaining croplands, it is clear that much more attention has to be given in the conservation programme to protecting croplands. In particular, this would imply that relatively less attention should be given to hillside terracing for reafforestation and relatively more to bunding of croplands. This is pursued further in Part III.

In addition to bunding and terracing, other structural conservation measures including check dams and diversion ditches have been completed by the PA's with assistance from the SWCD, as shown in table 8.5.

Table 8.5

CHECK DAMS AND DRAINAGE DITCHES COMPLETED:
1978/79 to 1982/83

('000 km)

	1978/79	79/80	80/81	81/82	82/83	Total
Check dams						
SWCD/FFW	1.6	.9	1.6	1.2	0.4	5.7
PA's (voluntary)	1.5	.9	1.2	1.1	0.7	5.4
Total	3.1	1.8	2.8	2.3	1.1	11.1
Drainage ditches						
SWCD/FFW	-	1.4	188.8	280.0	32.7	502.9
PA's (voluntary)	-	0.1	-	21.1	17.4	38.6
Total	-	1.5	188.8	301.1	50.1	541.5

Source: SWCD.

Given the resources, especially trained manpower, available within the last nine years, such large-scale achievements have necessarily been based on standardization of techniques, design and specifications of bund/terrace construction. This standardization, as well as the standards of field work actually achieved, have inevitably raised questions (e.g., by WFP evaluation missions, SCRP and others) about both the appropriateness and quality of the conservation works completed. Such questions are more easily addressed after an explanation - necessarily brief - of how conservation structures are intended to work.

The conclusion that the general standard of conservation structures has improved over the years, and especially in the 1980s, also emerges from comparison of the findings of successive WFP and FAO evaluation missions in recent years. This is attributed to the increasing experience of the institutions concerned, and the considerable efforts to train extension agents and PA leaders (section 8.5.3). Nevertheless, there still remain wide variations in construction standards between different sites and it has been observed by WFP that structures completed on a voluntary basis are often of a significantly lower standard than the work executed under FFW schemes (WFP 1982). Voluntary work teams are generally much larger and include women and children, whereas FFW teams usually include more men and fewer children. These observations have led to the suggestion that it might be better to develop voluntary conservation work more for maintenance than initial construction. But even the way in which FFW is organized (i.e., payment per kilometre of bunding/terracing) emphasizes achievement of quantitative rather than qualitative targets, and consideration might be given to gradually relating payment to hectarage effectively conserved (this is developed further in Part III). The goal should be to conserve land with as few structural measures as possible per hectare, thereby minimizing loss of land.

Differentiation in type and design of structures requires technical expertise and specific design proposals for different situations. Expertise is being built up only slowly (section 8.5.3), while the SCRP has yet to finalize specific conservation structure proposals for different situations. For these reasons differentiation of structures has been largely beyond the scope of the institutions concerned until now. Must bunds thus far constructed in the Highlands are level (zero gradient) and are supposed to have rear channels big enough to retain run-off with tied ridges. Tied ridges take up more land, and for this reason are not popular among farmers. In higher rainfall areas cross ties can also result in waterlogging - hence the SCRP proposals for graded terraces.

If bunds are not maintained and rebuilt to their original height at least annually (after the rains), on all but the gentlest slopes they can result in a short time in more erosion than would otherwise take place (by concentrating run-off at low points), and they will disappear altogether after five to ten years. Major damage most often results from cultivation too close to the bunds or in some cases across the bunds. Soil bunds in particular are liable to be damaged by overflowing run-off and/or animals. This can be countered by "stabilizing" them with perennial grasses or legumes. The use of grass for stabilization has lagged far behind the construction of bunds, and there has been too much reliance on seed supplies (as opposed to vegetative cuttings 1/ which establish more quickly), and unsuitable species such as Sudan grass or Columbus grass, which are not perennial. There are plenty of suitable indigenous grasses (e.g., Andropogon) which can be planted by splits and will spread sufficiently to cover the bunds without interfering too much with crops. Bulking areas should be widely distributed. Materials can then be transported by pack animals, reducing the dependence on arranging mechanical transport. The seeding of bunds not only partially offsets the loss of arable area so much resented by farmers, but reduces maintenance requirements. Care must be taken, however, not to use horizontally crawling grasses

1/ That is too little attention has been paid to organizing the collection and distribution of suitable vegetative material.

which could interfere with cultivation. Another reason farmers sometimes resist bunding is that they are considered to breed rats. Attention was drawn by peasant respondents in the EHRS Sociological Survey to this problem, addressed in Part III.

8.7 VEGETATIVE MEASURES

8.7.1 Inadequate development

Vegetative measures of conservation include any techniques which provide denser or greater vegetative cover of the ground for a greater percentage of time. "Ideally, vegetative measures for the control of soil erosion should, if practicable, always take precedence over engineering measures. The fact that engineering work involves physical movement of the soil is, in itself, creating an erosion hazard if it is not carefully carried out." (John and Styczen, 1984). Vegetative measures can include practices, patterns and calendars of cropping (including soil and residue management), and management of grass and forest lands. Ethiopia's rapid deforestation, overgrazing in the LPC and parts of the HPC zones, continuous ploughing for and late planting of teff, removal of dung and crop residues from fields, and reduction in fallow periods are all examples of negative vegetative measures commonly practiced in the Highlands. Ethiopian farming regrettably is essentially exploitive and land/soil management practically non-existent. "There is little if anything of positive value but much of negative impact, in prevailing cultural practices that alleviates the erosion problem." (SIDA, 1984). True, the fact that erosion is less severe in the HPP zone is partially due to the cover provided by perennial crops. However, soil cover has almost certainly not been a consideration in developing perennial crops in Ethiopia, and unfortunately very little attention has generally been paid by Government and people alike to vegetative measures of conservation.

Vegetative measures are almost totally neglected in agricultural training, planning, research and extension, and personnel in these fields continue to formulate projects, proposals and priorities (which inevitably have a bearing on conservation) and to advise farmers, policy makers, politicians - without reference to vegetative conservation measures. This is an obvious area in which one might already have expected a valuable contribution from the Sirinka Project (section 8.4). The neglect of vegetative measures in Ethiopia's conservation activities to date is undoubtedly the major weakness in an otherwise impressive programme. This partly reflects lack of awareness of the importance of vegetative cover in preventing erosion (sections 8.1 and 8.4.3) and the failure to translate such awareness into agricultural planning, training, research and extension. The major exception to this criticism is the reafforestation programme, which is designed to meet people's needs for fuel and timber as well as to contribute to conservation.

Two other vegetative measures are still infrequent but steadily growing in importance: the closure of steep and severely degraded hillsides to permit natural regeneration of vegetation, and the propagation of grasses and legumes for combatting degradation in grasslands and for stabilizing bunds/terraces. Activities in these three areas, namely reafforestation, hillside closure and use of grasses/legumes, are reviewed in the remainder of this section. Proposals for the development of other vegetative measures as well as the existing ones are made in Part III. The use of grass strips in conserving croplands is partly vegetative and partly structural. This practice is not widespread but was mentioned briefly in section 8.4 and 8.6 and is also the subject of proposals in Part III.

8.7.2 Reafforestation

The general objectives, organization, staffing, support services, achievements and constraints of Ethiopia's reafforestation programme were reviewed in section 5.10, and much of that section is equally valid with respect to reafforestation for conservation, which is the subject of this section. Generally, reafforestation has made and is making a very substantial contribution to conservation in the Highlands by the reclamation and protection of steep and/or severely degraded slopes, thus reducing run-off, improving water flow and storage regimes, and increasing availability of fuelwood, thereby decreasing the proportion of dung and crop residues used for fuel.

In the past five years over 37 million man-days have been put into reafforestation (11 million for raising seedlings and the balance for digging holes, planting, weeding, etc. A further 65 million man-days has been spent on terracing of hillsides, primarily for trees, so that two-thirds of the total labour inputs into conservation have been for reafforestation (see table 8.2). Over 500 million trees have been planted by the PA's, both by voluntary labour (17%) and in the FFW programmes operated by FaWCDA (50%) and SWCD (33%). (See table 8.6.) Around two-thirds of the seedlings have been raised by FaWCDA, although in the last three years the relative importance of nurseries operated by both SWCD and the PA's using voluntary labour has increased. From table 8.6 it can also be calculated that a steadily increasing proportion of raised seedlings are planted, suggesting reductions in wastage rates. Thus table 8.2 shows that an increasing proportion of total man-days spent in reafforestation is devoted to planting and correspondingly less for raising seedlings. Nursery productivity has improved from 64 seedlings raised per man-day in 1978/79 to around 75 more recently. A major problem affecting seedling production has occasionally been short or untimely supplies of polythene tubing. These are supplied

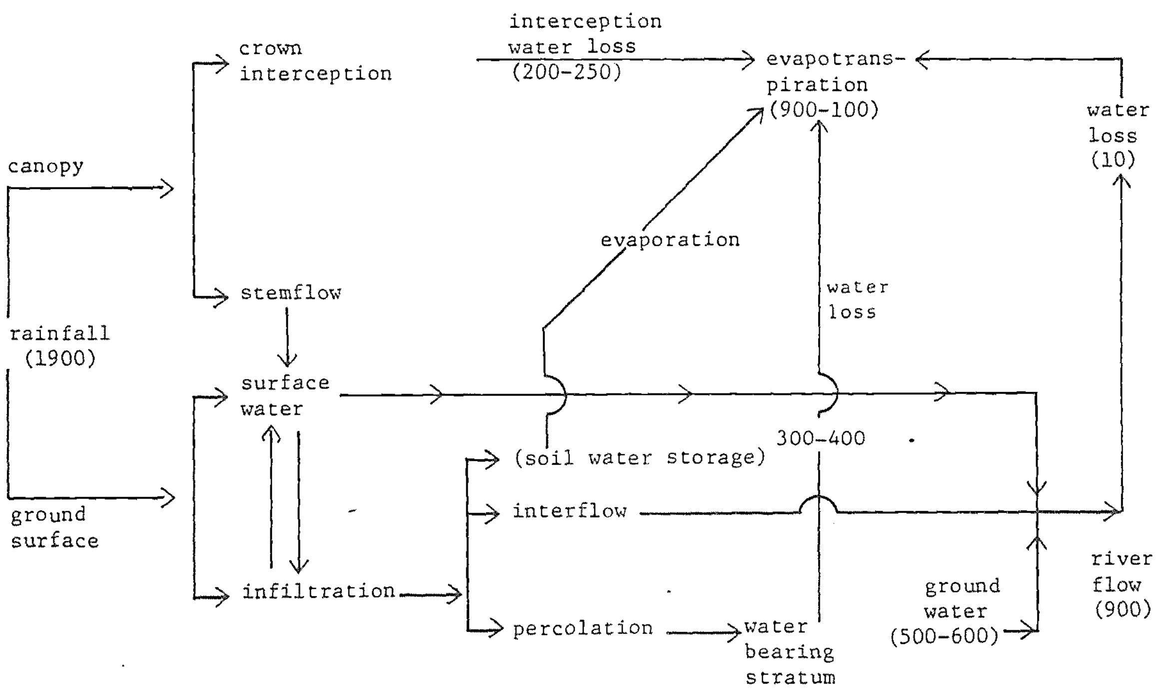
FORESTRY FOR SOIL AND WATER CONSERVATION

Forests are not only the source of wood products for economic benefits; they also produce the multiple benefits of reducing erosion, improving local water flow and drainages and generally preserve the environment. One of the most important functions of forests is their regulation of rainfall and run-off, thus the conservation of upland catchments.

Some rain water flows over the watershed as surface run-off and dischanges directly into streams or swamps. A portion infiltrates the soil and may move laterally along soil horizons as interflow to appear as streamflow, at times slightly lagging those of surface run-off. Surface run-off and interflow compose the flood discharge of a stream during and immediately after rainfall. Some water is retained in the soil and eventually is returned to the air by evaporation from the ground surface or by transpiration of the vegetation. Other water infiltrates the weathered layer and percolates as stratum or fissure water into the underlying material (i.e., fissured rock, sands, gravels or breccia). This groundwater is released over long time periods after the rainfall and composes the base flow of the stream. The spatial and temporal distribution of rain water is thus regulated by topography, geology, soils and vegetation.

Forests can significantly influence the regulatory characteristics of a catchment. Their influences are complex and interrelated. A forest cover and the litter it produces intercept rainfall and detain surface run-off and allow more time for infiltration. Decayed roots help maintain and improve the infiltration capacity of the soil. Thus, forests contribute to conservation by reducing total water flows down the catchment.

Figure 8.5



Note: Numbers in parentheses are the approximate quantities (mm) of water from an annual rainfall of 1 900 mm.

Source: FAO: Hydrological techniques for upstream conservation, 1976.

from Addis, but the company concerned no longer has the capacity to meet requirements (now over 100 tons p.a.). Transport emerges as another constraint during the short planting season, and consideration might be given to siting smaller but more dispersed nurseries in planting areas and using animal transport. Despite these problems, evaluation missions by WFP have concluded that nurseries are generally well managed.

Table 8.6

REAFFORESTATION ACHIEVEMENTS BY INSTITUTION: 1978/79 to 1983/84

(millions)

	1978/79	79/80	80/81	81/82	82/83	83/84	Total
Seedlings raised							
FaWCDA/FFW	71	129	118	100	79	22 1/	519
SWCD/FFW	11	33	17	45	44	n.a.	150
PA's (voluntary)	1	3	13	34	38	n.a.	89
Total	83	165	148	179	161	22	758
Trees planted 2/							
FaWCDA	24	38	40	66	51	30 1/	249
SWCD	11	33	33	43	44	n.a.	164
PA's (voluntary)	1	3	14	42	29	n.a.	89
Total	36	74	87	151	124	30	502

1/ For 9 months only.

2/ Excesses of tree planting over seedlings raised in any one year can be explained by possible carryovers from year to year and the fact that FaWCDA and SWCD sometimes supply each other.

Source: SWCD and FaWCDA.

Owing to their fast growth, an abundance of seed, and their great value as fuelwood, pulping timber and rough, multi-purpose timber, eucalyptus have been widely planted in the Highlands (section 5.10), especially globulus above 1 800 masl, and both globulus and camaldulensis below. Most eucalyptus, however, are not good trees for erosion control. When young, they are very susceptible to grass competition, and to obtain good growth clean weeding is necessary during the establishment period - which is undersirable on steep or eroding terrain. Even mature stands may be ineffective in halting surface run-off. It has been observed that in steep dry areas where Eucalyptus globulus has been planted, understory development and littler buildup are insufficient to prevent surface run-off.

In closed plantations it has a great water demand and an exceptionally extensive and dense root system which enables it to compete successfully for available soil moisture, especially with smaller, shallow-rooted plants; it may even destroy terraces. Where rainfall is less than 750 mm, the failure of understory to develop - coupled with a weakly developed forest floor - leaves the soil exposed to run-off. Under such conditions, it is recommended to thin dense stands and plant at wider spacings (less than 500 trees per hectare). Monocultures are also more susceptible to wholesale losses due to pest and disease.

Many factors contribute to the very low tree survival rates: inappropriate species selection; irregular delivery of seedlings; poor selection of sites; poor planting practices; and lack of protection from grazing animals (see section 5.10). These factors reflect inadequate research and extension services and sometimes lack of motivation among PA's to care for newly planted trees. Quite apart from individual insecurity of land tenure (section 3.5), lack of motivation to plant and/or care for newly planted trees sometimes arises because of concern over ownership of the trees. Whereas SWCD invariably passes ownership of trees to the PA's concerned, FaWCDA in some cases maintains ownership of the trees, at least until they are mature, and even after that in areas declared as state forest (usually areas more than 80 ha). Some of these uncertainties are being removed, and the reafforestation programme is being given added impetus by FaWCDA's recent establishment of its Community Forest Development Department (section 5.10).

Making allowance for replantings to replace failed trees, and at an average spacing of 2 000 trees per ha., it is estimated that some 150 000 ha have been successfully reafforested. Practically all of this is on land which has been terraced. The economic as well as technical justifications for terracing have been questioned (section 8.4), and more recently use is being made of small eyebrow or semi-circular terraces around the hole for tree planting. These reduce labour requirements by some 60 percent and conserve moisture for the trees, but such terraces do not keep as much run-off and sediment from lowerlands (a cut-off drain can fulfill this purpose). But from the conservation viewpoint, the regeneration of natural vegetation (section 8.7.3) supplemented with occasional planting of suitable species may be just as effective and much less costly than reafforestation with terraces, even eyebrow terraces. This is pursued further in Part III.

The potential role of agro-forestry (here defined as the multi-storied use of land for farming or the planting of trees within arable crop and livestock farming systems) has been relatively neglected. Only in the past two or three years have FaWCDA and SWCD initiated efforts to introduce fruit trees (guava, peaches, plums, papaya, avocado) in some farming systems. But agro-forestry activities need to be further strengthened with the introduction of suitable species of timber, fodder and fruit trees, shrubs, grasses and legumes. One of the most neglected agro-forest systems is sylvo-pastoralism. It is surprising that livestock has played such a dominant part in the rural economy, yet animal nutrition has been largely neglected. Proposals for development of agro-forestry are made in Part III.

8.7.3 Hillside closure

In addition to the conventional methods of reafforestation described in section 8.7.2, FaWCDA, SWCD and the PA's are revegetating much more cheaply by closing specified hillsides to grazing and cropping and, to a very limited extent, by sowing grass on slopes with shallow soils.

Hillside closure results in a thick regeneration of indigenous plants within two to four years, depending on the length of the growing period. Such natural regeneration is sometimes supplemented by some enrichment planting of trees, legumes and grasses. Well over 37 000 ha have been closed by the SWCD and the PA's, while many hillsides have been closed by FaWCDA, but FaWCDA is unable to supply data on the extent of their activities in this area (table 8.7). Apart from demonstrating the rapidity of natural revegetation, the closure of hillsides inevitably restricts access to fuel and forage, and if substitutes are not provided to compensate for such losses, local people can come to resent the closures. Wenner (1982) has drawn attention to possible negative effects of hillside closure in increasing grazing pressures elsewhere, in increasing the growth of low bushes (lowering both quantity and quality of grasses) and/or the growth of long and less palatable grasses. Excessive bush can lead to deterioration of ground cover. Canopy cover alone is not enough to control erosion, as can be seen for example, under densely planted Eucalyptus. Ground cover must be maintained, which means controlled utilization and keeping a balance between bush and grass in which grazing, browsing, resting, cutting and even burning can play a part. Closed hillsides have been kept closed even after cover has been restored, though cutting of grass has sometimes been permitted. There is a widespread fear among extension staff that if livestock are allowed back, the situation will rapidly revert. If peasants are going to manage their own land and take responsibility for it, they must also accept responsibility for proper utilization of grazing land. Continued closure of hills is negative because bush will become dominant, there is an increasing risk of fire, the resulting production of biomass is wasted, and it is resented by the peasants. It should be possible to maintain a reasonable cover and reasonable balance between bush and grass by closing sections in rotation or closing the whole area for two to three months every year during the rainy season. Neither policy should be beyond the capabilities of PA's to implement. Such policies, as well as others (e.g., pasture improvement, fuelwood lots, etc.) can offset the losses inherent in hillside closure. The benefits in public relations for the conservation programme by a more rational approach to hillside closure and utilization would far outweigh the risks involved. This is pursued further in Part III.

Table 8.7

HILLSIDE CLOSURES BY INSTITUTION:
1979/80 to 1982/83

(ha)

Agency	1979/80	1980/81	1981/82	1982/83	Total
SWCD	140	5 974	8 798	12 275	27 187
FaWCDA	na	na	na	na	na
PA's	51	2 223	3 369	4 701	10 344
Total	191	8 197	12 167	16 976	37 531

Source: FaWCDA and SWCD.

8.7.4 Pasture and fodder improvement

It is not possible to quantify the targets of nursery production and planting of fodder species as these are included by both FaWCDA and SWCD in tree seedling production and planting, and represent only a small portion of the totals given in table 8.6.

The main plants propagated by both SWCD and FaWCDA include leucenea, Pigeon pea, Morigna, Elephant grass, Sudan grass, Gatton Panic, Coloured Gunea, Dolichis, lablab, Desmodium uncinatum and Rhodes grass. Most of these grasses are meant to be planted along terraces and gulley bottoms and, in a few cases, on hillsides.

It is felt that for species planted by vegetative propagation (e.g., Elephant grass) the major supply sources should be located at strategic locations within the catchments or sub-catchments to minimize transport and increase viability of the planted material. This practice is already being undertaken in certain areas and should be applied to all areas where, for example, Elephant grass is to be planted. For species propagated by seed, consideration should be given to centralizing, to the extent practicable, the major centres of propagation. The degree of this centralization would depend mainly on the efficiency of transportation from the centres to the prospective planting areas. In this respect it is to be hoped that the Ethiopian Seed Corporation can start seed production of pasture and fodder species.

Plantings have sometimes failed due to inadequate rain. The conservation seed multiplication programme has to be planned to produce more adaptable and more hardy species that can provide good stability for terraces and also produce adequate forage. In some catchments, fodder species have been planted in mixed stands. This will make their harvesting unnecessarily laborious in the cut-and-carry system to be employed. The time and frequency of harvest will vary between species, as will the type of fodder (hay or green feed) provided. Proposals for pasture and fodder improvement are made in Part III.

8.8 MAJOR CONSTRAINTS

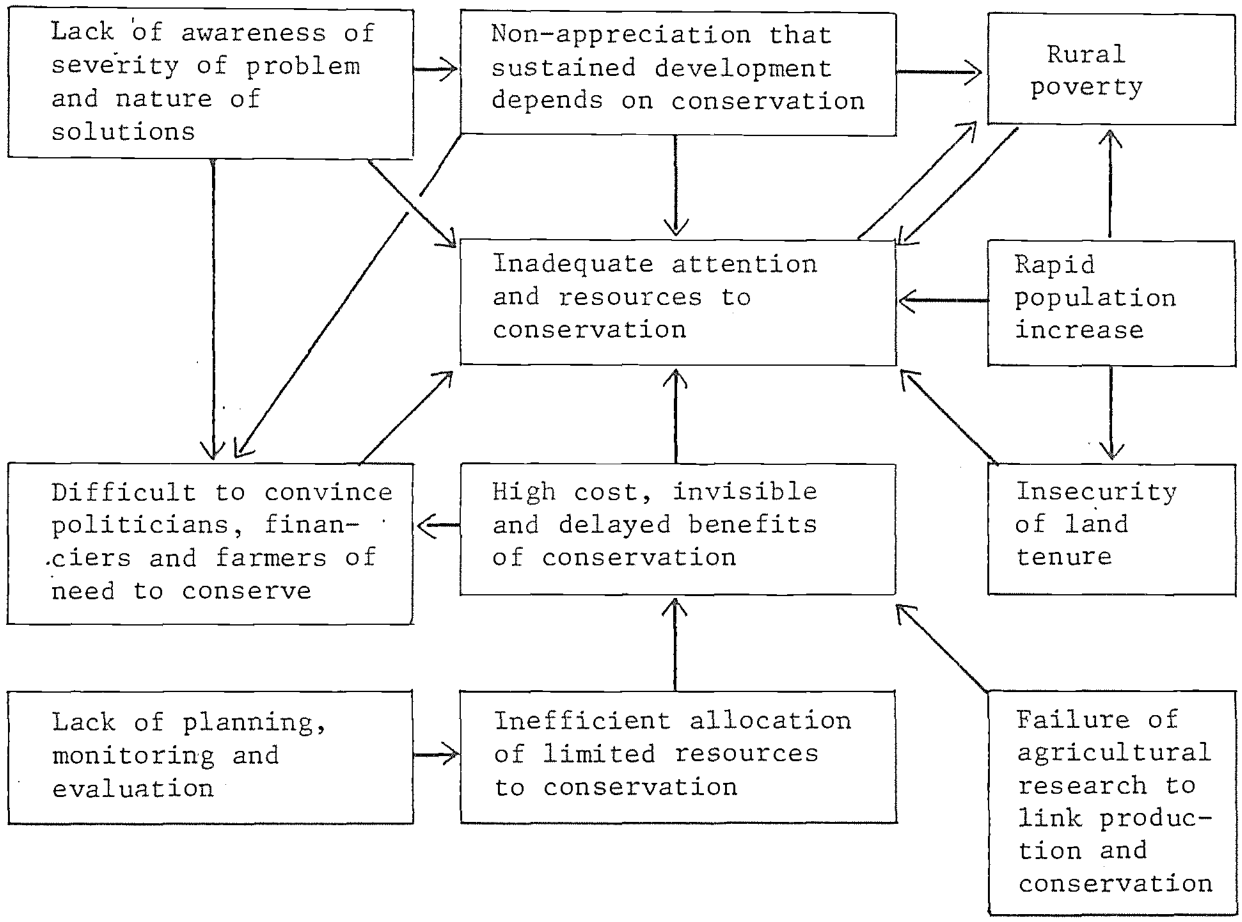
Ethiopian land use, like that in many other Third World countries, has been and still is essentially exploitive in the sense that more is being taken out of the land than is being put back. Conservation or considerations of longer term productivity do not feature prominently if at all in the decisions and practices of the main users of land in Ethiopia with respect to forestlands, grasslands and croplands. This has been the case for centuries, and despite the changes of the past decade, attitudes with respect to the land remain essentially the same. Thus conservation for all practical purposes is largely confined to the programme which, for the past decade, has been implemented by the GOE through the PA's and partly with some assistance from external agencies such as WFP. Confinement of conservation to this single programme is by far the most important constraint to conservation in Ethiopia. It confines its scope, nature, size, replicability and sustainability. This confinement derives from a number of specific fundamental constraints which also limit the impact of the Government's conservation programme.

Some of these constraints have already been mentioned in earlier sections of this chapter. This section consolidates and interrelates them. The following list of these fundamental constraints indicates how they are interrelated. (See also Figure 8.6.)

(a) Lack of awareness, not so much of degration as of the severity of the problem and solutions to it, among people at all levels - from farmers to top government. This, in turn, reflects inadequate coverage of conservation in both general education and training more specific to agricultural, rural and national development;

(b) Because of (a) conservation is not yet seen as an integral part of development and land use, but is viewed rather as a separate sub-sector, a reaction to a growing nuisance - the degradation problem. In planning, organization, budgeting, education, training, farming, etc., the essential interdependence of conservation and development is not yet seen;

Figure 8.6 MAJOR CONSTRAINTS TO CONSERVATION



(c) Continuing insecurity of land tenure discourages farmers from investing in their land;

(d) The results of (a), (b) and (c) is that inadequate resources and attention are given to conservation by politicians, policy makers, planners, researchers, extension agents and farmers. Highlands farming is exploitive of the resource base, and while the effects of the resulting degradation are being tackled, little is so far being done to make farming and land use less exploitive;

(e) It is difficult to break out of the vicious downward spiral of exploitive farming (d), because of the high and still growing population pressure on Ethiopia's land, the poverty of its people and rural infrastructure, and the lack of a message on conservational farming (h); but it is not impossible - the high population/land ratio can be turned to advantage in implementing a labour-intensive conservation strategy (Part III). Even so, the growth of Ethiopia's population probably presents the greatest single challenge to conservation and development alike (Part III);

(f) The high costs of conservation works and their long gestation periods make benefits difficult to see and quantify. This makes it more difficult to convince policy makers, financiers and farmers to invest in conservation (d). High costs and limited resources call for the systematic identification of priorities in activities, areas and over time (g);

(g) The resources that have been allocated to conservation have been spent as a rather ad hoc response to a partially identified problem, without any overall plan, and certainly not one which has been integrated into the broader aspects of rural development (b), and without much effort to evaluate the costs and impact of alternative policies, projects and approaches. 1/ Indeed,

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1/ The continuing pressures emanating largely from outside Ethiopia to retreat to the ad hoc approach because more systematic and explicit study (i.e., the EHRS) takes more time, should be resisted. Just because "ad hoc-ery" and "gut feelings" have prevailed in project selection in Ethiopia and other developing countries (much less in more "developed" countries), does not justify their continuation - especially when Ethiopia's very means of livelihood and development are being degraded so alarmingly. Witness the remarkably slow rate of development in the Third World generally - a theme recently pursued within the World Bank (Woods 1983).

this is the underlying rationale for the EHRS (Chapter 1), at the macro-level. At the micro-level it is only recently that integrated catchment planning has been initiated;

(h) The major omission by agricultural research in Ethiopia either to focus on or even relate indirectly to the degradation problem (b). Furthermore, the belated start of conservation research is now fragmented and in danger of being segregated from mainstream agricultural and land use research. As a result, with the exception of reafforestation and hillside closures, vegetative measures of conservation have been largely ignored. Benefits from structural conservation measures would be greater and more noticeable if there were some integrated follow-up designed to increase farm productivity, but this is lacking - partly because of the irrelevance of much of the agricultural research. The link between better conservation and increased production (b) has to be established and sustained, so that benefits of conservation are more visible to farmers and policy makers alike (d) (f).

Further important constraints include:

- institutional weaknesses (e.g., in coordination, monitoring, evaluation, supervision) which derive partly from lack of sufficient trained manpower, transport and operational funds;

- lack of food (and, to a much lesser extent, lack of food transport and storage facilities) to enable the FFW programme to act on an even larger scale as the catalyst;

- lack of tools and materials such as picks, shovels, watering cans, line levels, polythene tubing for seedlings, etc., as well as maps and/or aerial photography for detailed catchment planning.

From the above it may be concluded that, although there remain gaps in available technical knowledge of conservation measures and most particularly in relating that knowledge of vegetative measures to Ethiopian conditions, the most important constraints are social and economic: attitudes, motivations, finances, institutions.

Table 8.8

ESTIMATED TOTAL COST (1985 PRICES) OF CONSERVATION ACTIVITIES:
1978/79 to 1982/83

('000 EB)

Year	SWCD	FaWCDA	PA's (vol.)	Total
1974/75	na	2 433	na	na
1975/76	na	6 044	na	na
1976/77	3 937	9 655	na	na
1977/78	1 683	11 618	na	na
1978/79	20 399	20 099	12 000	52 498
1979/80	45 770	27 136	20 600	93 506
1980/81	36 942	33 069	24 800	94 811
1981/82	51 253	33 153	28 600	113 006
1982/83	54 176	41 547	25 600	121 323

Source: EHRS calculations made from FaWCDA and SWCD data.

8.9 COSTS, BENEFITS AND IMPACT

8.9.1 Costs

Based on data obtained from the FaWCDA and the SWCD and standard work norms (table A8.2), and valuing voluntary PA labour inputs at the rate of EB 2.00 per man-day, it is estimated (table 8.8) that the conservation programme has cost (in 1985 prices) well over EB 500 million since 1974/75. Total annual costs have increased sharply in the last five years so that they are now well over EB 100 million p.a. 1/

Manual labour, including the imputed value of voluntary labour, accounts for two-thirds of the total. Over 40 percent of the costs have been for activities organized by and through the SWCD, about a third by FaWCDA, and the rest has been contributed by voluntary labour organized by the PA's. The relative importance of different activities in terms of man-day inputs was indicated in table 8.2. It is estimated that reafforestation (including hillside terracing) has accounted for around 75 percent of total costs, and bunding for around 20 percent.

1/ Actual annual expenditures of around EB 70-80 million are lower than the estimated costs shown because non-paid voluntary labour inputs have been valued and included and because the costs are expressed in terms of 1985 prices.

8.9.2 Cost-benefit analyses

The benefits of conservation stem primarily from reducing the costs of degradation. The conceptual, methodological and statistical difficulties involved in trying to quantify the costs of degradation were described in Chapter 7. 1/ The quantification of benefits, therefore, involves all these difficulties plus additional difficulties of quantifying the impact of conservation measures in terms of percentage reductions in degradation achieved. Because of this no attempt was made in Chapter 7 to quantify the downstream costs of degradation on crop and grasslands. Therefore the analysis of benefits has to be similarly confined. As noted earlier, for practical purposes conservation is confined to the government programmes of bunding/terracing, reafforestation and hillside closure. As the conservation benefits of reafforestation and hillside closure accrue primarily downstream, it is particularly difficult to quantify these for the reasons stated. 2/ The EHRS attempt to quantify the benefits of the conservation programme to date is therefore confined to the "on-site" benefits from bunding on croplands 3/. These partial benefits are compared with the estimated costs of bunding, and an economic rate of return calculated. This cost-benefit analysis is supplemented by cost estimates for the entire conservation programme to date (section 8.9.1) and by more qualitative assessments of the benefits and impact achieved by that programme (section 8.9.3).

1/ Such difficulties have led to proposals to review and develop the methodology of the economics of land conservation (FAO 1981c), particularly with respect to conceptual and data-gathering difficulties raised by the need to value land, to measure inter-generational costs and benefits, to take into account externalities and downstream effects, and to estimate soil loss/yield relations.

2/ The non-conservation and the "on-site" costs and benefits of reafforestation and hillside closure can be quantified with relative ease. For example, the FAO Investment Centre has calculated internal financial rates of return of between 6 and 13 percent for fuelwood plantations (FAO 1984b).

3/ The cost-benefit analyses, including explicit statement of the methodological assumptions and data used, are contained in EHRS WP 12. In view of the qualifications described in that working paper, as well as in section 7.4.1 of this report, the cost-benefit analyses in particular must be viewed as only tentative. However, the calculated ERR is considered to be very broadly indicative of the returns generated by bunding croplands, at present farm productivity levels.

The costs of bunding are derived from table 8.8. All field manual labour here is valued at EB 1.00/day, reflecting the assumed lower social opportunity cost of labour during the agricultural slack season, when most bunding work is undertaken. Provision is also made for the costs of annual bund maintenance. (These are defined as labour costs, taken as declining from ten percent of construction costs, p.a., up to Year 10, and as opportunity costs - the productivity foregone of the land occupied by the bunds themselves - assumed, on average, to be ten percent of the area of the bunded croplands.)

The quantified benefits from bunding assume that the bunds reduce soil losses by 60 percent (reflecting field observations - SCRP 1984), and thus correspondingly reduce the estimated costs of soil losses (Chapter 7). It is also assumed that, in addition to reducing the decline in yield associated with soil losses, bunding actually increases yields, by better water conservation in those areas where yields are constrained by moisture deficiency - mainly the LPC and HPC zones. With respect to the latter, some data has been collected by Dr Tamirie of the University College of Agriculture:

> "... sorghum yield data for Kobo (Welo), semi-arid region indicate moisture conservation practices more than double the yields during drought years but no significant difference when there was enough rainfall.... In Hararghe Highlands even during the years with above-average rainfall, moisture conservation practice has given significantly higher sorghum yields.... crop response to fertilizer application is much higher at lower dosage of fertilizers - with availability of moisture..." (Tamirie 1983)

In 1981 Dr Tamirie found in Hararghe that on the average yields of plots with tied ridges were 57 percent higher for maize and 25 percent higher for sorghum than of those without tied ridges, while even greater yield increases were recorded in 1982. In the EHRS analyses, a far more conservative assumption has been made: that crop yields in bunded areas (in the HPC and LPC zones) increase on average by five percent in the first five years after bund construction, and thereafter by ten percent, due to increased water conservation. These assumed yield increases are considered to cover those increases (over present average yield levels in the HPC and LPC zones) attributed both to increased water conservation and to increasing soil depths in areas where yields may already be constrained by shallow soil depth. Thus these yield effects might also include any associated effects arising, e.g., from the fact that seed and fertilizer would be washed away, from improved fertilizer responses, from improved soil structure, etc.

On these assumptions, it is estimated that the investments already made in bunding croplands to date (around 390 000 ha) will, over the next 50 years, generate benefits in increased crop production of EB 1 650 million, compared to total costs of EB 420 million, at discounted 1985 prices. The IRR is calculated at 12 percent. This is reduced to 8 percent if the time horizon is limited to 25 years; to 8.5 percent if costs are 20 percent more than those estimated, and to 10 percent if benefits are reduced by 20 percent. These returns are very close to those calculated from cost and benefit estimates of all conservation activities in a single catchment (Upper Mulu, in Hararghe Region), in which the conservation programme has been active for several years (WFP/FAO, 1982). The latter analysis concluded that the programme had been effective in stopping soil fertility losses and in raising the income of farms in the catchment valley. The economic feasibility of the investments was acceptable, with an economic rate of return of about ten percent. Nevertheless, the analysis concluded that excessive attention had so far been placed on costly hillside terracing. Greater net economic benefits could have been realized by more emphasis on the improvement of on-farm productivity through technical packages. The ERR would then have been increased to about 20 percent. Although similar analyses have not been undertaken in the EHRS, it is probable that similar findings would have been reached: that is, better returns from the bunding of croplands than from the reafforestation with hillside terracing.

8.9.3 Benefits and impact

Erosion occurs primarily from croplands (Chapter 6). It has been estimated earlier in this chapter that at most around six percent of the erosion-susceptible croplands have so far been bunded, but that present rates of bunding would have to be increased markedly to increase this coverage, because cropland areas are likely to grow with the farm population. But part of the erosion on croplands is undoubtedly caused by run-off from denuded hillsides, and this provides the main conservation rationale for terracing and reafforestation, or closure and natural vegetation regeneration of such hillsides. While it is not possible to quantify the extent of "downstream" areas benefitting from reafforestation and hillside closure, nor the magnitude of the reduced soil losses in those areas, doubts have been expressed both on the advantages of allocating resources to reafforestation compared to allocating them to cropland bunding, and on the cost-effectiveness of specific measures of reafforestation, terracing and hillside closure (e.g., the Sirinka experiences in section 8.4, the technical issues in section 8.7, and the economics in section 8.9.2) The doubts become even more serious when the cost-effectiveness of these measures are compared to that of cropland bunding and the vast areas of erosion-susceptible croplands remaining to be conserved. Part III makes proposals based on some of these lessons from past experience (section 8.10).

Figures on the extent of land covered with bunds or terraces only partially indicate impact. The effectiveness of the measures concerned has to be taken into account. Successive WFP evaluation missions over recent years (1979 to 1982), as well as the SCRP, have generally noted improvements in the quality of conservation structures built, and EHRS consultants have also remarked on the satisfactory quality levels achieved, bearing in mind the qualifications noted in section 8.6. But the lack of maintenance has also drawn attention. Soil bunds which are partially ploughed up, or stone bunds which break down, can do more harm than good. Maintenance obviously needs to be improved to sustain - and, if possible, increase - the impact level of a 60 percent reduction in soil losses as estimated by SCRP.

Other non-quantifiable benefits from the on-going conservation programme which, in some cases, may be more important than the quantified benefits, include:

- reduction in the severity of impact of drought because of the improvement of water storage-drainage regimes in the catchment and the increased retention of soil moisture;
- improvement of supplies of fuelwood and timber, benefits of the programme most readily appreciated by rural people;
- improvement of catchment water supply and drainage systems;
- employment created by conservation activities;
- improvements in diet of the half-million families (more than two million people) receiving FFW rations; and
- reduction in the other downstream and social costs associated with continued degradation (Chapter 7).

8.10 MAJOR LESSONS OF EXPERIENCE

8.10.1 The critical needs

Over half of the Highlands is suffering, in various degrees of severity, from accelerated erosion resulting largely from the spreading misuse of land over many centuries, and with the accelerating growth of population. A commendable and remarkable start has been made in the last decade in tackling the erosion problem by the mobilization of millions of people through the PA's. But despite this mass mobilization and estimated costs of more than US$250 million over the past five years, so far only about six percent of the most susceptible areas (croplands) has been covered by the conservation programme. Thus even if the conservation programme continues to expand as fast as it has in the last five years (by over 20 percent p.a. on average in real terms), it will probably still take well over 50 years to cover all those areas of the Highlands already seriously eroded and likely to be seriously threatened by erosion. The costs would be enormous: over US$4 000 million at current rates and 1985 prices, and even then it may be doubted whether the resulting conservation measures would be really effective without additional improvements in scope, nature and design and continuing effort in maintenance. The costs of not tackling the problem would eventually be far greater. All this must be considered within the context of accelerating population growth, accelerating erosion rates, accelerating declines in plant yields and increasing severity of the effects of drought.

By far the most important lesson of experience is that, notwithstanding the commendable achievements of the past decade, much more has to be done to tackle the erosion problem. Much more can be done. Neither Ethiopia as a nation nor the international community at large can afford just to continue present efforts, for although these will relieve the situation significantly, the gravity of the problem is already such as to inevitably imply human suffering and poverty on scales which should not be tolerated by mankind nor by any of its governments. This means that:

(a) the conservation effort has to be enormously expanded, by the addition of much more resources;

(b) that resources devoted to conservation have to be used even more cost-effectively so as to achieve greater impact, given the inevitably continuing resource constraints; and

(c) the conservation measures established by initial efforts have to be adequately maintained thereafter.

Lessons of experience relating to these three critical needs for the future conservation and/or reclamation of the Highlands are reviewed in the following three sections, respectively. The lessons are forward looking and provide some preliminary indications for Part III of this report.

8.10.2 Increasing resources

The magnitude of the task is such that far more resources have to be mobilized and committed for longer periods - including human resources (both skilled and manual labour) and capital (both domestic and external, economic as well as financial). The major source of resources - and most importantly of mass manual labour - is the Ethiopian peasantry itself. But the Government of Ethiopia has to continue its role as a catalyst in overall planning, initiating and spreading mass mobilization, in allocating capital and skilled labour resources, and in creating socio-economic environment which encourages people to use land without undermining its longer-term productivity. The size of the problem and the rate at which it is growing, taken with the resource constraints within Ethiopia, inevitably imply the need for massive external assistance, both technical (but not just technicians specific to conservation engineering) and capital, including funds for investments as well as operations, food-for-work and foreign exchange.

The major constraint which has inhibited the mobilization of resources for conservation, both within and outside Ethiopia, is the widespread notion that conservation is a limited and independent sub-sector, largely concerned with soils (and wildlife), and that degradation need only occasionally be considered as an impediment to development and then only on a project-by-project basis, not as a matter of strategy, planning or policy. Consideration at the project stage, although necessary, is no substitute for proper consideration at the strategy, planning and policy stages, for by the time projects are considered, conservation can only be viewed in a necessarily confined context. When conservation is viewed in this light, fewer resources are allocated to it, especially as both domestic and external resource allocators too often see "conservation projects" as having very long gestation periods with relatively high costs and far-off benefits. Furthermore, resources allocated to "other sub-sectors" are not viewed in terms of their possible impact on conservation, so that negative effects may arise, or even if positive, they may be insignificant and/or coincidental. Development in the long term cannot be sustained without conservation, and this is particularly true in the now fragile ecosystem of the Ethiopian Highlands. Therefore, conservation has to be integrated with development - at all levels and by all agents involved in the development process, in planning and in practice. Resource-exploitive development has to be rejected as being non-sustainable and as exploiting future generations for the short-run gains to the present generation. It is compatible with neither sustained development nor socialism. A Conservation-based Development Strategy (CDS) has to be the major theme for people, Government and external agencies concerned with sustainable development in the Ethiopian Highlands.

Unfortunately, most of the Highlands population are so poor that they lack the economic flexibility to defer use of resources that often need rest or reclamation. People whose very survival is precarious and whose prospects of even temporary prosperity are bleak, cannot be expected to respond voluntarily to calls to subordinate their acute short-term needs to the possibility of long-term returns. Thus conservation measures that require deferral of resource use (e.g., hillside closure, reafforestation) need to be accompanied by development measures which will maintain if not improve living standards - otherwise such conservation will be neither replicated nor sustained. Conservation needs economic development just as sustained development needs conservation: Conservation-based Development. Erosion control in the Highlands should become the necessary first step toward reversing the downward cycle of low income, zero capital accumulation and land investment, deterioration of land resource base and even lower income thereafter. But whereas erosion control is a necessary first step in breaking the vicious circle, it is not sufficient; if living standards are to be improved it must be part of a Conservation-based Development Strategy.

> "If major conservation and reclamation programmes are to be mounted, they are likely to be most successful if the affected population is involved in their planning and if they are comprehensive in their approach to tackling not only the problems of land deterioration, but also other 'felt needs' expressed by the communities (e.g., health services, water supplies, etc.)... A 'carrot and stick' approach to government intervention to promote land conservation is acknowledged as necessary. The inclusion of 'sweeteners' such as roads, markets and education in land conservation programmes may be essential predisposing factors to success. As a corollary, financing for land conservation should usually be in the context of rural development projects." (FAO, 1981c.)

The interrelations of conservation and development have been emphasized above because conservation is not an end in itself, but is a means toward sustained development. Sufficient explicit recognition of these interrelations has been lacking so far in conservation thinking and activities in Ethiopia at all levels. At Government level, a Conservation-based Development Strategy means not only allocating more resources to direct conservation activities, but just as importantly, building conservation objectives into the design of rural and agricultural development programmes, policies and projects, and giving far greater attention to degradation/conservation in education, training and institutional arrangements for development. At the farm level, a Conservation-based Development Strategy means using land in such a way as to avoid reducing its longer-term productivity. It is only through a Conservation-based Development Strategy that sufficient resources can be mobilized to tackle successfully the degradation problem.

8.10.3 Making more cost-effective use of resources

Conservation needs of the Highlands are such that no matter how large a programme can be mounted now, its overall impact will probably be limited by resource constraints in the future. It is particularly important to use those limited resources to best advantage, applying them to highest priorities. Top priority areas will not only generate the greatest returns, but may best persuade greater participation in conservation through their demonstration effects. Priorities preferably should be selected systematically by reference to explicitly agreed criteria. Such criteria should be derived from an overall strategy - this is one of the purposes of the EHRS and indeed is the subject of Part III of this report. Planning at both macro- and micro-levels, complemented by relevant monitoring and evaluation, is necessary to improve efficiency in the use of resources allocated for conservation. The results of this planning exercise, for example, already suggest that relatively more attention should be paid to conservation measures on croplands than to hillside terracing for reafforestation, and that permanently closed hillsides are not the most cost-effective means of reducing run-off from degraded hillsides (section 8.9.3).

The most important means to increase benefits from resources invested in conservation is by improved farming. The more productive the land, the more beneficial it is to conserve. Conservation has to be fully integrated into systems of land use - the farming systems of the Highlands. This is the core of a Conservation-based Development Strategy. At present conservation is being superimposed in a rather standard manner on all farming systems. The potential roles of agro-forestry, forage cropping, management and selective enrichment planting in closed hillsides, and improved grasslands management remain to be developed in Ethiopia's conservation programme. Ordinary Highlands cropping practices, such as excessive ploughing for teff, compaction of soil by driving animals over it prior to planting, failure to return organic matter to the soil, reducing fallows and poor crop rotations have not yet been addressed by agricultural planning, research, conservation or extension personnel in Ethiopia.

The vegetative techniques of conservation are not only ultimately more effective in conservation, but can also be a means to increased production and development. Conversely, improved crop production methods (involving increased soil cover, and improvement of soil structure) should contribute positively to conservation. The importance of the soil cover provided by cropping has not yet been realized by agricultural planners, researchers, conservationists and extension workers in the Highlands. Increased crop cover provides potentially the most effective means of conservation, and good crop cover can be consistent with peasant development. Increased agricultural production could and should provide the motivation and the means for spreading conservation. The role of livestock is also important, and overgrazing continues to be an important source of degradation. At present, the Highlands livestock herd is geared primarily to providing draught power and a means of saving/investment (section 5.6). If livestock can be developed for the production of meat, milk, etc., this - together with changed feeding systems - will contribute substantially to conservation. The ILCA Highlands Programme is carrying out farming systems research designed to contribute to the more efficient use of livestock in the Highlands mixed farming systems, and thus improve overall farm incomes (Gryseels and Anderson, 1983). Findings from this research and the EHRS farm model analyses are used to present proposals for conservation-based farming systems development in Part III.

Greater cost-effective use of resources for conservation should also be sought by trying to improve the effectiveness of measures both through improved initial construction and better maintenance. Initial construction quality would be improved by expressing targets in terms of effective treatment of areas rather than in terms of quantities of bunding or seedlings planted. More attention should then be given to drainage considerations and the differentiation of designs and specifications for varying situations of climate, soil, slope and farming system.

The cost-effective use of resources also calls for appropriate organizational, institutional and motivational arrangements. Many agencies in addition to the SWCD and FaWCDA are already involved or should be involved directly or indirectly in conservation (e.g., IAR, University College of Alemaya, RRC, WARDA, LUPRD, ADD, etc.) and an initial precedent for formal collaboration between some of these agencies was established with the formation of a Coordinating Committee for the EHRS (EHRS Inception Report, 1983). Part III makes proposals for the evolution of organizational arrangement and takes up other questions raised (e.g., whether SWCD should continue to involve itself in reafforestation and road construction activities). Organizational lessons have been among the most important learned from experiences of the Sirinka project (section 8.4) - the need for project activities to be linked with the relevant local governmental administration and to involve farmers, if activities are to be replicated and sustained. Experience at Sirinka and elsewhere has also underlined the importance of clearly defining and stating objectives, providing for strong and consistent management and assured funding for a sufficiently long period for the desired action to be planned and implemented.

8.10.4 Maintaining conservation measures and impact

There is evidence (e.g., WFP and SIDA evaluation missions, SCRP observations, EHRS WP 13, etc.) to suggest that in some areas, bunds and terraces are being broken, either deliberately because they are resented by farmers short of land or, more often, coincidentally because of initial poor construction, lack of maintenance, cattle walking over them, or too close ploughing. Greater attention has to be paid to prolonging the impact of conservation works by better ways of establishing them, ways which reduce subsequent maintenance requirements (e.g., stabilization of bunds/terraces with perennial fodder or food plants) and by increasing maintenance levels through both education/training and appropriate motivation. Conservation education is necessary but not sufficient to motivate the rural people to pursue Conservation-based Development spontaneously. Motivation at present is constrained by insecurity of land tenure making it uncertain as to who benefits from conservation, by small plots and low crop yields (which make it necessary for farmers to cultivate their lands to the fullest extent possible) and, in some cases, by failure to involve individual farmers sufficiently in the planning of conservation activities, even on their own holdings (SIDA, 1984). Local participation in planning conservation is not only educational in itself, but builds public confidence and provides more information on problems, capabilities and experiences at the field level. Popular understanding stemming from genuine participation in planning is likely to lead to improved maintenance.

Popular participation in both planning and implementation can best be furthered by providing farmers with convincing economic evidence that they will benefit from the proposed changes and costs involved. Costs of conservation (giving up land for structures, revegetation, etc., and labour inputs) are usually much more obvious than the benefits. While farmers are aware of degradation, they do not always believe that they are the losers, for it is a long-term process and long-term benefits may accrue to others. Thus many economic analyses in other countries have concluded that physical conservation structures are unlikely to be worthwhile from the viewpoint of the individual farmer, without subsidies (e.g., food-for-work) and/or accompanying agronomic measures to increase farm production. Without such measures, resort has to be made to coercion, legislation and/or taxation. The EHRS Sociological Survey revealed that coercion is very much resented by peasants, and it can be counter-productive in the longer term - making people apathetic or even downright antagonistic toward construction or maintenance of conservation structures. This suggests that legislation too would be unpopular and difficult to enforce. Experience in other countries has shown that conservation legislation alone is rarely successful in spreading conservation (Hauck, 1981), though it may be used to support the conservation requirements. This and the possible use of taxation, credit and market forces to encourage Conservation-based Development among farmers are pursued in Part III.

The successful conservation of the Highlands cannot be attained over the mass of its land area nor sustained in the longer term unless peasants - if necessary, with subsidies and other inducements mentioned above - are convinced to incorporate continuous conservation into their systems of land use. This again calls for a Conservation-based Development Strategy, the underlying theme of Part III.

Chapter 9

RESETTLEMENT

9.1 INTRODUCTION

The role of resettlement in the economic and social development of Ethiopia transcends the questions of degradation and conservation-based development. In this study it is treated only in its (important) role as one of the types of action in a Conservation-based Development Strategy. This chapter briefly reviews agricultural resettlement experience, mostly of the last ten years, and gives indications of establishment costs and economic performance.

An obvious consequence of the concentration of a substantial majority of the population in the Highlands has been to create immense pressure on the land. The inevitable human-induced land degradation through the persistent need for food, firewood and building poles has, over the centuries, led to the cutting of forests on the mountain slopes and reduced the carrying capacity of parts of the Highlands. The degradation process was further aggravated by poor farming management practices. Today, the northern regions of Eritrea, Tigray and Welo, which were the earliest settlements and cultivation areas in the country, are widely deforested and denuded of vegetation. The problem is less pronounced in the southern parts of the country as intensive agricultural cultivation is historically recent. Obviously there has been and will continue to be a tendency for resettlement from north to south and west. The question of course is how much resettlement should be undertaken as a matter of policy and of resource commitment of public authority, and of what kind.

Usually, the effect of degradation and its steady annual expansion are hardly noticed as it is a long-term and pervasive process. The reduction of soil fertility combined with the fragmentation of the holdings in the Highlands led to many thousands of people being dependent on holdings which were too small to provide more than subsistence, and led many more to resettle in other rural areas or to migrate in search of food and work.

It was the severe drought of 1973/74 and the consequent serious famine which aroused for the first time national and international concern about a situation which had been deteriorating over many years. Famine, which brought disaster to the people in the northern regions (claiming possibly over 200 000 lives of the 4.2 million people in Welo and Tigray), spread in 1974/75 to the semi-arid lowland areas in the east and south of the country which are occupied by around three million nomadic pastoralists.

Figure 9.1

ETHIOPIAN HIGHLANDS RECLAMATION STUDY (UTF/ETH/037)

LOCATION OF MAJOR SETTLEMENT PROJECTS

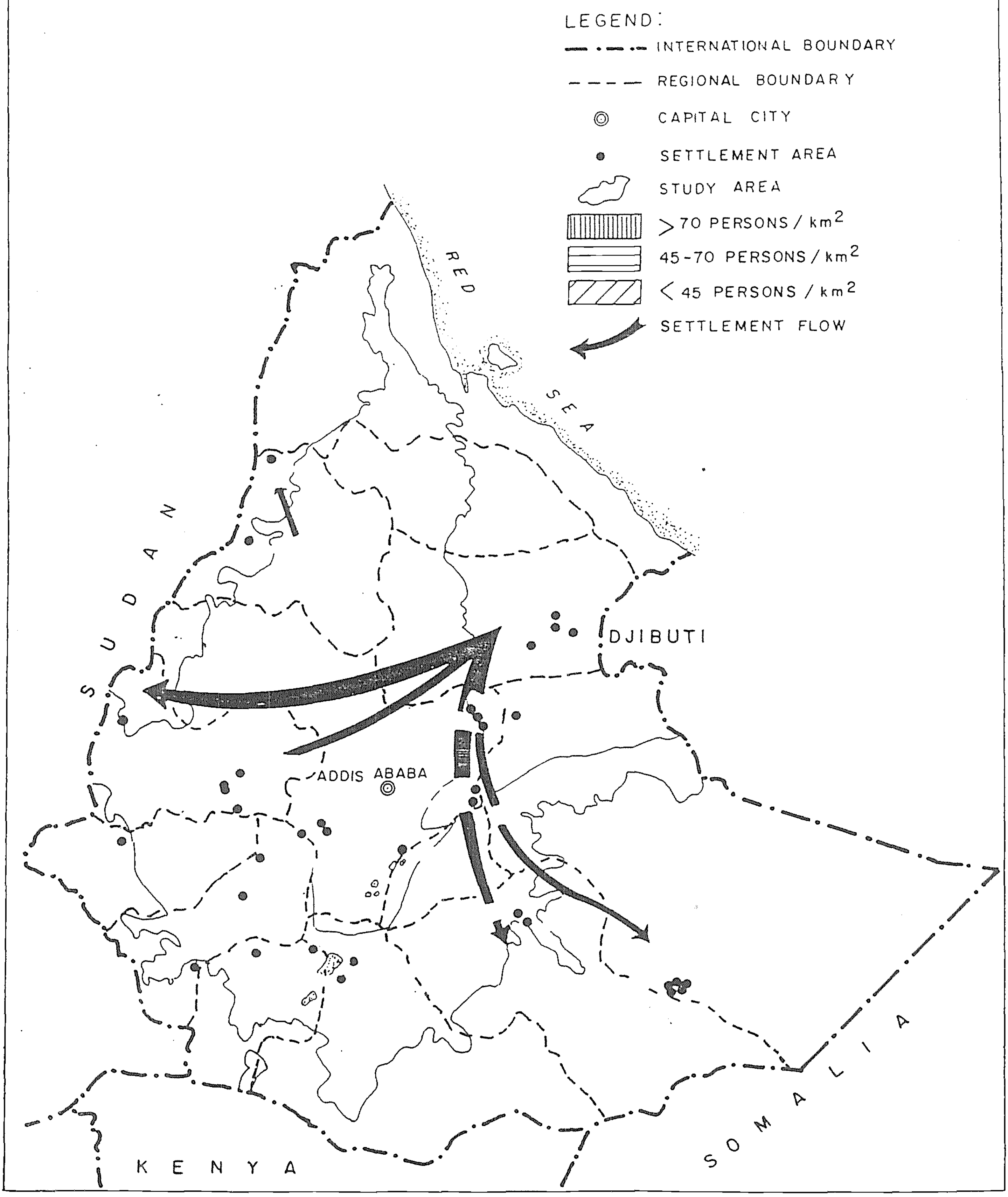
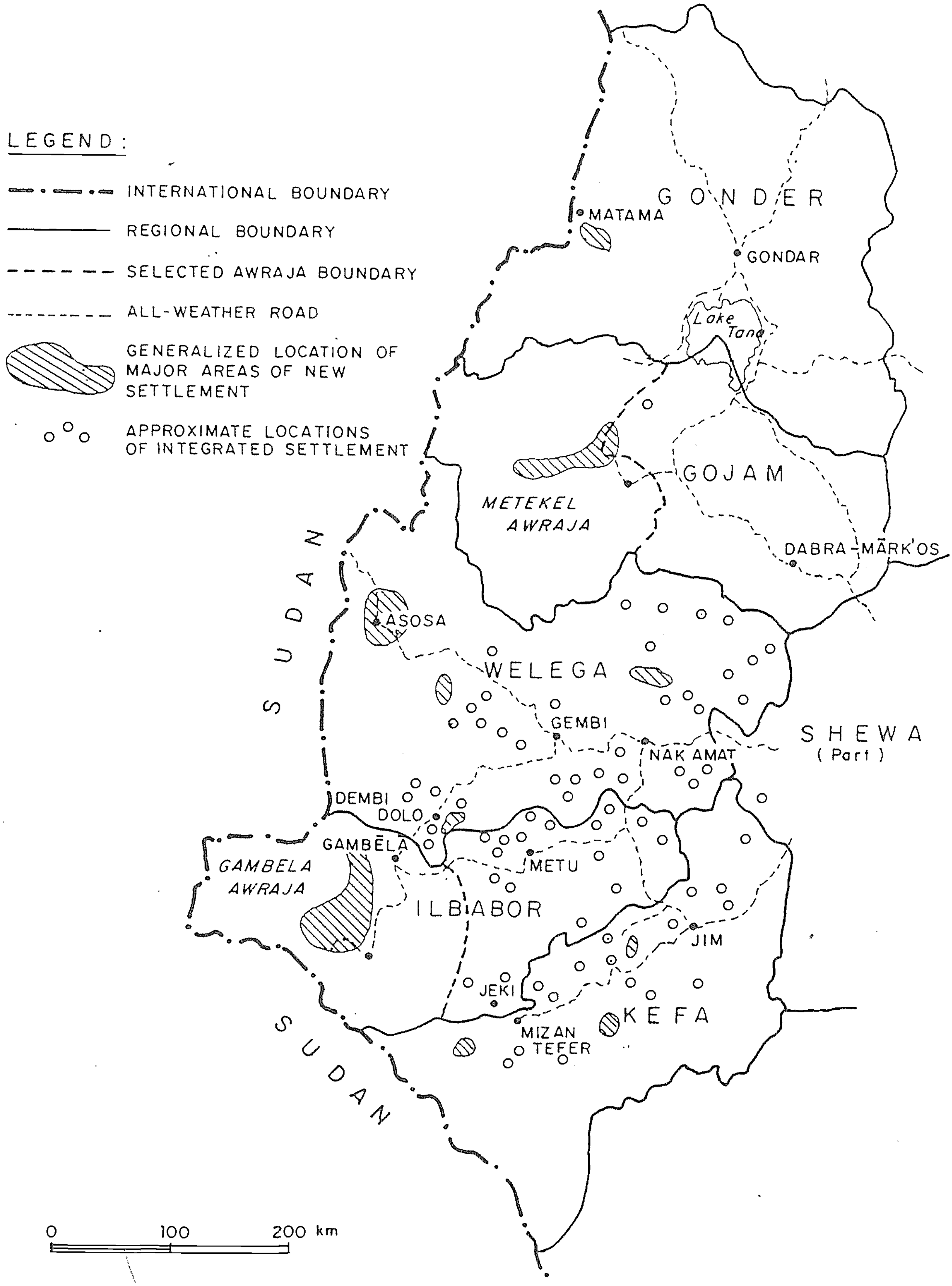


Figure 9.2

THE SIX SETTLEMENT REGIONS OF WESTERN ETHIOPIA



At the same time as the Government, with international assistance, developed a crash programme for relief and emergency settlement of drought victims based on the production of food grains under rainfed and irrigated conditions, high-level examinations of the underlying problems were made. A World Bank mission participated, and it was concluded that if major resettlement and land use improvement programmes were not implemented within the next decade, increasingly severe famines and further deterioration of living standards could follow. This led to the Drought Relief and Rehabilitation assistance for Ethiopia by the World Bank 1/.

High priority was therefore given by the Government to the identification of areas with potential for settlement, both rainfed and irrigated, in the large areas of unused or under-utilized land for the resettlement of people from the over-populated Highlands. Simultaneously, some people in eroded catchment areas were relocated to allow for improved land use and farming practices. This is the case of the Sirinka Catchment.

In August 1974, the Relief and Rehabilitation Commission (RRC) was established by Order No. 93 to coordinate the relief and rehabilitation aid and to distribute this to the needy, to conduct programmes of rehabilitation, and to minimize the likelihood of future disaster.

Although the purpose of this chapter is to examine Ethiopia's experience on resettlements since the establishment of the RRC in 1974, some consideration will be given to related developments on resettlement before the overthrow of the monarchy.

9.2. RESETTLEMENT AND LAND ADMINISTRATION POLICY BEFORE 1974

9.2.1 Studies on settlement and resettlement

Despite the difficult political climate for agricultural reform, a Ministry of Land Reform and Administration was established in 1966 and entrusted with the task of conducting various studies and producing policies in the field of land reform. Among its priority considerations were the adoption and implementation of settlement and resettlement programmes 2/. The Government appeared to give great importance to the issue of resettlements, both in terms of solving the problems of excessive labour/land ratio in the Northern Plateau

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1/ Appraisal of Drought Area Rehabilitation Project Ethiopia, World Bank, General Agriculture Division, East Africa, Report No. 444, June 1974.

2/ Source: Imperial Ethiopian Government, 3rd Five Year Development Plan 1968-1973, 1968. 425-426.

regions, and in terms of the modernization of agriculture and improvements in agricultural productivity in the economy as a whole. It was also hoped that by opening up virgin lands for settlement and by introducing improved and mechanized agricultural practices, rapid growth in agricultural productivity would result. These considerations were based on the assumption that the use of Government land would be planned and the traditional land grant system abolished.

A policy-oriented study was undertaken by Burke and Thornley of the Agricultural Development Service of the IBRD. The study held that it was necessary to achieve the maximum production from land to be settled in order to stimulate economic growth and so provide growing employment opportunities in the economy as a whole. They proposed the settlement of 1 800 families on 12-ha plots which would yield family incomes of EB 700, and of 200 families on plots of 140 ha with expected incomes of EB 8 000 per family. These proposals would have involved a total expenditure of EB 12 million on 2 000 families. These proposals were unacceptable to the Ministry on political and social grounds: they would have created a class with annual incomes well above the national average of EB 169 (1968/69), and excessively large holdings for the settlers (66 percent of ordinary holdings were less than 1.5 ha). As a result the Burke-Thornley report was rejected by the Government.

A 1971 report by a consultant for the Harvard Advisory Group advocated the abrogation of the Imperial land-grant system and proposed a comprehensive planned use of Government lands through an appropriate settlement policy. A key element in the policy was the support to be given to individual initiatives and to low-cost settlement programmes 1/. The need for the control of spontaneous settlement which was taking place on Government land at the time was also stressed by this report in order to use the nation's agricultural resources in a rational manner.

A report by the ILO Exploratory Employment Mission to Ethiopia (1973) did not consider the availability of Government land as sufficient to solve the problem of rural surplus labour 2/. The report supported a study conducted by the Planning Commission Office recommending that large-scale land development by commercial interests constituted a more feasible approach from the point of view of raising agricultural productivity, export earnings, and even of expanding employment.

Despite laudable commitments by the Ministry and the considerable time and money invested in studies of land settlement and resettlement

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1/ J.D. MacArthur. The Development of Policy and Planning for Land Settlement in Ethiopia, Addis Ababa. Ministry of Land Reform and Administration, 1972, Chs. 1, 4, 5.

2/ ILO/UNDP. Report to the Imperial Ethiopian Government of the Exploratory Employment Policy Mission, Geneva: ILO, 1973, p.33.

the Government was unable to submit any working land use policy and programme to Parliament before its overthrow in 1974. This was caused in part by opposition to the objectives of the resettlement policies and by the consequences of such policies, both of which would have clashed with the interests of the landed elite and threatened the regime's stability.

9.2.2 Spontaneous resettlement before 1974

Spontaneous resettlement took place throughout the centuries but particularly between 1940 and 1970. The absence of any official registration makes it difficult to measure accurately its magnitude. According to a study in 1977, "Numerically it is certain millions of people have been involed in some degree of resettlement since Italian Occupation, but any more precise figure can only be a guess". 1/.

While considerable resettlement was spontaneous because of the Government's failure to introduce a programme of low-cost resettlement, it took place in response to a number of changes which have occurred in Ethiopia since the Second World War. These are:

(1) The increase in population. The population was estimated to be 12 to 13 million in the mid-1940's (Perham, 1969) and about 27 million in 1972 (Ethiopian Government, 1972). In the absence of opportunities for accommodation of this increment in towns, there was widespread resettlement of people in rural areas, in search of land of better quality. Land suitable for subsistence cultivation was the major criterion for resettlement into even remote fringe areas of the Highlands;

(2) Improvements in communications across the country. The development of the road network resulted in expansion of the money economy, a growing commercial orientation of rural areas, and changes in values and aspirations among the population. In some cases seasonal migration for wage employment provided the cash needed, but many sought additional land to produce increased surplus for sale. As a result, resettlements associated with the increased demands for cash took place on land located closer to roads and small towns;

(3) The spreading of information about potential resettlement areas. Spontaneous resettlement was stimulated by the increasing movement of traders, Government officials and teachers throughout the country;

1/ Adrian P. Wood. Resettlement in Illubabor Province, Ethiopia (Ph.D. Thesis, University of Liverpool, England, October 1977). p. 84.

(4) Evictions of tenants on a significant scale in parts of southern Shewa and northern Arsi from 1968 as a result of the commercialization and mechanization of farming in these areas. In the CADU Project area (Arsi), for example, it was recorded that in 1970 alone as many as 550 tenants (or 25 percent of those previously farming in the area in the mid-1960's were evicted. 1/

9.2.3 Short- and long-distance resettlement

Apart from the study of Wood (mentioned above) there is little written on spontaneous resettlement, but it is certain that millions of people were involved between 1940 and 1974. With the exception of the desert lowlands and the regions where all suitable land was already densely settled, there are few areas where resettlement is not known to have taken place.

Most resettlements of the earlier periods involved short-distance migrations. Traditionally the Ethiopian farmers cultivated the plateau tops. Increasing population pressures and extensive agricultural practices led to overcultivation, erosion, and declining fertility in the traditional areas, with consequent spread of resettlement. In particular, cultivation spread gradually down the slopes, off the plateaus. These resettlements, involving mostly subsistence farmers, are known as "down-slope resettlements" and were typical of the earlier forms of resettlement in Ethiopia. While cultivation in some cases had already begun in the valley bottoms, the down-slope movement of habitations would normally proceed down to the "malaria belt". Further descent in malarial areas had to wait for better communications and transportation as well as the introduction of malaria eradication programmes and irrigation schemes. Finally, it must also be noted that resettlement also took place upslope, with cultivation of areas formerly regarded as too steep or too cool for successful cropping.

Long-distance resettlements occurred often when there were strong links between a source area and the resettlement area. Such links existed between the northern Highlands and the southwestern provinces of Welega, Ilubabor and Kefa due to the passage of traders and the knowledge of previous resettlement. It also appears that some evicted tenants, fearing further evictions, resettled over considerable distances into remote areas. It was not unusual to see the simultaneous resettlement of local short-distance migrants taking place with those of long-distance migrants in the same general areas. Wood's study, conducted in mid-1970s, of resettlements in southwestern Ethiopia

1/ Ministry of Land Reform and Administration, Draft Policy of the Imperial Ethiopian Government on Agricultural Land Tenure, Addis Ababa, August 1972, p. 69.

showed that differences in age, literacy, and motivation existed between these long- and short-distance migrants. The long-distance migrants were generally younger, often single and mainly literate. They had chosen to migrate because their rising aspirations could not be met in the home area. On the contrary, local migrants were found to be relatively older, family heads and mainly illiterate. Their decision to resettle was motivated in response to problems associated with the physical environment, the system of tenancy and land taxation. 1/

Spontaneous resettlements between 1940 and 1974 were both conservative and innovative. While the majority of the migrants retained traditional ways, some adaptation to different environmental conditions were necessary. These mainly involved the adoption of new staple foods and changes in agricultural and cattle herding practices. Sometimes these changes were learned by the settlers from the indigenous people, but in other cases they appear either to have been developed independently or introduced by Government or other agents of change. In some cases the settlers were also agents of innovation, spreading new ideas to the indigenous population. 2/.

9.2.4 Planned resettlement

Despite the extensive treatment of the issue of resettlement in the Third Five Year Development Plan (1968-73) and the considerable studies and discussions of resettlement as an economic measure, because of the difficulties outlined above only a few planned resettlement schemes were begun before 1974. No single Ministry or Authority was assigned responsibility for resettlement and all schemes were small-scale and separate projects, rather than parts of a national programme. On a national scale, resettlement was viewed in the context of a possible regional development strategy aimed at relieving population pressures in the northern Highlands and raising productivity through the use of underdeveloped land resources and the introduction of improved land management practices.

9.3 RESETTLEMENT SINCE 1974

Over the last ten years, the RRC provided resettlement assistance to about 46 000 families in eleven administrative regions under its regular Settlement Programme. These settlers have been from various backgrounds: drought-affected areas (±37.5%); nomadic origin (±25%);

1/ A.T. Wood, op.cit, Ch. 11 and p. 327.
2/ idem.

urban areas ($\pm$20%) and densely populated farming areas ($\pm$17.5%). 1/ Originally there were 88 schemes, but eleven of these had become self-reliant by January 1985 and were integrated into the existing rural structure of PAs, and two were converted into State Farms. Excluding the new schemes of the emergency programme begun in November 1984 there were still 30 237 settler households with a total of 123 700 persons (4.1 persons/family) in 74 settlement units. These were distributed into 50 "special scheme" units with 24 357 households and 24 low-cost scheme units with 5 880 households (see Table A9.5). Based on 1984 results, 57 schemes were reported already to have become self-reliant in terms of food and clothing requirements. (See Table A9.7, Basic requirements for settlement self-reliance.) Thirty thousand families is less than half of one percent of the total rural families (around 8 million), but the emergency programme of 1984/85 may add another 237 000 families, bringing the households in resettlement units to around 3 percent of the total farm households.

9.4 INSTITUTIONS INVOLVED WITH RESETTLEMENT SINCE THE REVOLUTION

9.4.1 Establishment of the Relief and Rehabilitation Commission (RRC) (Order No. 93/1974) 2/

In August 1974, the Relief and Rehabilitation Commission (RRC) was established with wide power to:

(i) provide relief to victims of disasters;
(ii) take short- and long-term rehabilitation measures;
(iii) seek assistance from domestic and overseas sources; and
(iv) coordinate the efforts of donor agencies.

Although resettlement did not constitute a priority programme of the Commission at the beginning, it later undertook resettlement activities as long-term solutions to persistent drought and population displacement problems.

High priority was therefore given by the government to the identification of areas with potential, under both rainfed and irrigated conditions, in the areas of unused or under-utilized land, for resettlement of people from over-populated Highland areas. Simultaneously, more people in crowded catchments were relocated within the area to allow for improved land use and farming practices.

1/ Information on settlements - 1985. EHRS data collected at RRC headquarters.

2/ PMAC, "An Order to Establish a Relief and Rehabilitation Commission for Areas Affected by National Disaster, 29 August 1974", Negarit Gazeta.

9.4.2 Establishment of the Settlement Authority (Order No. 78/1976) 1/

As the full magnitude of the task of rehabilitation and resettlement became apparent, the government's commitment to sustainable resettlement was underlined in the Land Reform Proclamation No. 31 of March 1975 that nationalized rural lands 2/. The public ownership of rural lands paved the way for the government to resettle people as it determined the need.

The next important development in connection with the implementation of planned resettlement was the establishment by Proclamation No. 78 of February 4, 1976 of a Settlement Authority as an autonomous unit within the then Ministry of Agriculture and Settlement 1/. The Settlement Authority was set up as a specialized body for planned land settlement with the following objectives:

(i) to resettle over-crowded farmers and urban unemployed on hitherto unoccupied and agriculturally viable lands, thereby alleviating the nation's acute underemployment and unemployment problem;

(ii) to introduce modern animal husbandry to nomadic mode of life with the eventual aim of combining agriculture and modern animal breeding; and

(iii) to undertake, in collaboration with concerned government agencies, soil and water conservation activities.

The accent thus was on resettlement of people as a means of alleviating unemployment and underemployment. According to its programme of work, the Authority would provide settlers with agricultural inputs on a credit basis, repayable loans for setting up cooperative shops, water supply, health care and education facilities. Settlers were expected to attain self-reliance within three years of establishment and become the owners and managers of their scheme. The target of resettling 20 000 families per year had also been set up by the Authority. 3/

1/ PMAC, Proclamation No. 78 of 1976: "An Order to Establish a Settlement Authority for Planned Land Settlement, 4 February 1976", Negarit Gazeta.

2/ PMAC, Proclamation No. 31 of 1975: "A Proclamation to Provide for the Public Ownership of Rural Lands", Negarit Gazeta.

3/ Ministry of Agriculture and Settlement. The Settlement Authority at a Glance, Addis Ababa. Commercial printers, 1978, pp. 3-5.

9.4.3 The New Relief and Rehabilitation Commission (Order No. 173/1979) 1/

Two major steps were taken later by the government. The first was the launching in October 1978 of the Revolutionary Development Campaign. The second, which in part resulted from the first, was the merging of the Settlement Authority with the RRC in April 1979 to form a single, expanded RRC responsible for overall relief, rehabilitation and settlement.

The new Commission brought, under one organization, tasks hitherto carried out by three different institutions, namely: the Awash Valley Authority; the Settlement Authority; and the former RRC. It was set up as an autonomous body, accountable to the office of the Chairman of the Council of Ministers, and was entrusted with two broad functions. The first is the coordination of relief and the distribution of relief aid to the victims of natural and man-made disasters. The second is the settlement of several types of "target" groups:

First, there are those who have been displaced due to disasters such as drought and war; those who have been left with little and practically useless land; and the rural landless. These, by and large, are inhabitants of the northern Highlands.

The second target group is the urban unemployed. An ILO mission estimated urban unemployment at nearly 20 percent of the labour force in 1978.

The third target group is the nomads and semi-nomads, who are at high risk. They constitute probably 10 percent of the total population.

With respect to its resettlement functions, the main responsibilities of the RRC, before the emergency resettlement programme of November 1984, were:

(i) to develop settlement strategies, priorities and programmes;

(ii) to undertake studies of soil and water resources and, in co-operation with other government bodies, prepare an inventory of lands suitable for settlement;

(iii) to formulate proposals and prepare detailed plans for settlement for national and international funding;

(iv) to ensure that the essential physical and socio-economic infrastructures are provided for during planning and implementation of settlement projects and coordinate the

1/ PMAC, "Proclamation No. 173 of 1979: A Proclamation to Establish a Relief and Rehabilitation Commission", Negarit Gazeta.

inputs of the relevant government ministries in this respect;

(v) to protect and conserve the national resources of settlement areas; and

(vi) to develop the settlements to the stage at which they become self-reliant cooperative farms, no longer dependent on RRC and needing to rely only on the normal services of the Ministry of Agriculture.

Important changes in responsibility were instituted with the emergency programme. RRC will continue to handle the resettlement to the site, but the various Ministries (chiefly the Ministry of Agriculture) will manage the new settlements. RRC will continue with the older units until they are judged self-reliant. Overall authority and coordination of all resettlement activities is now under a national committee guided by the Politbureau of the WPE.

9.5 RESETTLEMENT SCHEMES INSTITUTIONS

There are two sets of institutions governing the settlement schemes: the RRC, which is governmental; and the Producer Cooperatives of the settlers. 1/ The two are linked at the scheme level by the Unit Manager and other RRC staff members attached to the Unit.

9.5.1 RRC organization

To assist the RRC in meeting its responsibilities and obtaining the cooperation and support of other government bodies, an Advisory Council has been established. This Council comprises the Ministries and heads of departments of the Ministries, or Commissions, of Agriculture, Health, Education, Labour and Social Services, Urban Development and Housing, Interior, Water Resources, Transport and Communications, Industry Mines and Energy, and the Chariman of the All-Ethiopian Peasant Associations. The Chairman of the Council is the Commissioner of the RRC.

At Headquarters level, RRC is headed by a Commissioner, assisted by two Deputy Comissioners, one in charge of Development, the other in charge of Administration and Logistics. Directly under the Commissioner are the Aid Coordinating Services and the Audit and Inspection Services. The Development Division has the Early Warning and Planning Services, the Land Reclamation and Utilization Department, the Agricultural Technology Services Department, the Settlers Administration

1/ Since September 1945 "special" settlement units need not be organized, at the outset at least, as Producer Cooperatives.

and Cooperative Department, and the Engineering and Technical Department. Under the Administration and Logistics Division are: the Organization, Management and Training Services; the Public Relations and Information Services; the Air Transport Services and the Relief Aid Services. There are two general service departments: General Administration, and Finance.

At the Regional level, there are RRC Regional Officers, assisted by Deputy Regional Representatives. The offices comprise eight sections: Audit, Finance, Administration, Property and Transport, Agricultural Technology, Information and Public Relations, Relief, and Settlement. The Regional Office acts mainly as a liaison between the Headquarters at Addis Ababa and the Settlement Coordination Offices whose activities it supervises. The same arrangement is repeated at the Awraja level. At this level, however, the emphasis is on relief activities.

The Coordination offices are headed by Settlement Managers who supervise and coordinate the activities of up to five settlement units. A Coordination office is made up of the Settlement Manager's Section, the Administrative and Finance Section, the Agricultural Technology Section and the Settlement Administration and Cooperative Section.

The settlement unit is the lowest administrative/implementation level within the RRC organizational structure. At this level and in the case of the special schemes only, there are two parallel structures of management, one made up of government-supplied personnel (mainly RRC staff) and the other constituted by the settlers themselves. The basic task of the government personnel is to train counterparts from the settler population so that after three years settlers should be able to manage their own affairs. Government personnel at the unit level are the Unit Manager, a Cooperative Organizer, a Home Economist Agent, an Assistant Administrator, a Junior Mechanic and several Tractor Operators who are RRC staff. In addition each settlement unit has a Clinic Dresser from the Ministry of Health and several teachers from the Ministry of Education. However, it must be noted that the organization and management of settlements has been subject to some evolution and also shows regional variations.

9.5.2 The settlers

According to the government's settlement policy of 1981 1/ the RRC was to organize the settlers to form Producers' Cooperatives and help them carry out their development works and thereby find lasting solutions to their economic problems in line with the socialist mode of production - to promote the living standards of the settler population and enhance the economic development of the country.

1/ RRC Settlement Policy, Addis Ababa; RRC, July 1981.

The following applied to all the "special schemes" units which were organized since 1975 (PAs in settlements which then became Producer Cooperatives). The model for these resettlements, which came under the RRC regular programme, was the "Welba" (second) stage of PC development, in which members can have only 0.1 ha (instead of 0.2 ha) as a homestead plot; the PC does not pay rentals for the use of members' oxen, etc.; but some livestock may be privately owned. Income is proportional to "work points" earned.

On each settlement organized as a PC the following organs are established:

(i) The General Assembly, composed of all the settlers of the unit. This is the highest authority of the Producers' Cooperative. It meets once in three months or at least twice a year. Every settler is expected to attend, but there is a quorum of two-thirds of the membership;

(ii) The Executive Committee of seven to nine members. The Committee is elected by the General Assembly for a term of two years. Members may stand for re-election. This Committee is responsible for the day-to-day activities of the cooperative. It meets once a month, but it may hold emergency meetings when necessary;

(iii) The Control Committee of three to six members is elected by the General Assembly for a term of two years. The Committee is to check abuse of power and to see that duties given to members and organs of the Producers' Cooperative are promptly discharged. The Committee is also to ensure proper management and use of the property belonging to the unit;

(iv) The Development Committee of three to five members. It is elected by and reports to the Executive Committee, some of whose members may be elected to serve on the Development Committee. It is concerned with the achievement of increased production through improved technology and also reports on the effectiveness of innovations. It has the responsibility of ensuring that the teams accomplish their daily tasks;

(v) The Work-teams. Settlers are grouped in teams, each with a leader who assigns the work to the team members. The leader also works. Work involved in the various farm operations is graded, and work points are awarded.

With the announcement of a new RRC approach to settlement in September 1984 the "new special" units were no longer to be organized as PCs, at least at the outset. But since the emergency campaign of resettlement started in November 1984 conflicting reports have been heard that some "new special" schemes in the emergency programme have been organized as PCs. It is too early to know clearly just how the "new special" schemes are organized and function.

9.6 THE SETTLEMENT PROCESS BEFORE NOVEMBER 1984 (Pre-emergency conditions) 1/

According to the RRC programme, the settlement process starts with the selection of a "target group". Once the group has been identified several steps are taken by RRC to familiarize the people with the settlement programme and the advantages of joining it. The next step consists of conducting a demographic study of those who volunteer to be resettled. Once heads of families have registered, RRC proceeds with the site selection.

9.6.1 Site selection

The selection of sites is determined by a committee composed of representatives from relevant institutions, with the RRC as coordinator. A feasibility study of the proposed site is required. This study should involve:

(i) a pre-feasibility study on the location, climate, geology, soils, topography, vegetation, water resources, communications and land use of sites considered;

(ii) a general plan which focuses on how and when the objectives and targets of settlement are to be realized.

There is also to be a detailed plan which sets up a work schedule for every operation and quantifies the necessary material, financial and power (man, animal and machinery) requirements. This detailed site planning is the responsibility of the RRC.

However, as a result of the pressures of time, there is evidence that often such elaborate studies as outlined were not done. The case of the Melka Oda Project, where most settlers had to be relocated to Harawa because of the unsuitable soils, is one example. There have been many other examples recently.

9.6.2 Settler selection

The selection of settlers is entrusted to the RRC. The Ministries of Agriculture, Interior, Labour and Social Affairs, as well as the All-Ethiopian Peasants' Asosciation are expected to participate in recruitment and persuasion of people to resettle.

1/ Once again it is stressed that with the emergency programme begun in November 1984 there have been many changes in organization and procedures. Often some of these procedures were not followed even before the emergency programme, particularly with respect to site selection.

Selected prospective settlers must:

(i) express their willingness to be resettled;
(ii) be interested in agriculture for their livelihood;
(iii) accept the basic principles of cooperatives and be able to work.

In principle only volunteers are chosen for resettlement. However, there have been cases of involuntary resettlement, which inevitably resulted in a high turnover of settlers: urban unemployed (29%); peasant farmers (16%); and nomads (13%). 1/

9.6.3 Temporary accommodation

Once they have been selected, settlers are transferred to the site where they are first accommodated in common temporary shelters. Later they construct their own dwellings with the help of RRC (in the case of the Special Schemes).

9.6.4 Distribution of food and other items for two harvests

During an initial period the settlers are provided with food, clothing and basic house utensils until they become self-sufficient in production. Settlers are expected to be self-sufficient in food after 18 months of settlement or after two crop seasons.

9.6.5 Provision of economic base for a reasonable standard of living

In the case of the special schemes programme, the RRC provides each unit with an economic base consisting of infrastructure work, farm buildings and facilities.

9.7 THE SETTLEMENT MODELS (PRE-EMERGENCY, NOVEMBER 1984)

These "Regular Settlements" of the RRC constituted its planned settlement programme which comprised two types: the "Low-Cost" and the "Special" settlements. These settlements are based on the "Settlement Model" as described in the Settlement Policy Paper. 2/ The classification is based on the nature and intensity of the investments.

1/ Data collected by the team at RRC Headquarters.
2/ RRC, Settlement Policy, Addis Ababa, RRC, July 1981.

9.7.1 <u>The "Low-Cost Settlements"</u> (see Table 9.5B)

These settlements were established mainly on nationalized agricultural estates taken over because of the Land Reform Act. In the "low-cost settlements", the settlers are organized into PAs and allowed to cultivate their holdings individually. Although they are encouraged by the government to engage themselves in socialist forms of cooperatives, the decision to move to collectivization remains theirs. As the name suggests, the settlements tend to be labour-intensive. The main objective is to match unutilized land with underutilized labour.

A scheme under the "Low-Cost Settlement Model" consists of 250 families in an area of 625 hectares (2.5 ha/family) for rainfed agriculture and 375 hectares of land (1.5 ha/family) for irrigated units. Settlers are provided with seeds, oxen, technical support, credit, supplies and other inputs under budgetary provision from the government for up to three years, by which time they are expected to develop into a self-supporting Producers' Cooperative.

The land selected for "low-cost settlement" is to be free of trypanosomiasis to allow for oxen ploughing.

As of November 1984 the 24 "low-cost settlements" were 32 percent of the resettlement units and 19 percent of the households. 1/

9.7.2 <u>The "Special Settlements"</u> (see Table 9.5A)

These are large-scale planned settlements in sparsely populated areas. They automatically follow the "Welba" Producers' Cooperative model. Within the first year settlers normally are introduced to the basic principles of cooperative farming, and leaders of the cooperatives trained in cooperative management, job assignment and income allocation.

A special settlement scheme, following the Model, would consist of 500 families per 1 250 hectares (2.5 ha/family) in the case of rainfed settlements and 750 hectares (1.5 ha/family) in the case of irrigation units. The 1 250 hectare area is divided into: 1 000 ha for communal cropland; 100 ha for communal grazing; 100 ha for forest, soil and water conservation work, seed and seedling production, village facilities, etc., and 50 ha for homesteads.

Settlers are given training, spread over three years, in the fields of agriculture (crop production; animal husbandry; agricultural technology, etc.), cooperative management (accounting, stores management, administration, etc.), health (environmental sanitation, midwifery, etc.), and home economics.

1/ Low-Cost Settlements recently established under the emergency programme are not included.

The Special Settlements are costlier because they include more infrastructure, buildings, mechanical cultivation, etc., skilled labour for some of the farming operations, trypanosomiasis and malaria control programmes, and the technical support of up to 14 skilled persons from the RRC and the relevant ministries to help establish the settlement cooperative.

A "Special Settlement" project is expected to achieve self-sufficiency in three years. In addition to the evaluations to be made during the first two years of the project's life, at the end of the third year a team from RRC and the Ministry of Agriculture evaluate its economic and social condition to determine whether self-sufficiency has been attained. If the conclusion is positive, the project is transferred to the Ministry of Agriculture and is provided with services similar to those provided to other Producers' Cooperatives; if not, RRC runs the project for a few more years.

On the eve of the emergency settlement campaign of November 1984 the 50 "Special schemes" accounted for 68 percent of the RRC settlements and 81 percent of the settlement households. 1/

9.8 MANPOWER OF RRC

The RRC is charged with triple responsibility for Relief, Rehabilitation and Settlement Programmes. The total operation of the RRC in 1983 was carried out by 4 311 employees. The number of employees directly participating in settlement activities were 380, 32 percent of the total work force of the RRC. 2/

9.9 THE NEW SETTLEMENT APPROACH OF RRC, SEPTEMBER 1984, AND THE EMERGENCY PROGRAMME OF NOVEMBER 1984

After ten years of RRC experience and evaluation, weaknesses were identified and a new approach was adopted in September 1984. In a sense, however, the pressure of the famine resulted in an emergency programme of resettlement - on an unprecedented rate and scale. Where about 45 000 families had been resettled in ten years, 171 000 were resettled in eight months in the first phase of the emergency programme. A further 136 000 (minimum) was the target for the second phase, for completion in another such period from September 1985.

The emergency programme has dominated policy and procedures since November 1984 but the policy approach of September 1984 is worth noting: it reflected RRC opinion at that time and clarified the various types of settlement foreseen.

1/ "Special schemes" which are being established under the present emergency programme are not included.

2/ Data collected by the team at RRC Headquarters.

9.9.1 The new RRC approach of September 1984

The new policy was to put much more emphasis on the voluntary cooperation of prospective settlers, on the importance of moving the settlers as family units, and on the use of oxen for farm draft power. For the settlement programme as a whole, the Commission decided on four types:

(i) The "new" Special Schemes Settlement
The Commission would continue with modified Special Schemes, the main difference being that tractors and other machinery are to be withdrawn at the end of the second year. Under this programme it was intended to rehabilitate 6 000 heads of households a year as of 1985. This is essentially the form used in the first phase of the emergency programme, in fact, for about 100 000 families. Producer Cooperatives are not required, in which case settlers are allocated plots of 2 ha.

(ii) The Catchment Rehabilitation Settlement
This programme is really villagisation, not resettlement. In catchment areas where land is degraded and where reclamation is possible by taking appropriate measures without reducing population pressure, a villagisation programme will be implemented within the catchment. The first step will be to group the population in villages, in order to have better control over cultivation and grazing, and to mobilize manpower for soil conservation works. For 1985 it had been planned that 51 600 heads of families were to be enrolled annually in this programme. A list of 15 catchment areas to be rehabilitated within the coming ten years has been compiled. In the meantime, villagisation has been pushed on general, rather than conservational, rehabilition principles on a very large scale in Arsi and Hararghe as well as in Bale Region.

(iii) The "Spontaneous" (Low-cost) Settlement
This scheme will be carried out in areas that require very little clearing. The RRC will lay out and plan the inhabited locality of the settlement unit where the settlers will live, but will do very little else, apart from transporting the settler family and belongings. As from 1985 the programme was intended to settle 12 800 heads of households annually.

(iv) The "Integration" Settlement
In some areas, where there is no room for the establishment of new settlement units but where there is sufficient land for the PAs of the area to absorb more families, individual settler families are integrated within the existing PAs, up to the limit of the desired land/man ratio (i.e., permitting 2.5 ha/family). The assistance to be provided by RRC will be similar to that given in the case of spontaneous low-cost

settlements. It was expected that as from 1985 1 000 heads of households a year would be thus integrated, but in fact under the emergency programme which began in November 1984, about 71 000 were so integrated over 8 months in 1 269 localities. (See Tables 9.5C and 9.5E.)

9.9.2 The Emergency Settlement Programme - November 1984

Recognition of the scale of the famine in the northern regions of Welo and Tigray prompted the government to undertake an emergency settlement programme. The programme aims at settling about 308 000 families, almost a million people, in the western and southwestern parts of the country. Many of the receiving areas are close to the older settlement areas. (Asosa, for instance; see Figs. 9.1 and 9.2.)

The first phase, November 1984 to June 1985, involved 171 000 families. The second phase, which is now being implemented, involves 136 000 families.

In Phase One there were about 71 000 families in "integrated" type settlements and 100 000 in "new" special settlements. (See Tables 9.5D and 9.5E.) In Phase Two, only "new" special settlements are involved.

Basic modifications to the previous settlement policy in line with the RRC new settlement approach of September have been introduced to this new programme.

9.10 ESTIMATION OF COSTS AND BENEFITS

Three sets of data have been used: those obtained from the RRC Headquarters in Addis Ababa; those collected through a questionnaire in the preparation of WP 28; and, to a lesser extent, personal information gathered during field work through discussion with RRC staff, members of settlers' communities, and various other government, UN, and IBRD staff. A questionnaire was designed and used in the field, where a copy was filled in for each of the 20 settlement units included in the analysis. A list of these 20 settlements is given in Table A9.4. Some detailed information has been found for programmes before the emergency resettlement campaign started; thereafter the estimates are much more conjectural, but it is necessary, however roughly, to attempt to indicate something of the costs and direct benefits involved in these resettlements. Obviously there are other purposes and effects of resettlement which are not dealt with in this presentation.

The cost analysis section is first concerned with establishment costs, as opposed to recurrent charges, personnel and farm costs, which will follow. The establishment cost refers to all costs incurred from the time the settler is transported from his place of origin until he begins to fend for himself and ceases to receive food rations from the RRC. Reference is first to the "special" and "low-cost" models before the emergency campaign of November 1984, estimates of which will follow.

The specific items considered under this section are:

(i) Transport of settlers, including food ration in transit;
(ii) Infrastructural development work at settlement site;
(iii) Cost of farm structures;
(iv) Cost of farm machinery and equipment;
(v) Food support costs (usually for 18 months).

For the purpose of cost computation, a settlement unit is defined according to the RRC specifications concerning the "Settlement Model". The RRC planning model is a farming unit of 1 250 hectares, of which 1 000 hectares should be under crop, 100 hectares each under pasture and forest, and the remaining 50 hectares for the village and homesteads. Each unit of this size was intended to accommodate 500 settlers or heads of family, but in practice the average is about 487. Since the average size of the settler family before November 1984 was about 4.1, approximately 1 990 persons were settled in one unit. (In the case of "Special Irrigated" schemes, the irrigation facilities are provided for 750 hectares or 1.5 hectares per family. Irrigation settlements will not be discussed further here. There is little specific information, the relative importance is small, and the establishment costs are reportedly only about 3 percent higher.

Two main types of settlements are considered in the costing: the "special" units and the "low-cost" schemes. The main differences between the two lie in the degree of capital intensification (level of investment) and in the fact that almost all the "special schemes", at least before November 1984, were organized as Producer Cooperatives. Some speculative attempt is also made to indicate possible costs of settlements under the emergency programmes since November 1984.

9.10.1 Transport and feeding costs in transit

- Transport cost by road

  According to RRC Planning Services the costs per person of transporting prospective settlers from the northern regions of Welo and Tigray to the western and southern regions of Welega and Bale were as follows:

  -Welo (Kombolcha) to Bale (Harewa): Birr 66.50 per person
  -Welo (Kombolcha) to Welega (Asosa): Birr 76.40 per person
  -Tigray to Welega (Angar Gutin): Birr 35.00 per person

  For the purpose of calculation, the mean of the three, Birr 59.30, is used.

- Feeding cost
  Prospective settlers in transit receive daily food rations equivalent to Birr 3.50 from the RRC. It generally takes three to four days to transport settler families from the north to destinations in the south or west. The following per-person costs of food provided to settlers in transit were obtained from RRC.

  -Welo (Kombolcha) to Bale (Harewa): Birr 10.50
  -Welo (Kombolcha) to Welega (Asosa): Birr 14.00
  -Tigray to Welega (Angar Gutin): Birr 14.00

  The average of the above costs per person in transit is estimated at EB 12.80. To this is added the cost of one plate and one cup, valued at EB 4.00, given to each settler in transit.

Table 9.1 TRANSPORT AND FEEDING COST FOR ONE SETTLER IN TRANSIT

	Item	Cost (EB)
1.	Transport cost	59.30
2.	Food expenses during travel	12.80
3.	Plate and cup given in transit	4.00
	Total cost in reaching settlement site	76.10

Since the "low-cost" settlements under RRC did not involve long-distance migration but were almost a spontaneous type of resettlement within short distances, the cost of transport and food in transit was much lower. One-third of special scheme cost is used for the "low-cost" model.

- Cost of transport and feeding in transit for average special unit of 487 families:
  According to the RRC specifications, the cost of transport is not applicable to small children. The RRC therefore uses a factor of 3 persons per family for this calculation. The total cost of bringing 487 families to the settlement site is EB 76.10 x 3, or about EB 228.

9.10.2 Infrastructural development works at settlement site

Costs of the needed infrastructure works for the "special" units are given in Table 9.2.

The following observations should be made regarding this table: not all of the activities listed have in fact been undertaken in many of the "special" settlements. For instance, at some sites little or no land clearing may be needed. The figures given represent upper limits for special settlements. In addition there are variations between the settlement units, depending on how closely the RRC standard model was followed. Consequently, considering the inflation rate of the past years (5-10% per year) and the data collected and observations made during field visits, it appears realistic to consider the average cost of infrastructural work for any of the settlements visited as not exceeding 50 percent of the figures given in Table 9.2. It was therefore decided to reduce the estimated cost of infrastructural work by 50 percent.

Table 9.2 INFRASTRUCTURAL DEVELOPMENT WORKS - SPECIAL SCHEMES

Activity	Type of Special Scheme	
	Rainfed (EB '000)	Irrigation (EB '000)
Survey and engineering design	22.5	22.5
Land clearing and development 1/	750.0	-
Construction of farm roads	1 615.0	1 615.0
Irrigation facilities 2/	-	990.0
Total	2 387.5	2 627.5

Note: The above are "model" costs. In practice expenditures were no more than half of these; therefore the following figures are used:

Adjusted Total Cost	1 193.75	1 313.75

1/ Includes depreciation on bulldozers and running costs such as fuel, spare parts, drivers' wages.

2/ Canal structure, plus 3 motor pumps, equipped.

9.10.3 Farm strucutres

Farm structures include three types of buildings: those connected with farming activities; those called "facilities", which normally go with such communities; and settlers' houses. The number, unit cost and total cost for these standard structures for the special settlement model are shown in Annex 10 of WP 28 of EHRS. The RRC normally provides few farm structures for "low-cost" settlements. Structures existing on the settlement site were either constructed by the settlers themselves or by the former landlord (in the case of nationalized farms). House construction is also the entire responsibility of the settlers. However, a small portion (10 percent) of the estimate for the special schemes is used for the low-cost schemes.

The standard cost of farm structures for a special scheme is shown in Table 9.3 below. (For details, see Table A9.1.)

Table 9.3 STANDARD COST OF FARM STRUCUTRES - SPECIAL SCHEMES

	Farm structures	Cost (EB) - 1984/85
1.	Farm buildings	135 572
2.	Facilities	84 082
3.	Settlers' houses	1 319 867
	Total cost	1 539 521

Note: This has to be adjusted downward from the standard cost to 55% to reflect estimation of actual expense. Hence the figure is:

EB 846 737

The above figure EB 1 539 521 represents the maximum cost of farm structures for a special scheme, based on the original RRC estimates for 1984/85. In addition, variations in investments in farm structures have been observed between settlements. Consequently it appears that investments made by the RRC in farm structures amount to about 50-60 percent of the above cost in any of the settlements selected. For the purpose of this study, the cost of farm structures is estimated at 55 percent of the above cost, or EB 846 747. (For units in the "low-cost schemes", 10 percent of this figure is used.)

9.10.4 Farm machinery and equipment

Settlers joining a special scheme are provided with farm machinery, equipment and handtools, which are given to them on arrival at the site. The tools which are programmed for one settlement unit of 500 settlers' families are axes, shovels, pick axes, digging sticks, hammers, sickles and hoes. Usually 100 per unit of each item are distributed. In low-cost schemes, settlers are provided only with handtools, ploughs and oxen.

The number, unit cost and total cost estimated for all such machinery, equipment, etc., are shown in Table A9.2 and summarized in Table 9.4 below.

Table 9.4 COST OF FARM MACHINERY, EQUIPMENT, ETC.

	Item	Estimated Cost (EB) Special scheme	Low-cost unit
1.	Machinery	194 000	-
2.	Equipment	35 000	-
3.	Handtools	10 000	5 000
4.	Ploughs	-	3 000
5.	Oxen	-	75 000
	Total cost	239 000	83 000

9.10.5 Support costs for two cropping seasons

Until new settlers become self-sufficient RRC supplies them with food. Full rations are given in the first year, reduced to half in the second year, and none thereafter.

The cost of food ration and soap for a settlement unit of 500 families is estimated at EB 480 000. For a low-cost unit it amounts to EB 240 000 since there were only 245 farm families, on average, in these units.

Details of the type of food, the quantity supplied, and the estimated value of the items if given in Table A9.3.

9.10.6 Summary of establishment cost

A summary of the total cost of bringing the settlers to the point where they are expected to be self-sufficient in food is given in the following set of five tables, reflecting the best available information for the three years immediately before the November 1984 emergency, and with tentative national estimates for even the newer types of schemes of the emergency programme.

9.10.7 Low-cost schemes

From observations, discussions and incomplete data obtained during the field visits, it is clear that considerable variations exist among different "low-cost" schemes. In some schemes where the RRC provided assistance in land preparation during the first year, the cost per settler might well be higher. This was the case for some of the schemes in Tadelle/Haralle. In other cases some costs may be overestimated, as they may have been only specifications for planning purposes.

Table 9.5A RESETTLEMENT COST ESTIMATES

Establishment costs prior to emergency programmes of November 1984

"Special Schemes" 1/

Item	Per person (EB)	Per family (EB)	Per unit (EB '000)	Total for 50 units (EB mill.)
Transport and feeding to site	76	230	110	5.6
Infrastructural site development	600	2 450	1 190	59.7
Farm structures and houses 2/	425	1 740	850	42.4
Farm machinery, equipment 2/	120	490	240	12.0
Feeding support 2/	240	980	480	23.7
Total direct establishment costs:	1 460	5 890	2 870	143.4

50 units	24 355 total number of families
487+ average families/unit	99 645 total number of persons
4.1- persons/family	1 990+ average persons/unit

1/ "Special" units were usually fairly elaborately organized, from long distance sources, had fairly high capital costs, mechanical and agricultural staff services; commonly organized as Producer Cooperative farms (PCs).

2/ Details of items are shown in Annex Tables A9.1, A9.2 and A9.3.

Sources: RRC, EHRS WP 28, and observations of EHRS staff and information from various UN and IBRD staff.

Table 9.5B RESETTLEMENT COST ESTIMATES

Establishment costs prior to emergency programmes of November 1984

"Low-cost Schemes" 1/

Item	Per person (EB)	Per family (EB)	Per unit (EB '000)	Total for 50 units (EB mill.)
Transport and feeding to site	25 2/	75	20	0.45
Infrastructural site development	60	245	60 3/	1.45
Farm structures and houses	40	170 4/	40	1.00
Farm machinery, equipment	85	340	85	2.00
Feeding support	240	980	240	5.75
Total direct establishment costs:	450	1 810	445	10.65

24	units	5 880	total number of families
245	average families/unit	24 055	total number of persons
4.1-	average persons/family	1 000+	persons/unit

1/ "Low-cost" units were usually simple, often settled from distance sources, had low capital costs, little if any mechanization, minimal assisting services and were often either almost semi-spontaneous or resulting from ad hoc local circumstances such as removal of farmers from areas turned into State Farms. Such schemes have not featured largely in resettlement activity since mid-1985.
2/ Assumed at 33% of special scheme level.
3/ Assumed at 5% of special scheme level.
4/ Assumed at 10% of special scheme level.

Sources: As per Table 9.5A.

Table 9.5C RESETTLEMENT COST ESTIMATES

Roughly indicated, *pro forma* establishment costs of emergency programme schemes

"Integration Schemes" 1/

Item 2/	Per person (EB)	Per family (EB)	Total costs (EB mill.)
Transport and feeding to site	68	205	14.5
Infrastructural site development	-	-	-
Farm structures and houses	345	1 000	71.0
Farm machinery, equipment	115	340	24.1
Feeding support	240	690	49.2
Total direct establishment costs:	770	2 235	158.8

1 269	locations (pre-existing PAs)	71 000	families
56	families/location	206 000	persons
2.9	average persons/family	160+	persons/location

1/ In "Integration Schemes" settlers are inserted into existing PAs, where these have sufficient land area available.

2/ Based on corresponding estimates for pre-emergency "low-cost" schemes; see preceding table.

Sources: EHRS WP 8 and later EHRS team member estimates. Unofficial and intended only as roughly indicative (see Table 9.5A).

Table 9.5D RESETTLEMENT COST ESTIMATES

Roughly indicated, pro forma establishment costs of emergency programme schemes

I. "New Special" Schemes, First Phase 1/

Item	Per person (EB)	Per family (EB)	Per unit (EB '000)	Total for 50 units (EB mill.)
Transport and feeding to site	76 2/	230	110	25
Infrastructural site development	330	1 000	485	100
Farm structures and houses	375	1 150	555	115
Farm machinery, equipment	100	305	150	30
Support feeding costs	240	730	350	75
Total direct establishment costs:	1 120	3 415	1 650	345

1st Phase

207 units	100 000 number of families
483+ families/unit	305 000 number of persons
3.05 average persons/unit	1 470+ persons/unit

1/ The "New Special" schemes differ from the pre-November 1984 "Special" schemes in that they need not be of the Producer Cooperative form, usually with much less mechanization and other capital expense. Many of the figures, however, are almost pro forma, as it is too early to analyze the first-year operations.
2/ As in previous schemes; see preceding Tables 9.5A and 9.5B.
3/ Assumed, by EHRS, at 40% of previous special schemes.
4/ Assumed at 66% of previous special schemes.
5/ Assumed at 62% of previous special schemes.

Sources: EHRS WP 28 and later EHRS team member estimates based on extensive discussion with RRC, UN, and IBRD personnel. The estimates are of course unofficial, in the circumstances of the emergency campaign, and are offered only as roughly indicative, given the need of this Study for some estimate of settlement cost and performance. (See also Table 9.5A.)

Table 9.5D (cont'd)

II. "New Special" Schemes, second phase, from August 1985.

The establishment costs of these recent schemes cannot be estimated now. Indications of its expanded scope are given below. With costs per family similar to those of the first phase, total second phase costs would be about EB 465 million.

2nd Phase

273	units	136 500	families
500	families/unit	415 000	persons
3	persons/family	1 500	persons/unit

Table 9.5E SUMMARY OF ESTIMATES OF ESTABLISHMENT COSTS OF THE VARIOUS RESETTLEMENT SCHEMES

	Pre-emergency schemes 1974/75 to 1983/84		Emergency schemes, from Nov.1984		
	"Special" schemes	"Low-cost" schemes	"Integration" schemes	"New Special" schemes	
			Nov'84-June'85	1st Phase Nov'84-June'85	2nd Phase from Aug'85
	A	B	C	D	D
Families (thousands)	24.36	5.88	71	100	136.5
Persons (thousands)	99.65	24.05	206	305	415
Persons/family	4.1	4.1	2.9	3.05	3
Units (or locations)	50	24	1 269 1/	207	273
Families/unit	487	245	56	483	500
Persons/unit	1 990	1 000	160	1 470	1 500
Costs/family (EB)	5 890	1 810	2 235	3 415	(3 410)
Costs/person (EB)	1 460	450	770	1 120	(1 140)
Costs/unit (EB)	2 870 000	450 000	(not applic.)	1 650 000	(1 705 000)
Total costs of establishing (EB)	143.4 mill.	10.7 mill.	159 mill.	345 mill.	(465 mill.)

1/ Pre-existing PAs.

Note on overhead costs. A proportion of RRC's salaries and wages (and associated vehicle costs) should be considered as part of the (annual) costs of the resettlement programmes. An estimate can be made here only for 1983/84, when 32% of RRC staff were mainly concerned with resettlement activities. This amounted to about EB 125 million. For 1984/85 such costs were presumably higher in total.

Sources: As preceding Tables A-D; also see footnotes to these Tables.

9.11 RECURRENT COSTS AND BENEFITS

Only quantifiable costs and benefits are considered under this heading. Costs of education and provision of health and other social services have been excluded for two reasons. First, these services are provided by specialized ministries, and the data on costs for these services are incomplete and sparse at unit level. Second, it is difficult to estimate the benefits from these services, as they accrue over a long period of time and may also have spill-over effects on the farming communities around the settlements. In addition, these services are similar to those provided in the rural areas in general.

Of the settlements included in the analysis, data on agricultural performance was available for the three years through 1983/84. There was a wide range in costs of production as well as in crop outputs, which depended partly on changes in weather. Except for the 1983/84 season for which a full set of data was available, production figures for the previous years were rather incomplete. The estimation of volume and value of crop production had to be confined to 1983/84, which unfortunately was also affected by shortage of rain. 1/

9.11.1 Cost of production

This includes all direct costs incurred annually in the process of production. It covers costs of major inputs such as seeds, fertilizers, tractor services, and personnel costs. The direct costs are set out in Annex Tables A9.5 and A9.6. The figures relate to average estimates derived from typical "Special Schemes" with maximum capital investments, and to an average cropped area of 461 hectares per unit, or an average of 0.95 hectare per family. This figure is derived from Table 9.6 below. The average of 487 families/unit is used.

Table 9.6 AVERAGE AREA CROPPED - SPECIAL SCHEMES

Year	Average area cropped (ha) per settlement unit	Average area cropped (ha) per settler
1981/82	396	0.81
1982/83	508	1.04
1983/84	478	0.98
Average	461	0.95

1/ On the 5 sampled "low-cost" schemes, information available at the unit level was too weak and incomplete to permit analysis.

The direct cost of production per special unit is EB 57 430, or EB 125 per hectare cropped. This excludes the cost of personnel (EB 37 860), which brings the cost of production per unit to EB 95 290, or EB 207 per ha. (See Table 9.8 below.)

9.11.2 Estimated value of production

The main crops grown on the settlements for which fairly reliable yield figures were obtained are maize, sorghum, teff, pulses and oilseeds. The average estimated annual value of crop production for a typical special scheme is given in Table 9.7.

Table 9.7 AVERAGE ESTIMATED ANNUAL VALUES OF CROP PRODUCTION 1/

	Maize	Sorghum	Teff	Pulses	Oil seeds	Totals/ averages
Volume of production (qt)	2 695	1 273	107	110	51	4 236
Unit price EB/qt 2/	44	44	100	100	100	475
Value (EB)	118 580	56 010	10 700	11 000	5 100	201 390

1/ Production and value figures relate to 1983/84 since the figures for the previous two years proved to be incomplete.

2/ Prices given were maize 24, sorghum 27, teff 45, pulses 31, and oilseeds 48, but these producer prices were obviously much lower than parallel market prices. To approximate economic farmgate values the above prices were chosen as conservative estimates, which at least are consistent with prices used in project costs for food supplies.

Table 9.8 INDICATED FARM ECONOMIC PERFORMANCE OF "SPECIAL" SETTLEMENT UNITS 1/

	EB/Unit	EB/ha (461 ha)	EB/Settler (487)
Direct farm costs 2/	57 430	125	118
Unit personnel costs 2/	37 860	82	78
sub-total	95 290	207	196
Value of production	201 400	437	414
gross margin	106 110	230	218
Less: -fixed charges 2/	52 133	113	107
sub-total	53 977	117	111
Less: -allowance for investment in infrastructure (at 50 yrs) 3/	23 875	52	49
"Net margin" thus defined	30 102	65	62
			(15/person)

1/ It must be stressed that the sample of these special schemes (15 of 50) and the year involved (1983/84) may not be very representative of performance of all the special schemes (before the emergency programme of November 1984). But it is felt imperative to present some indication of the farming economics, particularly of the "Special Schemes", the more so as they were mostly producer cooperatives. The analysis uses the averages found in the estimate of establishment costs: 487 families and 1 993 person per unit.
2/ See Annex Tables A9.5 and A9.6.
3/ See Tables 9.3 and 9.4, above.

9.11.3 Remarks on the economic margins and performance

9.11.3.1 It should be noted that such special units were supposed to be cropping 2 ha per settler household, for an average of 487 households/unit: 947 ha. Thus performance in terms of area planted (461 ha) has been less than 49 percent.

9.11.3.2 The above margins are in "value" terms. In real terms the total production of 4 236 qt amounts to 8.7 qt/family. Allowing only 15 percent for losses, this would leave only 7.4 qt/family: about 180 kg/person (500 gr/day), or roughly 1800 Cal/day/person. This is not a generous allowance for "subsistence", though probably much better than in conditions at settlers' origins. An important point, however, is that there is no surplus, no cash income for settlers without subsidies. The results of the analysis are consistent with widespread assertions that many of these settlements are not self-sufficient in staple foods, some after more than five years. (However, counting also the "low-cost" schemes, 57 of the 74 units were stated to have met RRC standards of self-reliance as of December 1984. Of the total of 74 units, 24 are "low-cost".)

9.11.3.3 Yields are low. The value of production (Table 9.7 above) is consistent with a cropping pattern and average yields of, very roughly, the following:

	ha	Yield qt/ha	Reasonably expected feasible yield levels after several years' experience
Maize	215	11	15
Sorghum	159	8	12
Teff	18	6	7
Pulses	22	5	7
Oilseeds	19	3	4
	461		

Considering the input costs, specialized services, and years of experience, the higher yields in the last column above should be regarded as minimal and realistic. At the same values and crop mix, production and gross value would be 40 percent higher.

9.11.3.4 Planted area is low. After a year or two of experience it should be a realistic expectation that the target area to be cropped should be attained. The sample units of this analysis do not include the emergency units of 1984/85, and many of the sample units (at least 9 of the 15) are units of schemes which had been operating for at least five years. To the extent that the sample is representative and the figures roughly correct, the 24 355 settler families, as of the season of 1983/84, cultivated only about 23 000 ha. With the establishment costs shown in Table 9.5A above (EB 143 million), this implies an "establishment cost" of over EB 6 000 per hectare cropped, which would clearly not be replicable on a much larger scale. 1/

1/ If the "New Special" schemes of the current emergency resettlement programme achieve the indicated lower establishment costs (see Table 9.5D above), this would be cut to EB 3 260/ha, which, in turn, could be halved if the area cropped could be doubled.

9.11.3.5 If the above modest increase in yields and doubling of area cropped were achieved, the following improved margins would result, to be compared with the apparent actual performance shown in Table 9.8.

Table 9.9 SPECIAL SCHEME MARGINS IF IMPROVED YIELDS AND DOUBLED CROPPED AREAS WERE ACHIEVED

	EB/Unit	EB/ha (920 ha)	EB/Settler (487)
Direct farm costs	114 430 1/	125	236
Unit personnel costs	37 860 2/	41	78
sub-total	152 290	166	314
Value of production	529 200	608	1 087
gross margin	376 910	442	773
Less: -fixed charges	52 133 2/	57	107
sub-total	324 777	385	666
Less: -allowance for infrastructure investment	23 875	26	49
"Net margin" thus defined	300 900	359	617 3/ (150/person)

1/ Simple doubling of corresponding item in Table 9.8, to reflect doubling of planted area.
2/ Same as in Table 9.8.
3/ Ten times larger than in Table 9.8.

Total production accordingly would increase to 11 860 qt/unit (twice the area, at 40 percent higher yield). After the subsistence allowance of the previous production of 4 236 qt, there would be a gross surplus of 7 625 qt, worth about EB 362 000. Personnel costs, fixed charges, and amortization of infrastructure investment (a total of EB 114 000/unit) could be covered, leaving EB 248 000 per unit for surplus cash income, equivalent to EB 509/family or EB 124/person. This last amount would be substantially higher (considering only the income from crop production) than most estimations of rural per capita income in Ethiopia.

9.11.3.6 The importance of all the above (even given the crude and speculative numbers) is that, from an agricultural economics point of view, even the fairly costly "special" units could be feasible provided such fairly reasonable yields were attained and targets for planted area were approached. The sample of the special schemes was drawn from units which have had several years of experience, yet such yields and planted areas apparently have not been achieved. The answers may lie in the fact that large-scale programmes (even before the much larger-scale emergency campaign) are difficult to administer effectively and economically, and that PCs have yet to prove economic superiority.

If resettlement is to be an important part of the Conservation-based Development Strategy the schemes must be more efficient. Greater care in the preparation of the units, more modest rates of implementation (permitting more effective programme and unit management), and stronger economic incentives for settlers clearly seem to be indicated. In the emergency programme there is to be no insistence on collectivisation. The comparative performance of those new special schemes which are not organized as Producer Cooperatives should be very instructive.

9.12 RESETTLEMENT AND CONSERVATION-BASED DEVELOPMENT

For ten years resettlement programmes were conceived mainly as means of combatting drought effects in the LPC zones of Welo, Eritrea and Tigray; today, in the context of this study, it is also viewed as one of the long-term strategies for alleviating the problem of soil degradation in the northern Highlands. The emergency programme of 1984/85 explicitly accepts this.

9.12.1 Soil degradation and resettlement

Soil degradation is due to several factors which form a mutually reinforcing framework of adverse circumstances which is difficult to break. One of these factors is population pressure which can be reduced by resettling people in areas of lower population density. Moving people from an area in order to reduce pressure on the land is therefore one of the major steps to take in a reclamation exercise. However, because population pressure is only one of a number of factors leading to soil degradation, resettlement will not, by itself, remedy the situation. Other factors, such as destructive traditional farming practices, the topographical steepness, the geological fragility of the soils, etc., should be given as much attention as the pressure of human beings on the land. Because soil degradation is the cumulative effect of several factors, as much effort should be devoted to rehabilitating the areas of origin of the settlers as to preventing degradation in the settlement sites. Therefore resettlement as such will not be a major factor in Conservation-based Development unless proper measures are applied wherever the land resource is threatened.

It is too early to pass judgement on the impact of the very large-scale emergency resettlement programme under way, but the following points need to be kept in mind:

(1) Before the emergency scheme the resettlements can have had only a very small impact on the problem of degradation. No more than 45 000 families had been transferred, and although valuable experience was gained, it was at very high cost, especially on the special schemes (about EB 6 000/family). (See Table 9.5E.)

(2) The emergency programme, which should relocate over 300 000 in one year, represents action on a very large scale, at unit costs which might be significantly lower, but still high (perhaps EB 2 000-3 000/ha). The pace of the emergency programme can hardly be maintained for long. At best, the conditions for improving cultivation (in both conservation and productivity) will have been bettered for the settlers, but the needed changes in agricultural practice have hardly begun.

Indeed, the large scale and fast pace of such programmes as the current resettlement campaign very likely work against the possibility of infusing all peasant agriculture with conservational productivity-raising innovations. The problem of degradation needs to be kept in proper perspective. This means that transferring people from poor to better areas within the same agricultural resource frame can at best be of small effect compared to improving performance "across the board". There is danger that too much is expected of resettlement, even where it "works". Viewed in this perspective it would seem that the main policy on resettlement should be to adjust the size and pace of the programme to improve the quality and efficiency. That is: lower the unit costs, improve the economic return by raising yields and crop area, and develop more thoroughly the agricultural inputs supply, supporting services, and economic incentives of farmers. It should be easier to do this in well-managed settlement schemes, but there is no evidence yet that it has been done. In any event, the same improvements have to be effected far more broadly than the area covered by the new settlements.

9.12.2 Concluding observations

From the foregoing review in this chapter of the past decade of experience in resettlement programmes, the following major conclusions may be made.

(1) The uneven distribution of land and labour in the study area and the over-use and environmental degradation of some areas make a measure of population relocation absolutely desirable. Both short-distance and long-distance resettlements can and should play an important role in the reorganization

of agriculture for combatting the degradation of the Highlands, as part of a comprehensive Conservation-based Development Strategy.

(2) The resettlement programme conceived and implemented since 1975 under the "Special Scheme" model has proved too costly and fraught with serious problems of management, low labour and land productivities. There is no doubt that there has been insufficient time to prepare, plan and implement settlement programmes, and that qualified field staff are still insufficient. The special settlement model in fact appears to have been substantially revised in terms of initial capital investments in the new "emergency" programme schemes. But management probably cannot be improved much if the pace of the programme is not sharply slowed down.

(3) The simultaneous operation of alternative settlement models has proved a fruitful experience. It is now established that settlers in low-cost settlements generally show greater ability to become self-reliant than those in the special schemes. As a result of the general settlement management practices, settlers under special schemes become very dependent on the government. These practices were not only partially responsible for the high settlement costs, but also for creating conditions which were not conducive to settler participation in the scheme's activities. On the contrary, settlers develop habits and attitudes which become difficult to change. Consequently, whatever model of resettlement is implemented in the future should be considered within the overall context of regional development, aimed at lifting the average standard of living by raising the average standard of cultivation.

(4) Whenever possible, short-distance resettlement should be given preference. Short-distance opportunities must be sought.

(5) The degradation of the northern Highlands, caused by immense human and animal pressure on the land, was further aggravated by inadequate land use and poor farming management practices. Any resettlement programme should therefore be carried out in a planned way to reduce the chances of exporting agricultural malpractices into new areas. Afforestation and soil conservation works must be fully integrated in the operations from the initial stage of the resettlement. This argues for a slower pace, in which more care can be given to settlement operation plans.

(6) In malaria and tsetse fly infested areas, programmes for eradicating these physical constraints, as well as treatment for malaria should be considered essential in the first years.

(7) Resettlement programmes need to be carefully and continually monitored and evaluated from the first stage until they become self-supporting. It is absolutely necessary to strengthen the monitoring and evaluation of the existing schemes. This will allow the GOE to develop sound socio-economic indicators relevant to each of the different types of resettlements described. In monitoring and evaluation of the resettlements, the wishes and aspirations of the settlers must be taken more into account. There would therefore be more feed-back from the settlers and future developments and planning could be based as much as possible on "bottom-up" planning processes.

(8) There is a need to strengthen the Organization, Management and Training Division within the RRC. Manpower and training requirements at all levels should be more carefully studied, training programmes properly designed, and training methods adequately selected. Particular emphasis should be given to training of trainers as well as settlers. Now that the Ministry of Agriculture has direct responsibility for operation of new settlements after their establishment, the same applies to this agency.

(9) The sociological aspects of resettlement have thus far been neglected. In particular, there has been little or no emphasis on improvement of the status of women who, in fact, are not on equal terms with men as members of settler/farmer organizations.

(10) The conduct of special studies on settlement management, production and marketing, as well as studies of appropriate rural industry for settlers, also needs more attention. The conditions for research and observation in the emergency settlement programme today are not conducive to study of these important developments. Yet the need for careful research is vital; therefore strong encouragement to such study is needed.

(11) Farm output is powerfully influenced by settlers' access to agricultural support services, including appropriate farm equipment and tools. While experiments are being conducted on animal-drawn equipment under the FAO project CGP/ETH/034/LIB, consideration should be given to setting up a pilot farm equipment centre in one of the resettlement areas.

(12) Voluntary settlement and voluntary formation of collectives apparently need to be continually emphasized and maintained.

(13) Price incentives for farm production apparently are no less important for settler-farmers than for other farmers.