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Sustainable Poverty Alleviation Project-Ethiopia

NATURAL RESOURCES UNDER THREAT

An Analysis of the Farming Systems of Gimbo *Woreda*, Kafa-Sheka Zone, Ethiopia

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Tesfaye Legoye

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An Analysis of the Farming Systems of Gimbo *Woreda*,
Kafa-Sheka Zone, Ethiopia

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DEDICATION

This report is dedicated to the resource-poor farmers of Kafa-Sheka zone, Ethiopia: The homeland of arabica coffee

ABSTRACT

Situated in the Southern Nations, Nationalities and Peoples' Regional State, Kafa- Sheka Zone is famous for its natural resources, in which semi-domesticated coffee, honey and spices naturally abound. The zone is equally reputed for being the cradle land of arabica coffee. The recent past has witnessed a tremendous increase in population, which is largely attributed to the influx of settlers. These settlers, among others introduced cereal-based farming practises that have exerted immense pressure on the natural resource base.

Using the Agricultural Research for Development procedure, this study seeks to examine the causes of rapid deforestation in the zone; identify the farming systems and; analyse the constraints and opportunities for sustainable natural resource management in these systems. The study proposes research and development options aimed at mitigating the identified constraints and highlights areas of collaboration among the various stakeholders.

Accordingly, based on scale of deforestation, three zones were identified, from which four farming systems were delineated. Based on size of arable land, ownership of oxen and access to forestland, eleven farm types were outlined, three in the cereal zone and four in each of the other two (forest-coffee and transition) zones. The study identified no distinct relationship between ethnic group and farming practises. It revealed a subsistence based, rainfed farming system, with a rather low level of crop-livestock integration, a trend that is likely to persist in the future. Threats to the natural resource base take the form of expansion of farmland at the expense of forests, poor agronomic practises, and increased demand for fuelwood and timber for domestic use. Collaboration among stakeholders, conducive policy framework (land, investment, and wildlife), diversification in the farm level enterprises and institutional support (extension services, credit, & rural infrastructure) are suggested areas that offer scope for improvement.

The study concludes by proposing nine research and development options, two of which have been generated into research proposals for further elaboration and implementation by the stakeholders.

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ACRONYMS

ADLI	Agriculture Development-Led Industrialisation
AKIS	Agricultural Knowledge and Information System
ARD	Agricultural Research for Development
CBD	Coffee Berry Disease
CIMMYT	International Wheat Improvement Centre, Mexico
DA	Development Agent
DIFD	Department for International Development (UK)
DOA	Department of Agriculture
DSE	German International Development Co-operation
EARO	Ethiopian Agricultural Research Organisation
FREAC	Federal Research Extension Advisory Council (Ethiopia)
FEG	Farmer Extension Group
FRG	Farmer Research Group
FSR	Farming Systems Research
FYM	Farm Yard Manure
GDP	Gross Domestic Product
IAR	Institute of Agricultural Research, Ethiopia (defunct)
ICRA	International Centre for Development oriented Research in Agriculture
ITK	Indigenous Technical Knowledge
JARC	Jimma Agricultural Research Centre
KSZ	Kafa Sheka Zone
MOA	Ministry of Agriculture
NGO	Non-Governmental Organisation
NRM	Natural Resources Management
PA	Peasant Association
RBA	Regional Bureau of Agriculture
REAC	Research Extension Advisory Council
RED	Research Extension Division (in the research centres)
RELC	Research-Extension Liaison Committee
SNNPRS	Southern Nations Nationalities and Peoples Regional State
SUPAKS	Sustainable Poverty Alleviation Programme in Kafa Sheka Zone
TOR	Terms of Reference
TOT	Transfer of Technology
ZOPEDD	Zonal Planning and Economic Development Department

GLOSSARY

AKIS:	*The interlinked system of institutions and individuals involved in the generation, transfer and utilisation of knowledge and information for agricultural improvement.*
Agro-ecological Zone:	*a major area of land broadly homogeneous with regard to climatic and edaphic factors.*
Checklist:	*a list of headings for lines of questioning use as a guide in informal surveys.*
Cropping pattern:	*the yearly sequence and spatial arrangement of crops or of crops and fallow on a given area.*
Crop rotation:	*growing of two or more different crop types on a piece of land in rotation.*
Cropping Systems:	*the cropping patterns used on a farm and their interactions with farm resources, other farm enterprises and the technology, which determines their make-up.*
Deforestation:	*the uncontrolled removal of trees without a conscious effort to replace them.*
Enset:	*a false banana, which produces a thicker stem and more erect leaves than banana. Its root, stem and leaf stalks provide carbohydrate, which after processing can be cooked as porridge or made into sticky, unleavened bread called locally Kocho.*
Farming Systems:	*a collection of distinct functional units such as crops, livestock and marketing activities which interact because of the joint use of inputs that they receive from the environment.*
Injera:	*flat, spongy, bread like food prepared from teff .*
ITK:	*knowledge of local people about their environment and the technical aspects of their farming situations, including the capacity to expand their knowledge through observation and experimentation.*
Mixed cropping:	*growing of two or more different crop types on a piece of land at the same time.*
Mixed farming:	*farms with integrated crops and livestock activities.*
Monocropping:	*growing of the same crop on the same piece of land year after year.*
On-farm trials:	*experiments carried out in farmers' fields or with their livestock.*
Sustainability:	*the ability of a system to maintain productivity over the long term when subject to stress and shocks.*
System:	*An assemblage of objects and activities united by some form of regular interaction or interdependence.*
Teff:	*a small millet-like grain (Eragrostis tef) used to make injera indigenous to Ethiopia.*
Shilshallo:	*rough weeding by using local plough practised especially in maize and sorghum crops at knee height stage*

EXECUTIVE SUMMARY

Background

This report is a culmination of a collaborative research project between the International centre for development oriented research in Agriculture (ICRA) and the Ethiopian Agricultural Research Organisation (EARO). It presents the findings of an interdisciplinary team of six researchers from ICRA, who undertook a three-month field study on Sustainable Natural Resource Management in Kafa-Sheka Zone, with the following objectives:

Objectives of the study

- Assess the possible causes of the increasing rate of deforestation or reduction in the natural forest cover
- Identify and analyse the farming systems of Gimbo Wereda in Kafa-Sheka zone focusing on differences in their potential to incorporate sustainable natural resource management practices (e.g. agro-forestry) and taking indigenous traditional practices and existing conditions strongly into account
- Identify constraints and opportunities for a more sustainable management of natural resources in the farming systems of the study area
- To analyse and prioritise R & D options and develop participatory research proposals for sustainable NRM in farming systems to be implemented by government institutions (e.g. DOA, JARC) in collaboration with NGOs (e.g. SUPAK-S, FARM Africa) and farmers in the field study area

Jimma Agricultural Research Centre and the Zonal Kafa-Sheka Council of the Southern Nations, Nationalities and Peoples' Regional State hosted the study.

Methodology

The Agricultural Research for Development (ARD) approach was used in carrying out this study. ARD aims at developing a research agenda that responds to the needs of its clients and beneficiaries by contributing towards poverty alleviation and sustainable resource use. In order to target research, the area was delineated into geographically homogeneous agro-ecological zones, from which a farm typology for each of the zones was developed. This methodology integrates and analyses the interests of the diverse stakeholders and clients in order to identify relevant research and development options, which are then screened and prioritised. Accordingly, two of the options that offer scope for immediate implementation by the stakeholders were further generated into proposals.

Key Findings

Zonation and farming systems

Based on the scale of deforestation, three zones were identified: Forest, transition and deforested zones. The following farming systems were identified within these zones:

- Forest /coffee-based farming system (Forest zone)
- Forest /coffee/cereal-based farming system (Transition zone)
- Enset/cereal-based farming system (Transition zone)
- Cereal-based farming system (Deforested zone)

The forest /coffee-based farming system is predominant in the forest zone, where the natural forest cover is more or less intact. Households are allocated portions of these forests (forest plots), from which they gather the naturally occurring coffee and spices. Little or no management is practised, often limited to slashing the undergrowth prior to harvesting.

In areas where the forest cover is dwindling (the transition zone), the forest /coffee based-farming system is paving way for the emergence and dominance of the forest /coffee/cereal-based farming system. In this system, pulses and cereals (arable fields) are gradually assuming importance over coffee. This transition is largely attributed to population pressure and the influence of settler farmers, whose activities are exerting pressure on the forest base.

In the enset/cereal-based farming system, also in the transition zone, enset is the dominant crop in terms of its contribution to household income.

The cereal-based farming system is found in the deforested zone where the forest cover is almost denuded. This system is characterised by open, almost treeless fields of pulses and cereals.

Farming across these systems is predominantly smallholder, subsistence, rainfed and generally low input- output production ratios, a trend that is likely to continue. Livestock rearing and apiary are an integral component of these systems. The former is particularly indispensable as a source of draught animal power (ploughing and weeding) and farm transport, while the latter is a major source of household income. Vermin, pests and disease, declining quality and quantity of the natural resource base, inadequate draught animal power, labour shortages especially during peak labour periods and low genetic potential of local cultivars are among the most significant factors that militate against increased productivity. Rather weak institutional networks like input supply, credit facilities, policy framework, extension delivery, and marketing chains support these systems.

Farm Typology

Size of arable field, ownership of oxen and access to forest plot were the criteria used for developing a farm typology. Accordingly, eleven farm types were delineated: three in the deforested zone, and four in each of the other zones, as explained in the table below:

Zones	Farm types	Description
Forest	I	Two or more ha of arable land; with two or more oxen, with access to forest resources
	II	Two or more ha of arable land; with two or less oxen and having access to forest resources
	III	Less than 2 ha of arable land; less than 2 oxen and have no access to forest resources
	IV	Two or more ha of arable land; with 2 or more oxen and have no access to forest resources
Transition	I	Two or more ha of arable land; with two or more oxen and have no access to forest resources
	II	Two or more ha of arable land; with less than 2 oxen and have access to forest resources
	III	Two or more ha of arable land; with less than 2 oxen and have no access to forest resources
	IV	Less than two ha of arable land; less than oxen and have no access to forest resources
Deforested	I	Two or more ha of arable land; 2 or more oxen and have no access to forest resources
	II	Two or more ha of arable land; less than 2 oxen and have no access to forest resources
	III	Less than 2 ha of arable land; less than 2 oxen and have no access to forest resources

Increase in population over the years has exerted pressure on the shrinking natural resource base. This has manifested itself in the form of deforestation. Population increase leads to a corresponding expansion in the arable land, rise in the consumption of fuel wood for both cooking and lighting, and an increase in the demand for timber for shelter construction. The source of these necessities is often the natural forest, into which no renewal attempts are being invested.

Gender analysis revealed that while women contribute immensely towards agricultural production, they have limited access to and control over both the productive resources and the benefits that accrue from agriculture.

Research and Development Options

The study identified, screened and prioritised five research options, one development option and two research and development options. Two of the four research options, which offer scope for immediate implementation were developed into proposals. The options are:

Research

- On-farm evaluation of bare-root method of transplanting coffee seedlings
- On-farm evaluation of maize, coffee, spices and enset technologies
- Evaluation of mud hives as intermediate beekeeping technology
- Study of indigenous beekeeping practices and identification of bee flora
- Evaluation and utilisation of multi-purpose trees
- Identification and evaluation of local fodder species and legumes

Development

- Introduction of fruit trees into the farming systems

Research & development

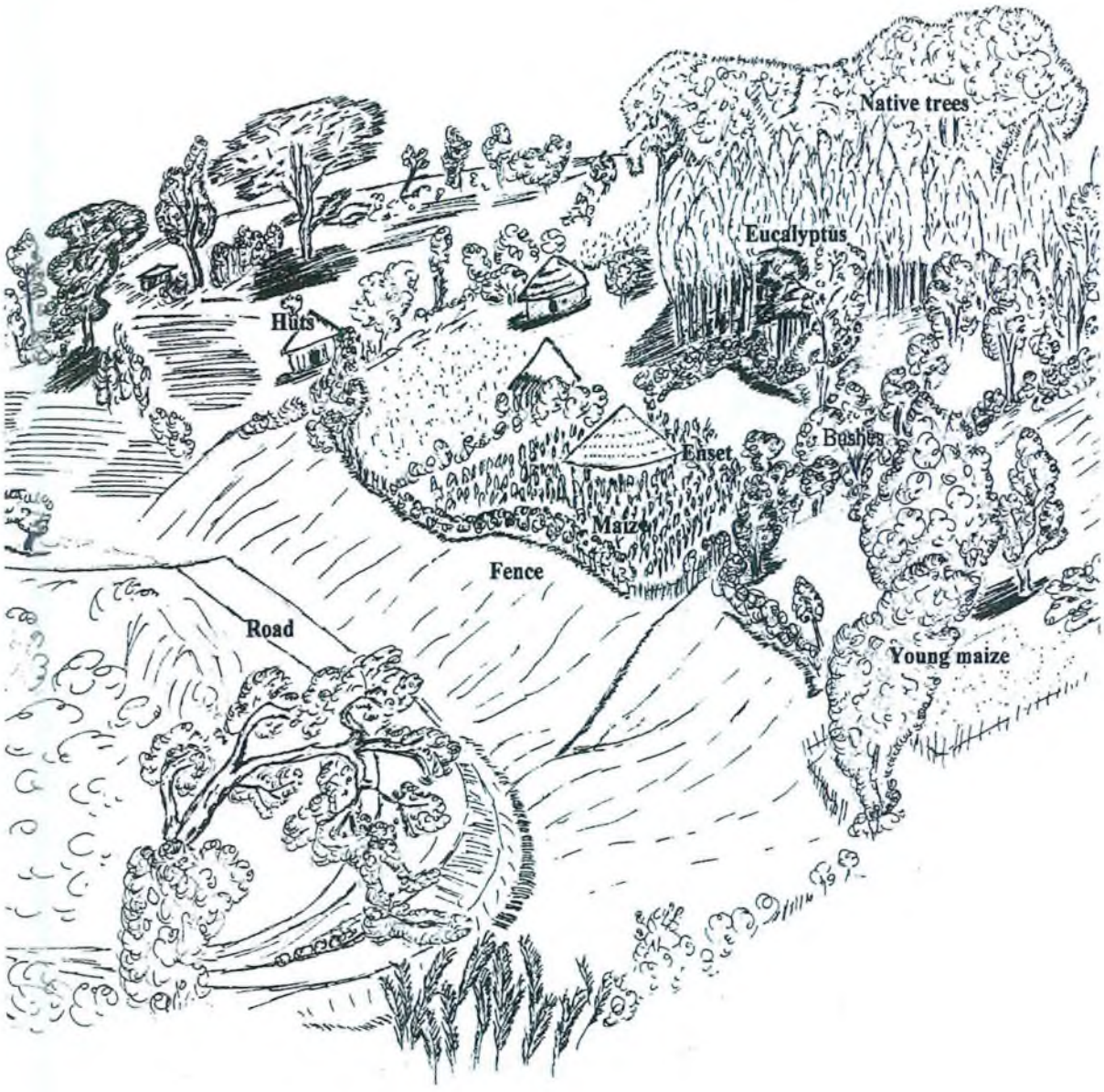
- Study of indigenous knowledge in enset production and development of extension manual

Two of the research options, On-farm evaluation of bare-root method of transplanting coffee seedlings and on-farm evaluation of maize, coffee, spices and enset technologies, which offer scope for immediate implementation were developed into proposals in consultation with (and acceptance by) all the stakeholders.

In light of its natural resource endowment, Kafa-Sheka is a zone of enormous agricultural potential (of cash crops such as coffee, tea and spices) capable of turning into the food basket of Ethiopia. However, expansion of farmland at the expense of forest, limited diversification in the farm enterprises, poor crop-livestock integration and weak institutional support, remain key obstacles to the attainment of this potential.

NATURAL RESOURCES UNDER THREAT

An Analysis of the Farming Systems of Gimbo Woreda



CHAPTER I INTRODUCTION

1.1 Brief outline of the report

This report is divided into six interlinked chapters whose contents are briefly described below.

Chapter 1 *Introduction:* This chapter presents the background to the study, with specific focus on institutional framework, objectives and justification. The general background of Ethiopia, including its economy with emphasis on the agricultural sector is described. Kafa-Sheka, which is one of the twelve zones in the Southern Nations, Nationalities and Peoples Regional State and the focus of this study, is introduced.

Chapter 2 *Methodology:* The Agricultural Research for Development (ARD) approach, which was used in this study, is described. The process followed from the preparatory phase up to final report write up and the subsequent dissemination of research results is described.

Chapter 3 *Farming Systems:* This chapter contains a detailed description of the identified zones, crop, livestock and apiary sub systems based on results of the team's surveys and interviews with stakeholders. The interactions, dynamics and changes, constraints and opportunities are presented. Based on the notion that farm households are not homogeneous, a farm typology for each of the agro-ecological zones was developed.

Chapter 4 *Natural Resource Management:* Farmer's practices that impact on the natural resource base in each farming system are described. Institutional and policy implications, which have a bearing on natural resource management, are discussed.

Chapter 5 *Discussions and Recommendations:* This chapter contains a discussion (with in built recommendations) of selected issues, which were raised in the previous chapters, essentially highlighting the perceptions of the team. It borrows heavily from experiences elsewhere.

Chapter 6 *Research and Development Options:* Screened and prioritised Research and Development Options are proposed. Two of them, which offer possibilities for immediate implementation are developed further into proposals.

1.2 Context of the study

1.2.1 Institutional framework

This field study was carried out as a joint activity between:

- The Administrative Council of Kafa-Sheka Zone, in the South Nations, Nationalities and Peoples' Regional State (SNNPRS);
- The Sustainable Poverty Alleviation Project (SUPAK-S);
- Department of Agriculture (DOA);
- The Kafa-Sheka Zonal Planning and Economic Development Department (ZOPEDD);
- Jimma Agricultural Research Centre (JARC);
- Ethiopian Agricultural Research Organisation (EARO); and
- The International Centre for development oriented Research in Agriculture (ICRA).

The Zonal administrative council of Kafa-Sheka, SUPAK-S and JARC hosted it. JARC has a national mandate for coffee and spices research in Ethiopia. The centre also collaborates with eight other national research programmes. It has four sub-centres and four testing sites, with a total research staff of seventy-six. An interdisciplinary team of six scientists from five developing countries including two Ethiopians carried out the study.

1.2.2 Justification of the study

The Kafa-Sheka Zone has been and is still known for its forest cover, forest products and spontaneously growing coffee and spices. However, the area covered by forests is decreasing, due to population pressure (including new settlements), expansion of crop production and agricultural commercial investments (e.g. tea and coffee estates). These practices seriously damage the genetic diversity of flora and fauna living within the ecosystem (genetic erosion) and may contribute to changing the climatic conditions of the area.

There have been attempts by government to control the process of deforestation and promote afforestation programmes in open and marginal lands. However, these attempts have largely failed and the rampant destruction of the forests is continuing in the area. As the livelihood of the farmers here is directly or indirectly dependent on forest products, there is an urgent need to develop strategies that will promote sustainable exploitation of natural resources and conserve the genetic diversity of the area. An integrated approach taking into account the diversity of problems and opportunities in the area is called for.

There appears to be large differences in natural resource and agricultural management practices between farmers living in traditionally settled areas and those living in newly settled areas. The new settlers have introduced different cropping systems, mainly cereal-based. As their cereal-plough system is less compatible with agro-forestry practices, deforestation seems to occur more rapidly in the newly settled areas.

Natural resource management and agro-forestry practices such as the management of traditional forest produce (wild coffee and spices) and the cultivation of coffee, fruit trees, root crops or enset, seem to be better integrated into the systems of the traditional inhabitants.

However, the differences between the two systems are not so clear cut anymore as many transitions are developing. So, it is better to consider current systems as operating somewhere on a deforestation scale that runs from a natural forest area (gatherers and hunters) to completely deforested areas (farmers in the maize belt).

1.2.3 Objectives of the study

The field study had the following objectives:

- Assess the possible causes of the increasing rate of deforestation or reduction in the natural forest cover
- Identify and analyse the farming systems of Gimbo Woreda in Kafa-Sheka zone focusing on differences in their potential to incorporate sustainable natural resource management practices (e.g. agro-forestry) and taking indigenous traditional practices and existing conditions strongly into account

- Identify constraints and opportunities for a more sustainable management of natural resources in the farming systems of the study area
- Analyse and prioritise R & D options and develop participatory research proposals for sustainable NRM in farming systems to be implemented by government institutions (e.g. DOA, JARC) in collaboration with NGOs (e.g. SUPAK-S, FARM Africa) and farmers in the field study area
- Formulate recommendations for participatory sustainable management of the available natural forest resources in the Wereda and zone.

1.3 Background: Ethiopia

1.3.1 General information

Situated in the North-eastern part of the Horn of Africa, Ethiopia is the second largest country in sub-Saharan Africa, covering an area of about 1.1 million square km, with an estimated population of 57 million people (Anon, 1998). Ethiopia shares a common border with Djibouti (Northeast), Eritrea (North), Kenya (South), Somalia (East) and Sudan (West).

The population growth rate in Ethiopia is very high, expected to reach close to 120 million by the year 2020 (World Bank, 1997). There are about 75 ethnic groups of various sizes and power. The largest in numbers are the Oromos. Others include Amharas, Tigres, Gurages, Kambatas, Wolaitas and Aderies (Sisay, 1992). The official language of the country is Amharic. The two major religions are Orthodox Christianity and Islam.

Camerapix (1995) described Ethiopia as a country of immense geographical contrasts. High mountains (greater than 4000m) give way to flat lowlands, sinking 116 m below sea level in the Danakil depression. Temperature ranges from the icy cold of the high mountains, through the temperate highlands, the site of most of the country's agriculture; to the torrid lowlands. Torrential downpours of the highlands contrast with minimal precipitation of the perched, almost waterless lowlands. Tropical rainforests are situated mostly in the west; the deserts and semi-desert scrublands are situated mainly in the east and south.

It has a tropical monsoon climate with wide topographic-induced variation. There are three climatic zones: the cool zone, Temperate zone and the hot zone. The raining season is from mid June to mid September, but there are also rain showers from February to March and the rest of the year is dry.

1.3.2 Economy

Ethiopia's economy is heavily dependent on agriculture, which accounts for 57% of the Gross Domestic Product (GDP) and 90% of export earnings as well as supplies raw materials for the limited agro-industries. At the same time, it is the country's principal source of energy. Biomass of wood and agri-wastes provide about 95% of the energy consumed in Ethiopia (World Bank, 1984). The economy suffers from weak infrastructure, heavy dependence on a single agricultural export, coffee (generates 60% of export earnings), a small industrial base and shortage of skilled labour force (Sisay, 1992).

Apart from coffee, other important crops include pulses, oilseeds, cereals, sugarcane and potatoes. The major food crops are maize and wheat. Smallholders dominate agricultural production, which accounted for more than 94% of total numbers of holdings, area under all crops and total cultivated area in 1993 (Table1.1).

Table 1.1 Distribution of land area, production, and household systems in 1993

Category of Farms	Households (no.)	Cultivated area (ha)	Production of major food grains (% cult. Area)	Production of all crops* (% cult. Area)
Smallholders	8206 (98.7%)	5987 (94.7%)	95.1	94.4
Producer co-operatives	94 000 (1.1%)	114 000 (1.8%)	1.9	2.0
State farms	18 000 (0.2%)	222 000 (3.8%)	3.0	3.6

Source: Cohen and Isaksson 1988 cited in Stround and Mekuria, 1993 *excluding coffee

The agricultural sector suffers from frequent periods of drought, poor cultivation practices, and deterioration of internal security conditions. In real terms, agricultural growth averaged only 1.5 percent per annum during the early 1990s. In the mean time, the population of the country grew by 3 percent per annum, resulting in a widespread food scarcity and poverty in the country (World Bank, 1997).

Besides crops, livestock such as cattle, goats, sheep, donkeys, poultry, horses and camels are important components of all the farming systems although concentrated in the highlands.

The manufacturing sector is heavily dependent on inputs from agricultural sector. The government is considering selling off a portion of state owned plants and is implementing economic reforms that are gradually liberalising the economy. The major problems are the improvement of roads, water supply, and other infrastructure, which were badly neglected during years of civil strife. The main industries are food processing, textile and drinks. Main exports are coffee, hides and skins. The imports are foodstuff, machinery, vehicles and fuel.

1.3.3 Recent economic developments

Currently, Ethiopia has chosen an agricultural-led economic strategy known as Agricultural Development Led Industrialisation (ADLI), as the basis for the country's overall development. The ADLI approach aims at utilising Ethiopia's massive agricultural and industrial potential while minimising the risks that arise from high vulnerability to adverse weather conditions, such as low rainfall and the resultant drought.
A major objective of ADLI is to increase the productivity of small farmers and thereby improve food security in both rural and urban areas. Within the ADLI framework, the government initiated a five-year Agricultural Development Programme. Specific policies have been introduced to provide technical and institutional support to farmers, including fertiliser supply and distribution, improved seed supply and distribution, development of small-scale irrigation, conservation of natural resources and environment, and extension work.

1.4 Kafa Sheka Zone

1.4.1 Background

Kafa-Sheka Zone is located in the North-western part of the Southern Nations, Nationalities and Peoples Regional State, with a total land area of 1.328.924 hectares. The capital city of the zone is Bonga town, which is located 440 Km Southwest of Addis Ababa. The zone comprises eight Weredas (districts) namely: Chena, Gimbo, Decha, Masha, Yeki, Tello, Menjio and Gesha. The zone has an estimated population of 176, 230 with over 90% of the people living in the rural areas (ZOPEDD, pers.com).

1.4.2 Vegetation and land use

Based on altitude and temperature, three climatic zones can be delineated: "*Dega*" (cold zone), 2500 to 3000 meters above sea level (m.a.s.l); "*Weina-Dega*" (semi-cold zone), 1500 to 2500 m.a.s.l. and "*Kolla*" (hot zone), 500 to 1500 m.a.s.l. Average annual temperature varies from 16 to 20 ^{0}C while mean annual rainfall ranges between 1,600 and 2,200 mm. The area receives abundant and well-distributed rainfall. The long rainy season permits the growth of two crops per year. The two rainy seasons are *Meher*, (major rainy season, June - November) and *Belge* (minor raining season, November - May).

Most of the KSZ is part of the south-western Ethiopian highlands, which is characterised by a rolling plateau. Altitude gradually increases from below 500 m in the extreme south to about 3,350 m in the small mountain ranges in the west and east of the zone, (SUPAK-S, 1998).

The zone is richly endowed with natural forest cover, forest products and spontaneously growing coffee and spices. However, the forests are drastically shrinking as a result of uncontrolled bush fires, fuel wood extraction, timber production, population increases with growing demands for arable land and poor reforestation efforts (Ahrens, 1997). The forest cover is estimated to be about 388,000 hectare or 29.2 % of the total area (Table 1.2).

In addition to the regular growth of population in the area, the development of new settlement schemes and promotion of agricultural investment schemes (such as tea and coffee) in the zone have aggravated the deforestation process.

Table 1.2 Land use, Kafa-Sheka zone

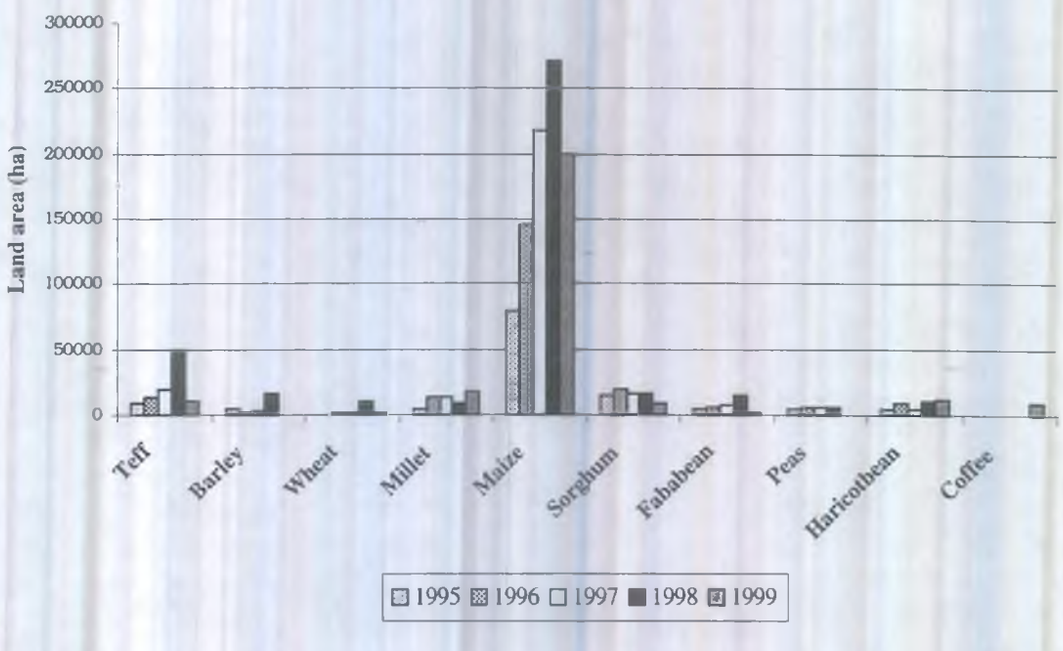
Land use	Area (Hectare)	Percent of total
Cultivated land	575,423	43.3
Arable land	167,444	12.6
Forest land	388,045	29.2
Other	198,009	14.9
Total	1,328,923	100

Source: Kafa-sheka zone office, Bonga (unpublished data, 2000)

1.4.3 Agricultural activities

The soils of the zone are predominantly nitosols; deep fertile reddish clayey soils which support agricultural production. The major crops grown are coffee and teff (*Eragrostis teff*) for cash, maize, enset (a false banana), finger millet, sorghum, barley, wheat and a variety of pulses for food (Figure 1.1). Cattle, sheep, donkeys, goats, poultry, horses and mules are the major livestock kept by farmers. In the cereal based farming systems of the zone, mules are important in land preparation especially for teff, which requires a fine seedbed.

Figure 1.1 Land area under arable crops in Gimbo (1995-1999)



Bee keeping is an important income-earning activity. Gathering of forest produce is also important especially among the indigenous dwellers. The department of Agriculture and the development agencies provide extension support.

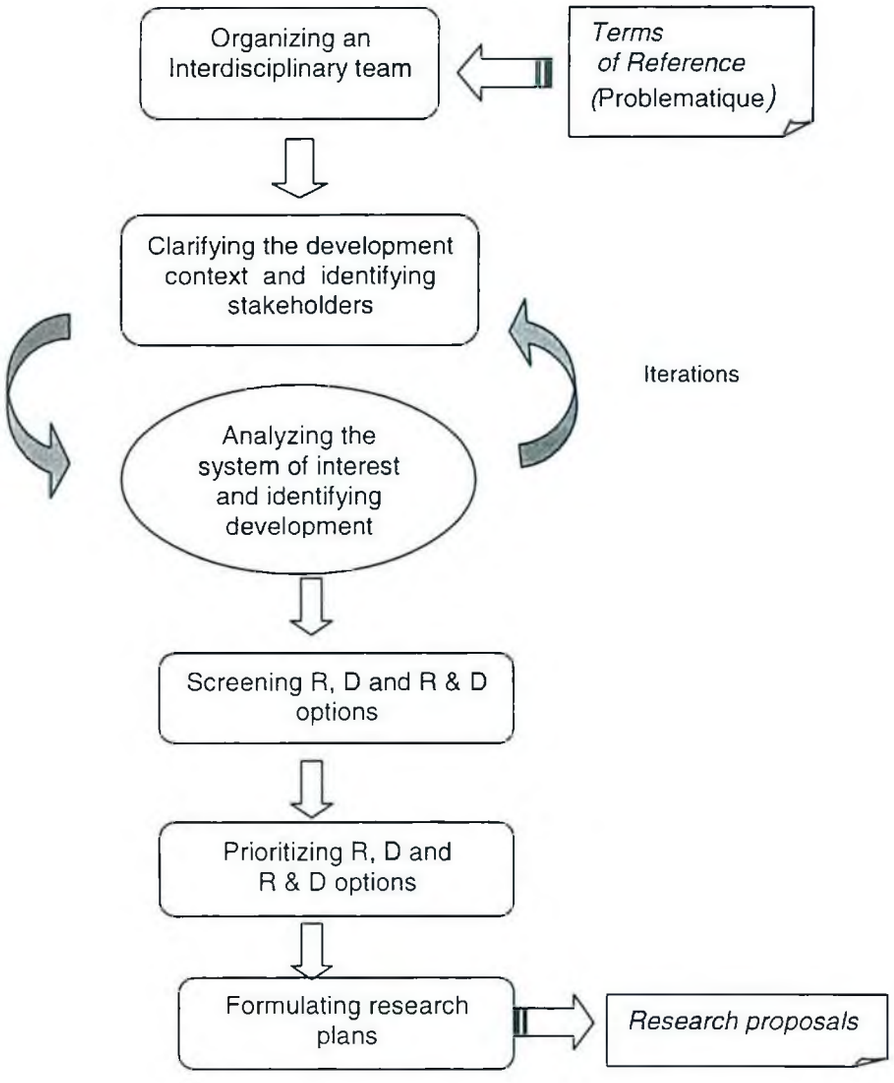
CHAPTER 2 METHODOLOGY

2.1 The research approach: Agriculture Research for Development (ARD)

The team followed the Agricultural Research for Development (ARD) approach in carrying out the field study. Inter-disciplinary teams using participatory methods and, integrating the perspective of all relevant stakeholders implement the ARD procedure. It is demand driven and supports research efforts relevant to resource poor farmers. It aims to contribute towards poverty alleviation and food security, competitiveness of farm enterprises and sustainable resource use.

The ARD approach (Fig 2.1) consists of the following iterative steps:

Figure 2.1 ARD approach (ICRA)



2.1.1 Terms of reference (TOR)

The TOR is a document given to the team by the organisation that is hosting the study (in this case EARO – JARC and Zonal Kafa-Sheka Council of SNNPR). The TOR has been developed by a task force with representatives of the host institutes and ICRA and contains a brief description of the study area and the topic to be addressed by the team. It also contains key research questions meant to guide the team.

2.1.2 Organising an interdisciplinary team

During this stage, team working rules and their operationalisation and mechanism for planning and monitoring are defined. Individual contributions were identified based on strength and expertise. A team contract was drawn up summarising the above.

2.1.3 Clarifying the development context

Clarification of the development context within which the problematique resides enhances understanding of the purpose and objectives of the study, for instance, the role of policies, markets, rural organisations, development agencies, and research and extension organisations. The context of the study is examined through the use of "Spray diagram" and "Rich picture" (Figure 2.2). The `rich picture'' is used to help develop a representation of relevant domains and elicit an understanding of the views of the people within each domain. It is useful as summary of the knowledge elicited from resource persons and secondary data. It can be useful for discussion and as a means of identifying the areas in which the knowledge is limited. As it puts the problem within the systems context, different views of the stakeholders can be reconciled at this stage. From this initial analysis the relevant unit of the analysis is identified.

2.1.4 Evaluating stakeholders' interest

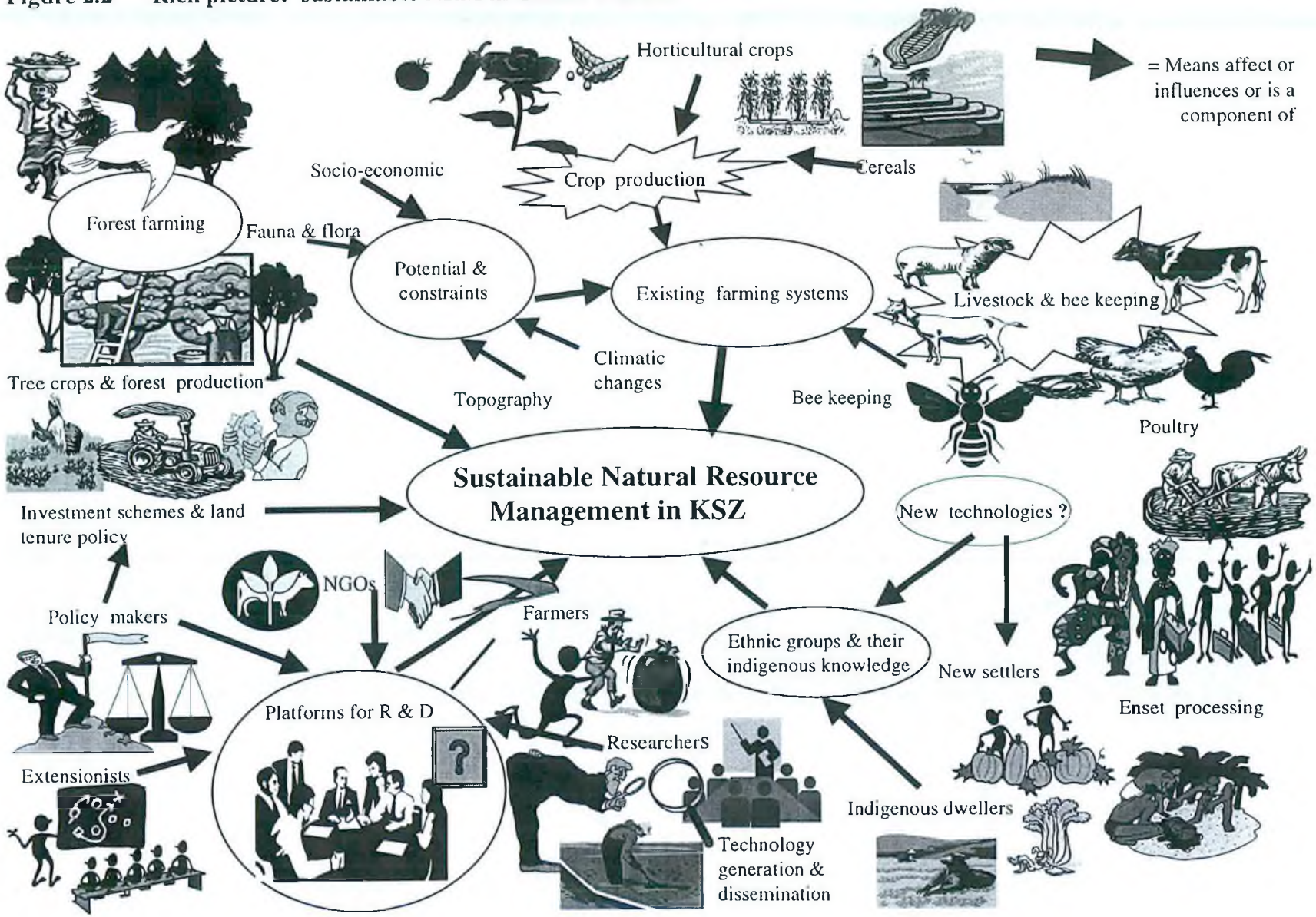
The relevant stakeholders in the problem area of the study are identified and their interests are delineated. Linkages among them and areas of common interest in relation to sustainable natural resource management in farming system of KSZ are identified. The interests and relationships among stakeholders were evaluated by using stakeholder linkage, importance and influence matrices.

2.1.5. Analysing relevant systems

The systems approach within an agricultural context was employed to analyse and organise the interactions among components of the farming systems. The team focused on agricultural production/arable farming, and not on forest production because the latter is the system of interest of FARM Africa operating in the area.

The farms were classified into homogeneous groups. This characterisation is called farm typology. These groups become recommendation domains or farm types that can use similar research technologies.

Figure 2.2 Rich picture: sustainable NRM in Gimbo Woreda



2.1.6 Identifying development options

The development requirements that need to be considered are: poverty reduction and social equity; sustainable natural resource management; economic competivity and welfare of people. Based on the analysis of the relevant systems and constraints and opportunities, potential areas of intervention will be identified and appropriate research and development options developed.

2.1.7 Screening research options

In order to understand the implications of proposed research and development options, the identified options will be screened for:

Environmental sustainability: this is the ecological component of sustainability, which implies amongst others protecting the environment. It includes the persistence of all components of the biosphere, using renewable natural resources in a manner that does not eliminate or degrade them or otherwise diminish their usefulness for generations. Issues considered for analyses are:

- Proper management of natural resources (soil, water, forest use, etc.)
- Biological interactions
- Environmentally encouraging regulations
- Ecological externalities
- Environment-safe techniques

Economic competitiveness: The objective is to identify indicators of competitiveness of a technology or an entire commodity system, which can be used to evaluate and prioritise options. If a proposed technology requires substantial changes in the use of factors of production, or major changes in storage and /or marketing, then it be necessary to think about the system change which will be required to be operated competitively.

Social equity: This is concerned with the distribution of "benefits and costs" that may accrue from change, both economic and non-economic. Non-economic criteria might include the way in which changes in society increase the rights of minority groups. The social equity criteria also look at issues such as "empowerment", capacity strengthening, and control.

2.1.8 Prioritising research options

Priority setting aims to select the best portfolio of research and development activities for a certain research system, institution or programme. The primary objective of priority setting is to make the most effective use of the resources available for research and development. All stakeholders are involved in developing criteria for prioritising the screened research and development options. Priority setting ranks options in their order of importance to satisfy a defined set of criteria. To produce a matrix of prioritised options, a combination of relevant criteria formulated by stakeholders and the team, and use of sound decision support tools are needed.

2.1.9 Developing research proposals

The prioritised research options are translated into detailed, researchable proposals. Central to such a proposal is a logical framework, which can be used to relate and summarise the objectives, activities, inputs, outputs of and means to evaluate the work proposed.

2.2 The research process, methods and tools

2.2.1 Preparatory phase

The stakeholders with ICRA constituted a task force, which prepared a TOR for the study. The task force also prepared a memorandum of understanding between ICRA and the other stakeholders. The memorandum of understanding showed the responsibilities of each stakeholder towards the successful execution of the field study. The TOR clearly defined the direction and focus of the study and the expected outputs.

Before arriving in Ethiopia for the field study, the team spent 3 months at ICRA in Wageningen. These three months were split into nine weeks of knowledge acquisition made up of a series of workshops exposing the team to the various ARD steps, tools and concepts. The acquired tools and concepts were put into practice in field exercises in Noord-Brabant, The Netherlands. The knowledge acquisition phase was followed by three weeks of field study preparation. The team developed a code of conduct embodied in a team contract, which was signed by all members. The whole field study was planned including activities to be carried out each week and the expected outputs (Figure 2.3).

The team was given the Terms of Reference (TOR, Appendix 1) at this stage. This was studied and the development context clarified. The clarification was helped by the viewing of a Video clip of the study area brought by the counterpart. The team also had extensive discussion with the reviewer who has worked in Ethiopia. Additional literature and secondary data related to study area were analysed. From this, the team's perceptions and understanding of the problematique was visualised through spray diagramming and the development of a rich picture (Figure 2.2.). Initial analysis of stakeholders' and the linkages between them was carried out (ARD steps 2 & 3). The research questions to be answered appropriate tools that could be used and expected outputs were discussed and documented.

2.2.2 Introductory workshops

Upon arrival in Ethiopia, an introductory workshop was held at the headquarters of Ethiopian Agricultural Research Organisation (EARO) in Addis Ababa. Another workshop was held at Jimma Agricultural Research Centre (JARC) in Jimma. A final introductory workshop was held at Bonga town. The main objectives of these workshops were to present the team's perception of the field study problem and obtain suggestions on the proposed field study plan. Suggestions received at the workshops helped the team to focus the study better. Lists of participants at the workshops are presented in Appendices 3, 4 and 5.

Figure 2.3 Field study activity flow chart

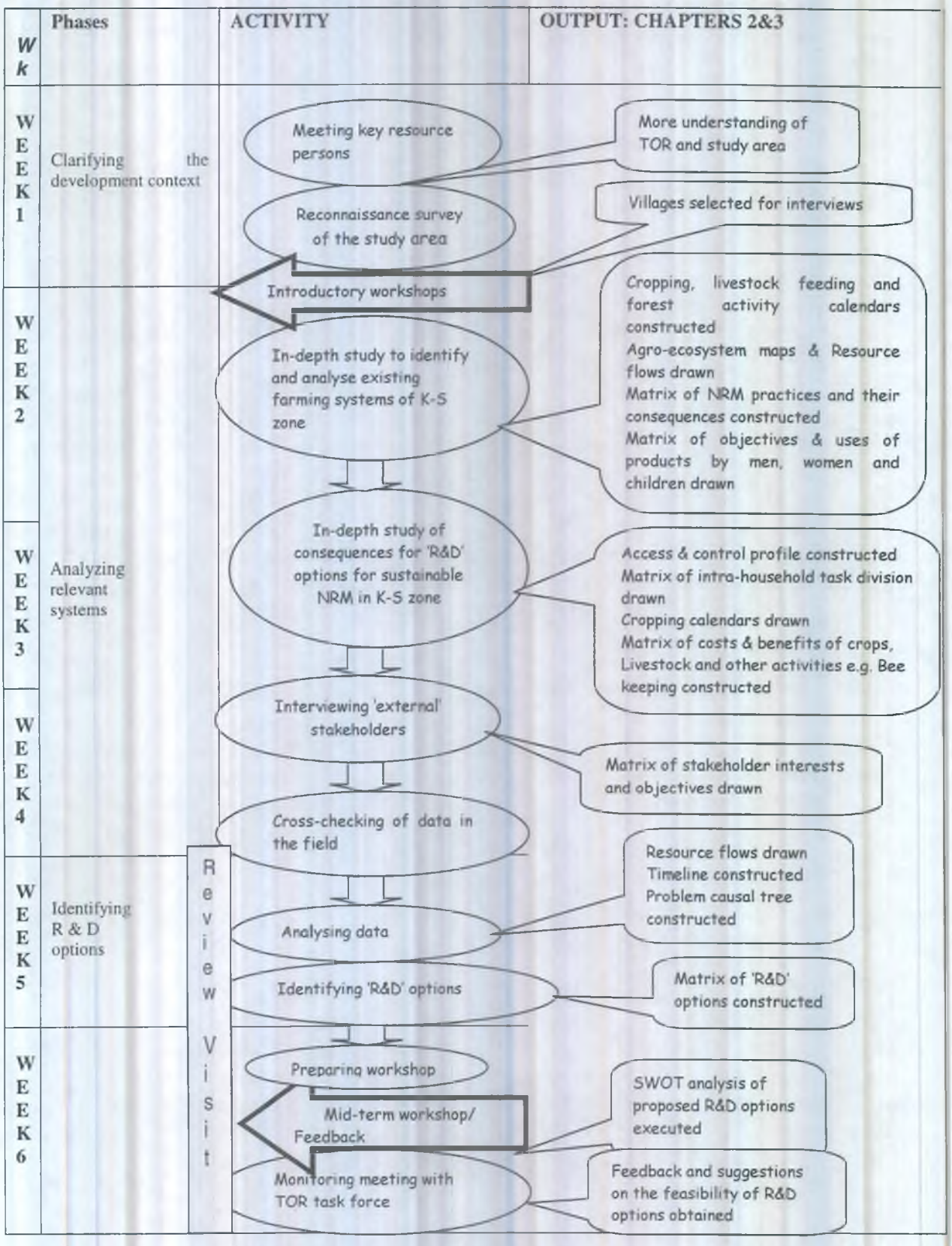
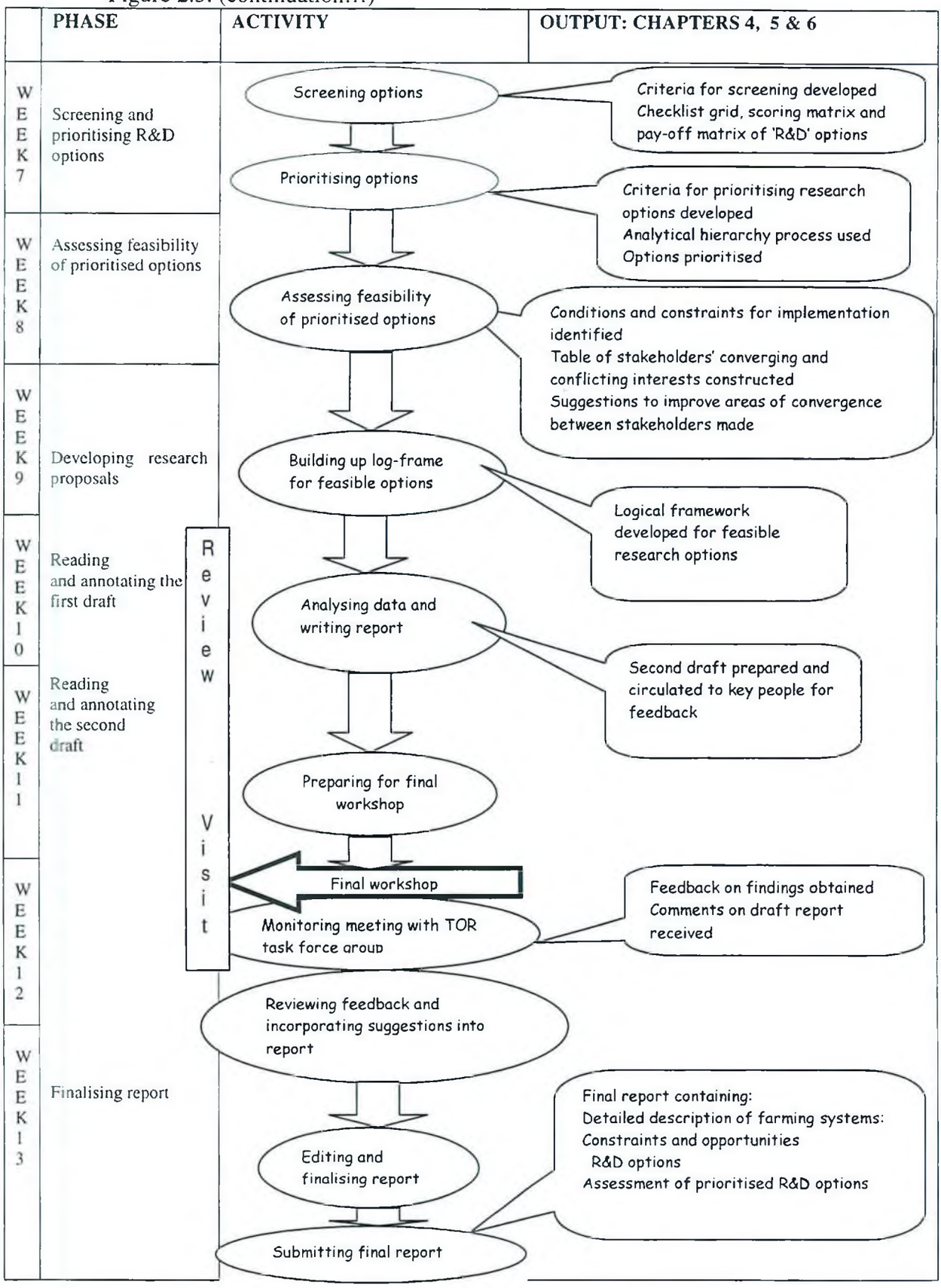


Figure 2.3. (continuation…)



2.2.3 Reconnaissance survey

A brief reconnaissance survey of the study area was conducted upon arrival in Bonga in order to familiarise the team with the zone and to verify how the actual situation reflects the impressions gathered from secondary literature, resource persons and the counterpart. Six Kebeles from Gimbo Woreda that represent the diverse farming systems of the area were covered during this survey. Particular attention was paid to the cropping systems, livestock production systems, vegetation, soil types, population, natural resources management practices, deforestation, on-going research and development programmes. Key informants, including Development Agents (DAs) were interviewed. Transect walks were undertaken with farmers and the development agents. This enabled the team to identify topographic sequences and their relation with cropping systems; and to discuss farm practices problems and farmers' aspirations with them.

2.2.4 Site selection

In the TOR, six Peasant Associations (PAs), from which, two representative villages in each were to be, studied (Table 2.1).

Table 2.1 Peasant Association and reason for its selection

Peasant Association	Reason for selection
Yebito	Forest/coffee-based farming system
Wushwush	Forest/coffee-based farming system
Awasho	Coffee-based farming system
Sheika	Enset-based farming system
Zingaj	Mixed cropping system
Shombakechib	Cereals-based farming system

However, during the introductory workshops and the reconnaissance survey, it became apparent that it would not be possible to exhaustively cover the all the PAs originally suggested. Consequently, four PAs and two representative villages in each were selected (Table 2.2 and Fig 2.4).

Criteria for selection of Peasant Associations

- *Distance from Bonga:* Only PAs within 40 km radius of Bonga were selected
- *Accessibility*: It should be possible for the team to go to a PA and return to Bonga on the same day
- *Where PAs are situated on the "scale of deforestation":* At least one PA should be selected to represent each of the identified farming systems

Criteria for selection of villages within the PA

Altitude:	As much as possible, villages should be selected to reflect distinct altitudes (midland and lowland)
Accessibility:	Villages should be accessible to the team to carry out in-depth study
Representativeness:	Selected villages in PA should represent dominant farming systems

Fig. 2.4 Selected PAs for the field study

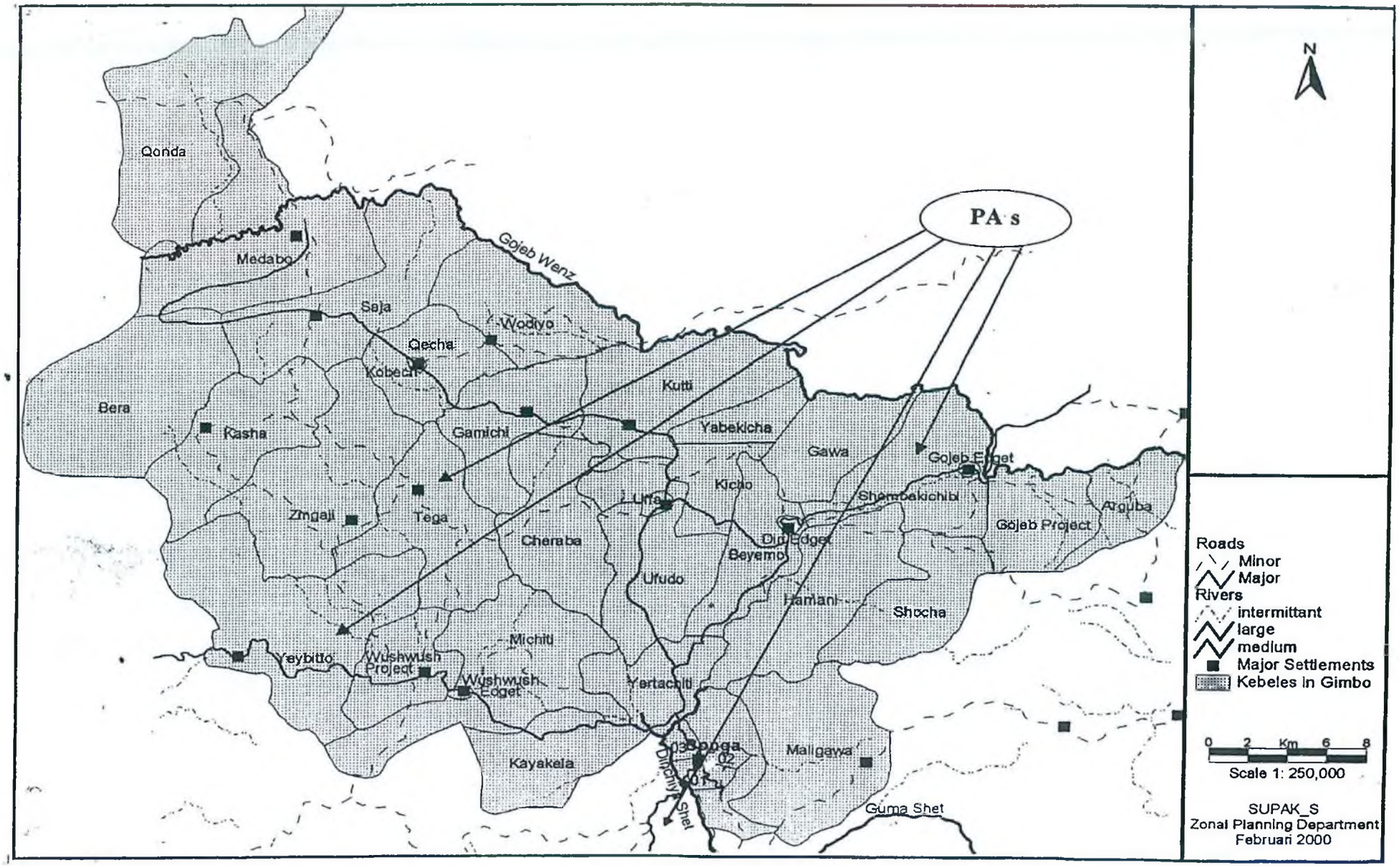


Table 2.2 Selected PAs, constituent village(s)

PA	Village(s)	Altitude(m.a.s.l)	Dominant Farming system
1.Yebito	Betagenet	1,750	Forest /coffee
	Betaselem	1700	
2.Tega tega	Tega	1,750	Forest/coffee
	Gerashuka	1,800	Forest/coffee/cereals
3.Shombakecheb	Number four	1,700	Cereals
	Korkomba	1,600	Cereals
	Gojam sefer	1,600	Cereals
4. Baha	Baha	1,800	Enset/Cereals

2.2.5 In-depth studies

First Phase

The first phase of the in-depth studies commenced immediately after the reconnaissance survey. Using the checklist (Appendix 8) developed earlier, the team divided into two groups and interviewed farmers both individually and in-groups in all the selected villages. The group meetings enabled the team to work with the farmers in a participatory manner to develop seasonal calendars of farm activities; timelines of historical events and agro-ecosystem diagrams. The group meetings were also used to discuss criteria for developing a typology of the farm types. Individual interviews were used to understand the basic structure and functioning of households as units of production, in the context of the constraints and opportunities that prevail. After data collection, the team reviewed the activities of the day, discussing the key information collected and how it would be used. Strategies were then developed for the next day ensuring that any missing gaps were covered. The data was then entered into the data sheets developed for that purpose.

2.2.6 Mid-term review workshop

A one day mid–term review workshop, which drew participants and stakeholders from JARC, ZOPEDD, DOA, FARM Africa and SUPAK-S was held on the 17th May 2000, at ZOPEDD offices, with the following objectives:

- Present the progress of the field study
- Obtain feed back and future options
- Identify gaps in information gathering
- Develop a plan for the second phase of the study

After presentations by the team on field study methodology and preliminary findings (zonation, farm typology, stakeholder analysis, and production constraints and opportunities), participants were divided into three sub- groups. Each sub-group held a brain storming session, which was proceeded by a plenary presentation on:

- Farm typology
- Research and development options
- Areas and modalities for collaboration among stakeholders

As a result, the preliminary farm typology was refined, R & D options were identified and possible areas and modalities for collaboration among stakeholders outlined.

2.2.7 Farm typology

During the in-depth studies, criteria that might be used to classify the farmers for the purpose of research targeting were discussed with participating farmers. These were:

1. Land size
2. Ownership of oxen
3. Access to regular technical information
4. Access to off-farm income
5. Access to forest resources
6. Membership of social institutions
7. Ethnic groups

These criteria were developed into a preliminary typology, presented and discussed in the mid-term workshop with all the stakeholders. On the basis of the discussion, the preliminary typology was refined and finalised. The basis of the refinement was the question, which the team asked itself: do the farm types require different research and development interventions in view of the problematique?

2.2.8 Screening and prioritising options

The team identified a number of Research and Development options, which were discussed and prioritised with farmers in a four of the selected villages. The options were also discussed with the relevant stakeholders. These discussions enabled the team to evolve criteria for prioritising the options. The options were assessed for their contribution to economic efficiency, environmental sustainability and social equity, and their probability of success. The assessment of the individual criterion is based on subjective information, which is expressed in a scale (in this case, from 1 to 5). In mathematical terms, the final score for option can be expressed as:

$$Y_i = \sum_{j=1}^{n} w_j * y_{ij}$$

Where Y_i = final score of option i
w_j = weight of criterion j
y_{ij} = the score of option i on criterion j
n = the number of criteria

The options were prioritised based on the value of the final score; the higher the score of an option, the higher the priority it gets. Two of the options, which offer scope for immediate implementation was developed into proposals (see chapter 6).

2.2.9 Final workshop

A final workshop was held at Bonga with the objectives of presenting the main findings of the study especially, the options identified and the research proposals to all the stakeholders. Modalities for implementation of the proposals were discussed. Participants (see appendix 6) also discussed how to enhance the incorporation of the ARD perspectives in research endeavours.

CHAPTER 3 CROP, LIVESTOCK AND APIARY FARMING SYSTEMS

3.1 Zonation

3.1.1 Agro-ecological zones

An agro-ecological zone is a major area of land that is broadly homogeneous in climatic and edaphic factors, but not necessarily contiguous, where specific crops exhibit roughly the same biological performance (Hoque, quoted in Mettrick, 1993).

The study area was classified into zones (Figure 3.1) based on the *scale of deforestation* that KSZ is witnessing. Using this factor, scale of deforestation, the following zones could be discerned:

Forest zone

This zone is characterised by steep to gentle slopes, abundant forest cover with semi-domesticated coffee and spices. The soils are deep, fertile and reddish brown in colour. Besides collection of coffee and the spices, there are homestead plots with enset, bananas, maize and haricot beans. Beekeeping is an important activity in this zone. Main problems of farmers include damage to crops by wild animals and the coffee berry disease (CBD).

Transition zone

This zone is also characterised by steep to gentle slopes. The forest (with semi-domesticated coffee) has been depleted. The land area under cereals is increasing, as the forest dwindles. The soils are similar to those in the forest zone but the fertility is decreasing in the areas under cereals. Major crops besides coffee and enset are maize, tef and haricot beans. Main problems include CBD, damage to crops by monkeys and trypanosomiasis.

Deforested zone

Arable fields with cereals such as maize, teff, barley, finger millet and sorghum have replaced the forest. The legumes, haricot beans, faba beans and peas are important. The soils generally have become less fertile. Diseases in crops and livestock are prevalent. Scarcity of fuel wood is an emerging problem.

Table 3.1 Agro-ecological zones in the study area

FOREST ZONE

FEATURE	A	B	C	D
LANDSCAPE	**Steep slopes**	**Moderate slopes**	**Gentle slopes**	**Flatland**
FIELD TYPES	forest, with coffee, spices,beehives	arable land, beehives	arable land	swamps and grazing lands
SOIL TYPES	reddish brown soils, black soil rich in organic matter	deep fertile reddish brown soils	reddish brown soils	sedimentary brownish soils
MAJOR CROPS	coffee, spices	maize, teff, barley, haricot beans, scattered trees	enset around homestead, vegetables, bananas	pasture land, common grazing land
PROBLEMS	bee colonies attacked by Rodents and ants, CBD, sheet erosion	crops attacked by baboons monkeys and warthogs	unidentified enset diseases Newcastle disease in poultry	over grazing; tripanosomiasis, blackleg

TRANSITION ZONE

FEATURE	A	B	C	D
LANDSCAPE	**Steep slopes**	**Moderate slopes**	**Gentle slopes**	**Flatland**
FIELD TYPES	denuded forest with wild coffee, homestead on the fringes	arable land with home-stead, scattered trees, palm trees	arable land	grazing land scattered trees
SOIL TYPES	reddish - brown soils	deep reddish soils	enriched soils with farm yard manure, high organic matter black soils	clayey soils
MAJOR CROPS	wild coffee, enset around the homestead	maize, beans, teff, enset	maize, beans, teff, enset	pastures
PROBLEMS	crops attacked by wild animals and CBD	crops attacked by wild animals and diseases	crops and livestock attacked by wild animals, crop diseases, weeds	livestock diseases trypano-somiasis in cattle

DEFORESTED ZONE

FEATURE	A	B	C	D
LANDSCAPE	**Steep slopes**	**Moderate slopes**	**Gentle slopes**	**Flatland**
FIELD TYPES	Forests, homesteads on the fringes of the forest	arable land with scattered avocado, mangoes	arable land with scattered eucalyptus trees around the homestead	swampy land, arable land beyond the swamps
SOIL TYPES	brown/ black soils	deep black loamy reddish soils	deep black soils high in organic matter	Greyish, shallow soils
MAJOR CROPS	enset and cereals	maize, pulses, enset, bananas	maize, finger millet, barley, teff , sorghum, vegetables, banana	maize, pulses, pepper
PROBLEMS	crops attacked by wild animals and crop diseases	crops attacked by baboons monkeys and warthogs diseases, weeds	decrease soil fertility, weeds livestock diseases: blackleg, antrax poultry attacked by hawks	over-grazing; low fertility leaf blight in maize pepper disease

When the two factors of altitude and scale of deforestation are combined, the selected Peasant Associations could be placed in the zones as shown in table 3.2:

Table 3.2 Position of selected peasant associations in Gimbo Woreda

ZONES	MIDLAND (1,700-1,800 m.a.s.l)			LOW LAND (1,500-1700 m.a.s.l)
1 FOREST	YEBITO			
2 TRANSITION		BAHA	TEGA TEGA	
3 DEFORESTED				SHOMBAKECHEB

3.1.2 Farming systems

Introduction

A farming system is a collection of distinct functional units, such as crops, livestock and marketing activities that interact because of the joint use of inputs they receive from the environment (Harwood, 1979). Interest in farming systems research and analysis began in the mid seventies following the realisation that agricultural research has had relatively little success in generating and disseminating technologies which are widely adopted by small-scale, resource-poor, risk-averse farmers in less favoured environments. It came to light that many of the technologies developed by on-station research, though technically sound, appeared not relevant to the needs and socio-economic circumstances of small-scale farmers.

It was felt then that the solution lied in researchers working with farmers and understanding their concerns and socio-economic needs. It was believed that technologies developed through such a process stood a better chance of being adopted by farmers. A key feature of farming systems research has been the use of multidisciplinary teams of natural and social scientists to analyse farming systems and delineate recommendation domains for the targeting of research. Despite its shortcomings, farming systems research and analysis is still relevant in providing a systems perspective to the understanding of the complex nature of farming in resource-poor, risk prone environments.

Field types used by farmers

The main field types used by farmers are:

- *Coffee plots.* These are plots of improved coffee planted by farmers.
- *Forest plots.* These are naturally occurring forests from which farmers collect semi-domesticated coffee and spices.
- *Homestead gardens.* These are fields around the home, fertilised with farmyard manure. Crops grown are mainly enset, vegetables, bananas and legumes.
- *Arable fields.* These are fields of crops such as maize, teff, finger millet, sorghum, haricot beans and faba beans.

Resulting farming systems

The study identified the following farming systems in Gimbo Woreda:

Forest zone:
- Forest gathering/coffee-based farming system

Transition zone:
- Forest gathering/coffee/cereal-farming system
- Enset/cereal-based farming system

Deforested zone:
- Cereal-based farming system

A description of each of the farming systems is given below.

Forest gathering/coffee-based farming system

This system is dominant in Yebito Peasant Association (PA). The PA still has abundant natural forests. Coffee and spices occur naturally in these forests. Household forest plots from which they collect coffee and spices for household consumption and sale. The coffee and spices are hardly maintained. The undergrowth is cleared just before picking of the berries commences. Little or no pruning or pest and disease control is undertaken. Consequently, yields are very low and of poor quality. Because coffee is an important source of cash, many farmers are planting their own trees in small plots (coffee plots) on the fringes of the forests with improved seeds/seedlings supplied by the department of agriculture or some of the development NGOs operating in the area. Such farmers are relatively better off. Coffee holds the potential to turn the fortunes of many households here. Yebito PA is also the base of a number of investors who are taking advantage of the rich forest soils and favourable climatic conditions to develop coffee and tea plantations. Livestock keeping is an integral part of this farming system

Forest gathering/coffee/cereal-farming system

This farming system is found in the areas where the forest is dwindling and being replaced with cereals and pulses such as maize, sorghum, barley, finger millet, tef, haricot beans, peas, and faba beans. Forest plots and forest gathering of semi-domesticated coffee and spices remain important, cereals are gradually surpassing them. This is largely the result of the influence of settler farmers from the northern part of the country whose main crops are the cereals. The settlers are relatively well off. This is further enticing the indigenous people into cereal production. Livestock production is an important feature of this farming system. This is the dominant farming system in Tega Tega PA.

Enset /cereal-based farming system

Enset is a plantain-like perennial crop indigenous to Ethiopia. Although it is found in all the farming systems, it is the dominant crop in some peasant associations both in terms of the acreage and also its contribution to total household income. It is usually planted around the homestead where it benefits from cow dung application. It is grown more by the indigenous people than by settlers, although changes are taking place in this regard. Besides manure application, there is very little maintenance. Its broad leaves quickly suppress weeds. Its processed pseudostem produces a much sought-after, highly priced starchy food. The enset /cereal-based farming system is prevalent in Sheika and Baha peasant associations. Though Beha PA is outside Gimbo Woreda (is in Decha Woreda), the distinct dominance of enset in its farming systems made the team include it in its study.

Cereal-based farming system

This farming system is prevalent in Shombakecheb PA. The forest is almost gone here and the landscape is characterised by nearly treeless arable fields of maize, teff, sorghum, finger millet, faba beans, haricot beans, peas and pepper. Homestead gardens are an important feature, and the development of coffee plots is being promoted. Livestock rearing is very important in this farming system. Oxen provide the draught power for ploughing as in other farming systems but are more important here. Ownership or access to oxen has a strong influence on farmers' cropping practices.

Despite the differences outlined above, these farming systems have the following common features:

1. *Subsistence production levels.* The main objective of the farmers in all the systems is to meet the subsistence needs of their households. Very little commercial production was found except the few coffee and tea plantations
2. *Little use of external inputs.* It is a low input-low output production system. External input availability and cost are major constraints to raising farm-level productivity. Where these inputs are available, they are beyond the means of most farmers. Providing farmers with affordable inputs such as improved seeds and other planting materials would bring marked improvements in the lives of the farmers
3. *Similar land preparation methods.* All farmers prepare their land using the ox-plough. The ox is an indispensable asset to all farm households. Households without the ox are really handicapped in their efforts to meet its objectives

4. *Livestock production and beekeeping* are an integral part of all the farming systems.
5. The principal *means of transport* of farm produce to markets are donkeys, horses and mules. Head loading of produce is also common.
6. *Weak institutional support.* Extension delivery systems, input supply and marketing structures are weak

3.1.3 Farm typology

In order to target agricultural research the suppliers of new technologies must realise and define variability in their client base. It is necessary to ask who is the client of the product and what recommendations they need for improvements? One approach is to develop a typology to identify and classify different farm households into homogeneous groups. A typology aims to group production systems which function in a similar way but also reflect farmers' strategies, decisions and limiting factors (Mettrick, 1993). For this study, a typology serves as a tool to classify farmers in different homogenous groups, which require different research and development interventions.

In deciding on the criteria for farm typology, two key questions were discussed. First, are there differences between farm types in their access to resources and farm management decisions with respect to natural resources management? Second, if there are different farm types, do they need different research interventions? Based on these considerations, the criteria below were used to classify the farm households into farm types under each zone.

Size of arable fields

- 2 ha or more
- Less than 2 ha

Ownership of oxen

- 2 oxen or more
- 1 ox or less

Access to forest plots

- Those having access
- Those without access

The choice of criteria was intended to reflect the factors that determine households' strategies to manage farming at field level. As it is assumed that this is the most applicable level of research interventions. In this section the rationale behind each criteria is presented.

Size of arable field

The size of arable field is a key criterion in making choice for different farm activities by the farmer. Consequently the choice of farm activities may have significant impact on natural resource management. Moreover, different farm sizes (small or large) face different constraints and provide different opportunities with respect to natural resource management. For instance, large farmers may opt for coffee farming on their sloppy land but smaller farms

may opt only for limited number of coffee or other multi-purpose trees because of limited land. In that order the farms were classified as small (less than 2 ha. of arable field) and large (2 or more of arable field). The larger farm are more interested in cash crops like coffee, mango and avocado while small farmers want increase their food grain production.

Ownership of oxen

Ownership of oxen is considered to be a major factor in classifying farm households, as oxen are the only source of draft power for land preparation. Growth of weeds and vegetation in the fallowed fields and in crop fields is very fast because of high rainfall that makes the ownership of oxen even more important for farming. The household with no ox or having only one and dependent on other farmers for oxen, may not be in a position to prepare their land and plant crops at the optimum time. In the forest zone, there are fewer oxen because the main field types are forest plots and homestead gardens. In the transition zone, there are more oxen because arable fields are important, and hence ownership of oxen. In the deforested zone, arable fields are very important and ownership of oxen is even more important.

Ownership of oxen may determine the nature of land preparation and cultural practices especially the number of tillage and the number of weeding. Further, the access to oxen may determine the choice of crops and crop rotation because different crops have different requirements. Farmers with one or no ox need different research interventions like minimum tillage and single ox driven implements as compared to farmers with two or more oxen.

Access to forest plots

Access to forest plots with wild coffee, spices and possibilities for bee keeping is considered an important criterion to classify farm types in the Forest and transition zones. The farmers who have access to forest to collect coffee and spices, and have beehives face different constraints than those who do not have access. Therefore different opportunities exist needing different research and development interventions.

Based on the above-mentioned criteria the households in each of the three zones were classified into farm types to enhance targeting of research and development interventions. These farm types under each zone are listed on the next page in order of their prevalence (Table 3.3).

Other considered criteria

In addition to the above identified farm types, farm households could also be classified based on other criteria like access to regular technical information, access to off farm income, access to market and ethnic groups. But the numbers of farmers in these groups are too small to constitute separate farm types.

Access to regular technical information

The farmers who have access to regular technical information could be entry points for initiating participatory research and development programme. For instance, they may become active members of the Farmer Research Groups (FRGs) to be established (see Chapter 5).

Table 3.3 Farm Typology

Zones	Farm types	Description
Forest	I	Two or more ha of arable land; with two or more oxen, with access to forest resources
	II	Two or more ha of arable land; with two or less oxen and having access to forest resources
	III	Less than 2 ha of arable land; less than 2 oxen and have no access to forest resources
	IV	Two or more ha of arable land; with 2 or more oxen and have no access to forest resources
Transition	I	Two or more ha of arable land; with two or more oxen and have no access to forest resources
	II	Two or more ha of arable land; with less than 2 oxen and have access to forest resources
	III	Two or more ha of arable land; with less than 2 oxen and have no access to forest resources
	IV	Less than two ha of arable land; less than oxen and have no access to forest resources
Deforested	I	Two or more ha of arable land; 2 or more oxen and have no access to forest resources
	II	Two or More ha of arable land; less than 2 oxen and have no access to forest resources
	III	Less than 2 ha of arable land; less than 2 oxen and have no access to forest resources

Access to off-farm income

Farmers with off-farm income may have better opportunity to invest in farming. This source of investment may allow farmers to opt for different options that favour improving the productivity on their farms.

Access to market

Farmers who have poor access to markets need different research and development interventions compared to those with better access. For instance, farmers with poor access to market need introduction of high value-low volume crops.

Ethnic groups

In the past, ethnic background has had a significant influence on the farming systems in Gimbo Woreda. Settler farmers from the northern parts of the country promoted cereal and legume production and also introduced new varieties into the existing farming. However, currently they and the indigenous farmers have so intermingled and learned from each other that now all the farmers (settlers or indigenous) are following almost the same cultural practices and planting the same crops. Therefore this criterion does not qualify anymore to be used for farm classification.

3.2 Crop sub-systems

Introduction

Ethiopia is the centre of origin and genetic diversity of many cultivated crops such as enset (*Ensete verticosum*), tef (*Eragrostis tef*) and Arabica coffee (Westpal, 1975; Vavilov, 1951; Sylvian, 1967). Farmers in Gimbo wereda depend very much on crop cultivation, which is dominated by a range of food and cash crops. Fifty per cent of farmers interviewed had a total landholding of 2 to 3.5 ha and the average is 1.5 ha (Table 3.4).

Table 3.4 Land holdings in Gimbo Woreda

Land holding (ha)	% of farmers
< 2.0	17
2.0-3.5	50
≥3.5	33
Total	100.00

Land holdings are very small and many young people do not have land because there has been no land distribution since 1991.

3.2.1 Main crops

Apart from maize, the land area occupied by other crops is less than half a hectare. Maize is grown nearly by all farmers as a leading food crop. Enset, teff, sorghum, and haricot bean follow in order of importance (Table 3.4).

Finger millet and pepper are grown as major crops specifically in the lower areas of Shombakecheb PA. Coffee is an important cash crop especially in the forest and transition zones. The other crops, which are considered to be minor but may be potentially important in the future, include faba bean, barley, wheat and root crops such as taro (*Colocasia esculente* L.), sweet potato (*Ipomoea batatus* L.), Irish potato, yam (*Discorea* spp.) beetroots and carrot.

Yields of all the crops are generally low. This may be largely due to the use of unimproved crop varieties, poor cultural practices, small size of farmlands and destruction by wild animals. For instance, the average yield of maize is only 800 kg/ha on farmers' fields (Table 3.5) However, DoA maize demonstration plots give yields of up to 6,500kg/ha (Appendix 8).

Compared to other food crops, enset is more productive. Farmers in all the zones grow it around the homesteads.

Table 3.5 Status of crops grown by farmers

Crop	Proportion of farmers growing (%)	Average area (ha)	Average yield (kg/ha)
Maize	100.00	1.60	800
Enset	72.22	0.34	NE**
Teff	69.44	0.34	245
Haricot bean	38.89	0.20	367
Sorghum	47.22	0.25	345
Faba bean	33.33	0.25	325
Millet	22.22	0.30	1167
Pepper	19.44	0.25	1400
Coffee	36.11	0.31	500
Barley	38.89	0.25	167

** farmers are not able to estimate

In essence, coffee and the spices in the forest zone, coffee and cereals in the transition zone and cereals in the completely deforested areas dominate crop production. Farmers gather different spices such as `korarima' (*Aframomum conorima*), "timiz" (*Piper* spp) and coffee (*Coffea arabica* L) from the natural forest. The new settler farmers introduced the cultivation of cereal crops. However, nowadays, farmers exchanged their indigenous knowledge and at present their livelihood much depends smallholding mixed cropping based on the growing of a range of food and cash crops.

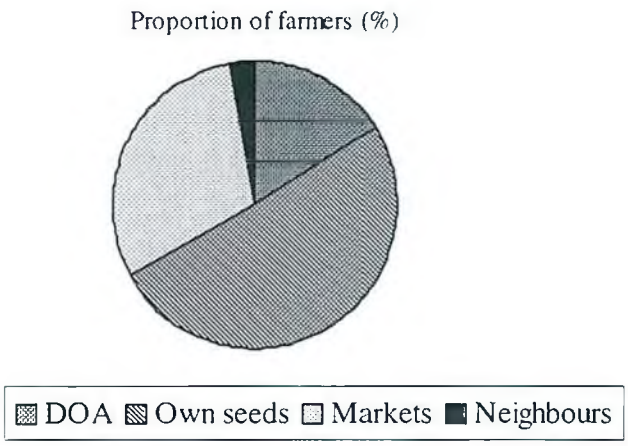
3.2.2 Planting materials

Fifty percent of farmers use their own seeds, while about 30 % use seeds purchased from open markets (Figure 3.1). These seeds may be genetically mixed. DOA, FARM Africa/Ethiopia and SUPAK-S are trying to distribute improved varieties of some crops, like maize, tef and coffee. In addition, DOA provides farmers improved seeds of maize and tef through its extension package programmes. However, there appears to be reluctance on the part of farmers to take advantage of this package because the improved seed is supplied together with fertiliser, which is considered rather expensive.

In the words of one farmer:

> *''We need improved seeds, not fertilisers. Our local crop types give low yields and are easily affected by insects and diseases. We do not require expensive inputs beyond our reach''.*
>
> --Farmer at Tega Tega PA.

Figure 3.1 Sources of planting materials



3.2.3 Land preparation and sowing

All farmers prepare their lands using ox-ploughs. It is an age-old practice whereby a simple traditional tool is used to cultivate the land without much turning of the soil. The frequency of ploughing depends on soil types, length of fallow period, crop types and availability of oxen. Uncultivated lands, hard and compact soils require more ploughing compared to loose loamy soils. In addition, crops with small seeds such as teff require fine seedbeds. This is to ensure better contacts between seeds and soil and hence maximum germination and stand establishments.

On the average, farmers plough 3 times for maize and 4 times for teff. The average number of ploughings for other crops is 2. There is shortage of oxen for ploughing in the study sites. Those farmers who do not have an ox use share cropping. Depending on the agreement, crop seed may be contributed by both farmers and the produce shared equally.

The time of land preparation and sowing depends largely on the rainfall pattern. This year (2000) for example, maize was sown late in March because of the prolonged dry season. Land preparation for maize usually starts early for sowing to take place either between November and December or January and February. Sowing time also vary according to altitude variations. Farmers in the midlands of Yebito PA sow maize early in November-December while those in the lowlands of Shombakecheb PA sow in February-March (Figure 3.2).

3.2.4 Cropping patterns

Most farmers practice sole or monocropping. That is, farmers do not try to maximise crop productivity on the limited farm size by mixed cropping. However, depending on crop types, soil conditions and rainfall pattern, few farmers practice sequential and rotational cropping patterns. For instance, farmers at Shombakecheb use such sequence as maize-haricot bean-pepper and millet. In this case, if they sow maize- finger millet- haricot beans the first year, the next year will be pepper-finger millet or maize- millet or maize on the same corresponding fields. In Yebito, Baha and Tega Tega, either sorghum or barley follows maize with a sequence of either maize-sorghum-tef-barley or maize-barley-tef-sorghum.

3.2.5 Weed control

The climate of the area favours the fast growth of both annual and perennial weeds. Common weeds in crop fields are the broad leave weeds (*Guizotia scabra, Galinsoga pulviflora, Tagetus minuta, Bidens pilosa* and *Amaranthus spp*) and grassy weeds (*Cyndon dactylon, Digitaria* spp, and *Cyperus* spp) under shade and open fields, respectively. Weed infestation is higher in the homestead fields with more fertile soils. Most farmers use cultural weed control practices such as slashing, hoeing and hand weeding. Weeding is accomplished by the use of family or communal labour. All farmers apply ox-plough "*shilshallo*" primarily for weeding maize fields after it reaches knee height. Besides controlling weeds, it thins out dense plant populations and reduces lodging.

The use of herbicides is not common mainly due to the high costs and the unavailability of spraying machines. For the labour intensive crops like tef and finger millet, farmers prefer to use herbicides.

3.2.6 Insect pests and diseases

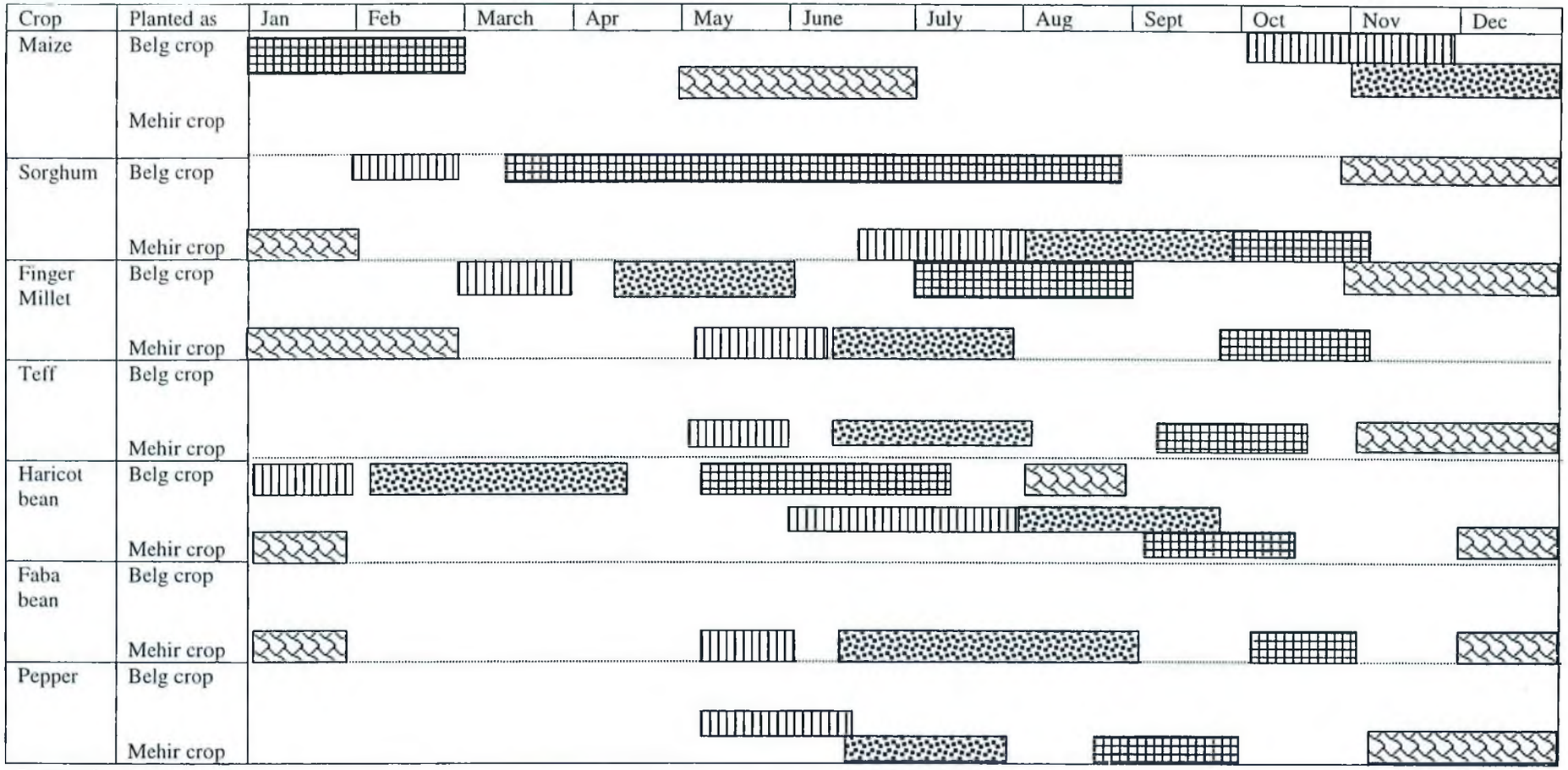
Insects and diseases are a major threat to crop production. They occur during different seasons of the year and at different growth stages of the crops. Maize stalk borer and armyworms are the major insects that affect maize. Storage pests include weevils, rats and rodents. Birds' damage is severe on sorghum. The main maize disease is the maize streak virus, which occurs before the full grain filling stage and causes ripening of the cob. Leaf scotch and leaf rusts are also common on maize. In coffee, the main disease is the coffee berry disease. Its damage depends on the variety, season and attitudinal variations. Bacterial wilt diseases are common in pepper and other vegetables.

Storage pests are controlled in silos by smoking. Birds are scared away from crop fields by children. Farmers try to control crop diseases using `escape mechanisms', which include early planting and crop rotation.

3.2.7 Harvesting and storage

Family and or hired labour is used for harvesting and threshing of crops. Maize is harvested using cutlass in order to remove the cob from the stalk. The sickle is used for harvesting tef, millet and sorghum. They heap up tef and other cereals so that they can be threshed out using sticks or ox trampling. The grains are then stored in silos or jute bags.

Figure 3.2 Seasonal cropping calendar for deforested zone, cereal-based farming system



Leyend:

Belg crop = Nov – May (Minor rainy season)
Mehir crop= June-Nov. (Main rainy season)

Land preparation
Harvesting
Sowing/planting
Weeding

3.2.8 Wildlife attack

Wild animals, especially baboons, monkeys, warthogs and badgers are a major problem of farmers, particularly in the forest and transition zones. Their attack on crops appears to be the single most important constraint stressed by all farmers. Farmers are frustrated by their inability to control wild animals. Scaring wild animals away from crops is an activity that runs from sowing right through to harvesting. This constitutes a serious drain on vital family labour and time. Maize is particularly vulnerable with crop losses of up to 50%. One farmer explained:

> " I did not cultivate all my land because I cannot keep wildlife away day and night. Otherwise, they will damage all my crops. My house is closer to the forest where different types of wildlife live. Unless, the government finds immediate solutions, I will remain a poor farmer".
>
> --- Farmer at Yebito PA.

3.2.9 Main crop production constraints

The major constraints of crop production mentioned and ranked in order of importance by farmers are presented in Table 3.6:

Table 3.6 Ranked crop production constraints

ZONE	FARMING SYSTEMS	RANKED CONSTRAINTS
• Forest	• Forest/coffee-based	• Wild animals attack • Inadequate improved planting materials • Coffee berry disease
• Transition	• Forest/coffee/cereal -based	• Damage by wild animals • Inadequate oxen and labour • Inadequate improved planting materials • Coffee berry disease • Maize streak virus disease • High cost of improved seeds and fertilisers • Inadequate oxen
• Deforested	• Cereal- based	• Inadequate oxen • Inadequate improved planting materials • Maize streak virus disease • Shortage of labour and land • Premature ripening of pepper • High cost of improved seeds and fertilisers • Erratic rainfall • Wild animals attack

3.3 Strategies to circumvent problems of access to land, oxen and labour

Access to land oxen and labour significantly influence productivity. Farmers have developed coping strategies to circumvent difficulties in accessing these productive resources. They exploit their networks to develop social arrangements that enable them to have access to these factors of production. These social arrangements are particularly important for resource-poor farmers who are unable to have adequate land, a pair of oxen or labour especially during the peak farming seasons. These social arrangements as encountered in the farming communities are described below.

3.3.1 Land sharing arrangements

Land provides the resource base on which agricultural production takes place. The land reform act of 1974 guaranteed the right of all Ethiopians to the use of land. In many peasant associations, there was not enough land for redistribution. The result is that land sizes are small. People without land enter into sharecropping arrangements in which they contribute either their labour to cultivate the land or provide planting materials and share the resulting produce with the landowner. Those with land, which is inadequate to sustain the family, use similar arrangements to ensure adequate food supply to the household. In the forest and transition zones, landless people collect coffee and spices from the forest and share the produce with the forest `owners'. These social arrangements thus enable the poor and landless to earn a living.

3.3.2 Labour sharing arrangements

Family labour is the main source of labour available to households. Because many children go to school nowadays, labour shortage especially during land preparation, weeding and harvesting is a major problem of farmers. Farmers again, use their social networks to enter into labour sharing arrangements to provide the much-needed labour. This practice is very old. Bart Van Halteren (1996) describes an important labour sharing arrangement called *Dafo* among ethnic groups of Kafa-Sheka Zone. *Dafo* is a work party of up to 15 people who help in land preparation, sowing or harvesting or other agricultural activity. The participants work for a day, and the beneficiary provides food and drinks. If a person refuses to work in a *dafo* for a day, it is not very likely that he himself will get help from other persons when he organises a *dafo*.

Labour sharing arrangements are always components of social structures within villages. Even each ethnic group can have its own arrangements. For instance, in villages in the forest-based farming systems, during the coffee harvesting season (November to December), farmers turn to outsiders (people from outside the village or ethnic group) to provide the needed labour to pick the berries. In exchange for their labour, the "foreigners" earn half of each single harvested bag of berries.

3.3.3 Oxen sharing arrangements

Oxen provide the draught power for land cultivation. Ownership or access to oxen is important for farmers to make productive use of their land. Farmers are always eager to own a pair of oxen. Without it, their capacity to produce enough food for the household may be curtailed.

Nevertheless, farmers who do not have oxen or have only one ox, turn to their relatives or neighbours for assistance. Access to the use of oxen is perhaps more important for many farmers than owning. Farmers without oxen can still plough their land through the oxen sharing arrangements.

However, these arrangements are at times not as simple as they may appear to be (see Figure 3.3). They depend on factors such as degree of confidence between the parties, the commitment from the borrower to return the favour when asked, and the social status of the parties within the community.

Types of oxen sharing arrangements

Type 1 is very common amongst farmers who are neither the poorest nor the richest in the village. Within this category are, for example, young farmers who are starting a farm. Farmers having only one ox temporarily turn to this arrangement until they are able to get one more.

Type 2 is typical amongst poor farmers who do not have any ox. They often have no option but to enter into this arrangement which tends to make them poorer because they have to give a large portion of their produce to the oxen owner. These farmers desire to have their own oxen and save towards it. Oxen are expensive and the payment of the oxen owner from the sale of agricultural produce does not help the saving effort. Such farmers often have to raise the required money by engaging in off-farm activities.

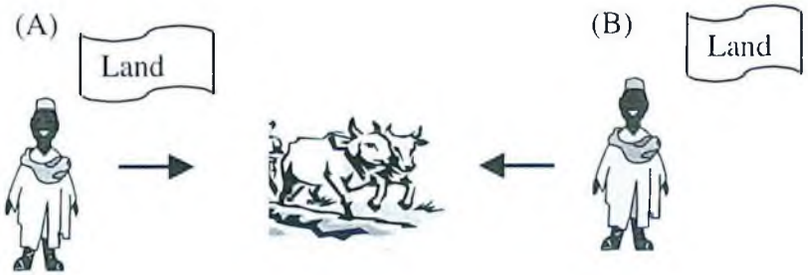
Farmers who have neither land nor oxen fall into type 3. They are often immigrants from other parts of the country. They share their produce equally with the land and oxen providers. These arrangements enable them to earn a living.

Type 4, is less common because few farmers have four oxen. These farmers decide whom to call on to assist. Usually they favour their relatives (brothers) although the favour is not free. They may ask for assistance during harvesting and other activities.

Type 5, is another common practice, especially in Shombakecheb PA where farmers use four oxen to plough the land. First one farmer's plot is ploughed then the other. This arrangement does not confer further benefits to the parties although it can last through the whole growing season.

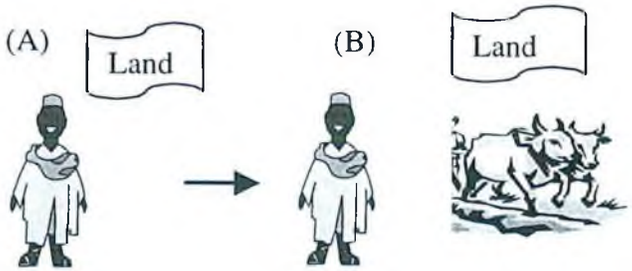
Figure 3.3 Types of oxen sharing arrangements

TYPE 1



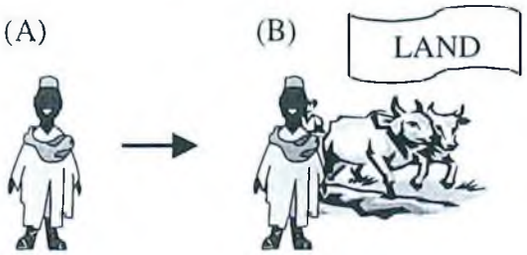
Both farmers (A) and (B) contribute one ox to compose an oxen-plough. Farmer A will first plough his land then gives the oxen to farmer (B) so that he also can plough his.

TYPE 2



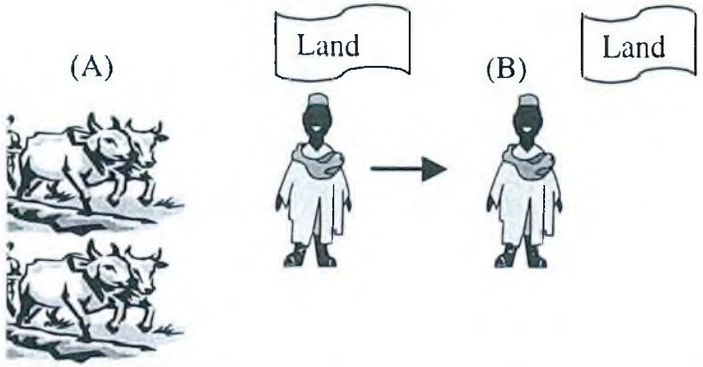
Farmer (A) borrows from farmer (B) the oxen to plough his cropland, but in return he has to give part of his produce to farmer (B) (the owner of the oxen)

TYPE 3



Farmer (A) (landless) borrows oxen and land from farmer (B) to cultivate cereals and in return he gives half of his total produce to the landowner.

TYPE 4



Farmer (A) having four oxen and enough land ask farmer (B) to help him to plough his land to sow cereals. In return farmer (A) will lend two oxen to farmer (B) so that he can plough his land.

TYPE 5

Farmer (A) makes his oxen available to plough either his land or farmer (B)'s land. Farmer (B) does the same. Since there are four oxen available, ploughing is done faster. Both farmers have no further benefits besides sharing oxen and labour.

3.4 Livestock sub-system

Introduction

Livestock production is an integral component of the smallholder farming systems of Gimbo Woreda. Every household keeps some livestock. Important livestock are cattle, sheep, goats and poultry. These animals are kept for food, cash or draught. Cattle herds are particularly important. Cows provide the household with milk, which is sold in the market. Oxen are invaluable for land preparation. Where access to land is not a limiting factor, ownership of oxen largely determines extent of crop cultivation. Equally important are horses, mules and donkeys, which are kept for on-farm and off-farm transport of goods and produce.

Livestock also have other functions. They are a symbol of status and a reflection of wealth. They are used in payment of bride price and offered as gifts to strengthen social bonds. The integration of livestock into the farming system is particularly important for increasing security, by diversifying the food generating activities of the farm household.

3.4.1 Types of Livestock

Cattle

About 55 % of the households owned at least an ox, with a range of one to four. The average number per household is one. Animal draught power is indispensable for crop production. Households without oxen hire from neighbours or engage in reciprocal work arrangements. Cows are important particularly for milk and milk by-products. The output of milk per cow per day does not exceed two litres for local breed due to poor management practices.

Mules, donkeys and horses

These beasts of burden are indispensable assets of farmers. Many farming areas are inaccessible by lorries and these animals provide farmers the only means by which they can transport their farm produce to the marketing centres. Horses and mules are hardier and are used for long distance travel. They are particularly useful in areas where the terrain is rough and difficult.

Sheep and goats

Sheep and goats are found in most households. They are reared mainly for sale. The number of sheep per household ranges from one to five. Some households have as many as ten. Average number of goats per household is two. Sheep and goats become adult at eighteen months kidding/lambing interval is usually one year.

The sheep found in the study area are characterised by medium size body, neck and tail. Most of them are polled and their body is covered with coarse and short hairs. The skin colour is mostly red, with occasional black and white. Ewes mostly produce one or two lambs at parturition. Mutton is preferred meat source for festivals. The skin is also in high demand for processing into hides. Because sheep are docile and easy to handle, farmers usually prefer to rear them to the goats.

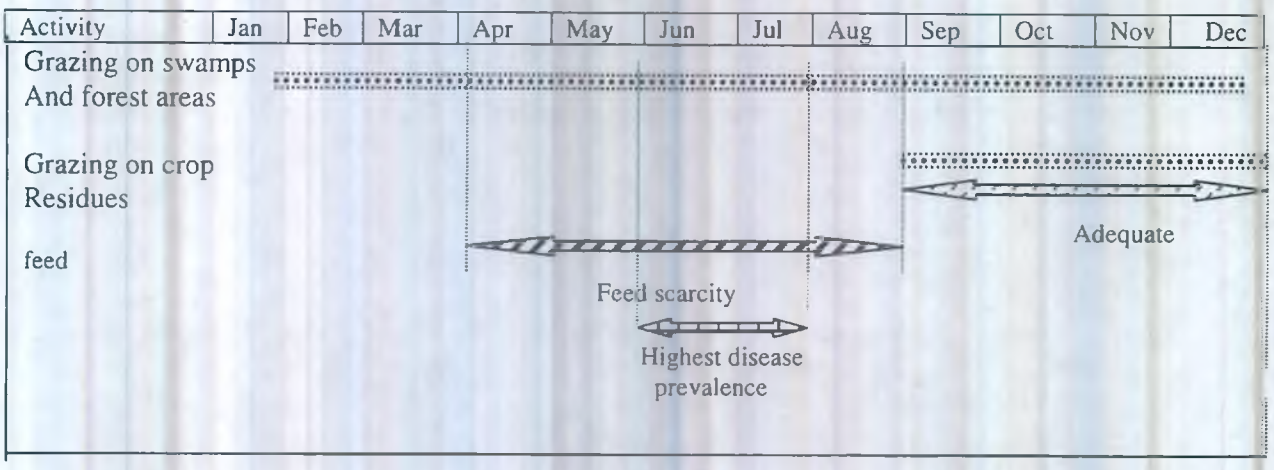
Poultry

Chicken are the main poultry kept to satisfy the immediate small cash needs and meat source for the family. Free range is the common husbandry practice, in which the birds roam about the fields in search of food, becoming exposed to attack by hawks, foxes and cats. Little or no feed is provided, as supplement. Consequently, productivity is low. The average laying capacity per year of the local hen, is only fifty eggs and chick survival rates are low. The main constraints facing poultry keepers include absence of improved breeds, high incidence of diseases such as Newcastle and coccidiossis and attack on chicks by hawks, foxes and cats.

3.4.2 Grazing land

Grazing in open fields and swampy areas is the main source of feed for livestock. In most areas communal grazing land is diminishing and as such not able to meet the feed requirements of livestock. This leads to overgrazing soil erosion and fertility problems. Natural herbage which is estimated to constitute more than 98 % of the daily feed for cattle is without doubt inadequate moreover, it has a marked seasonality (Fig. 3.4) and is often of low quality. Swampy lands are often breeding grounds for pathogens and ectoparasites. Foot and mouth diseases are common in areas where livestock are grazed in swampy lands.

Figure 3.4 Livestock feed calendar



3.4.3 Animal health

Diseases and pests attack are a major cause of death and reduction in numbers of livestock. They occur largely as a result of poor management practices. Most farmers are not able to tell the names of common diseases but are able to give graphic description of them that aid identification. Some of the parasites/diseases frequently mentioned by farmers are:

- *Liverflukes*. Infestation with liverflukes is a common problem. The farmers used swampy areas for grazing which favours the multiplication of host snails. Well-fed animals are more resistant to the effects of chronic infection and can tolerate a higher burden of liverflukes than those with a low plane of nutrition.
- *Blackleg*. This is an acute bacterial infection of cattle affecting the muscles mainly of the leg. Affected animals show a high temperature and are depressed and severely lame.
- *Anthrax*. This is a deadly, contagious bacterial disease, which affects cattle, sheep and goats. It causes sudden death shortly after infection.

- *Coccidiosis*. This is caused by a bacterium. It causes reduced food intake and diarrhoea followed by loss of weight. Mortality is often high. Infected chickens stand with hunched backs, closed eyes and dropping wing.

3.4.4 Summary

Main constraints and potential opportunities of the livestock sector are presented in table 3.7:

Table 3.7 Livestock sub-system: constraints and opportunities

Constraints	Opportunities
• Shortage of grazing land	• Availability of crop residues • Existence of peasant associations who are responsible for land use allocation
• Attack on livestock by hyenas	• Involvement of wildlife conservation authority
• Low genetic potential of local breeds and prevalence of diseases	• Existence of Holeta Agricultural Research Centre for animal improvement
• Inadequate extension support	• Existence of NGOs • Potential involvement of private sector in veterinary drugs supply • Existence of new extension methods through village animal health care workers

3.5 Apiary sub-system

3.5.1 Traditional bee keeping

Traditional bee keeping is as old as the people themselves are. It has been practised for thousands of years without much modification. Several bee colonies can be found in all towns and villages. It is an economically important activity, providing a substantial part of household incomes.

Farmers use age old, cylindrical hives made out of locally available non-processed materials such as cactus, *Croton macrostachy*, bamboo and other forest trees. In addition they use cheap local materials like straw, false banana leaves, bark of trees and animal dung. Almost all methods are based on the concept of minimal management. They fix up the beehives and hang them on identified trees. For harvesting, they have to climb up the trees to reach the baskets which were placed in the upper branches, then use a flaming torch to clear the bees and allow the honey to be collected.

During the harvesting, the colony is often destroyed because the honeycomb together with the brood is cut out with a knife. These hives are small and do not lend themselves to large-scale production. In most cases, two harvests per year are obtainable. The first is in October-November and the second, which is the main harvest in April-May. There are two types of honey, a pale, granular type derived mainly from *Schefflera abysinica*, called "geteme" (meaning white honey) and a reddish brown type. They are preferably used as table honey and in the preparation of a local beer (*tej*), respectively.

Yield of crude honey depends on the bee species, climate, vegetation and availability of water. However, average yield of crude honey from traditional beehives is four kilograms per beehive, as compared to thirty kilograms from modern frame hives. Apiary is predominant in the forest and transition zones, which are endowed with natural forests.

3.5.2 Improved bee keeping practices

Modern bee keeping is generally a recent phenomenon. In 1980, the Ministry of Agriculture introduced the frame beehives of the zender type through the farmers' service co-operative societies. The Ministry provided extension service, short-term training and marketing facilities for the table honey produced by the producer co-operatives. Following the collapse of many farmers' co-operatives, the use of modern methods of bee keeping slackened.

3.5.3 Economic and social importance

In areas where the forest cover is substantial, income from bee keeping is probably as significant as that from crops or livestock. Apart from honey, beeswax and honeybee are also sources of income. Many women are involved in processing and sale of honey beer. Honey plays a big role in the cultural and religious life of the people. No wedding or other social event can take place without, *tej,* which has long been the national beverage.

There is a close relationship between apiary and forest resources. As the forests dwindle, bee-keeping activities go down. The reverse is also true. This is because bees are associated with certain trees and shrubs (Table 3.8). The reduction in forest cover is due to population pressure, agricultural commercial investments and expansion of crop production. This situation has not only reduced the number of important honey tree and bushes but also the number of bee colonies.

Table 3.8 Important honey trees and bushes

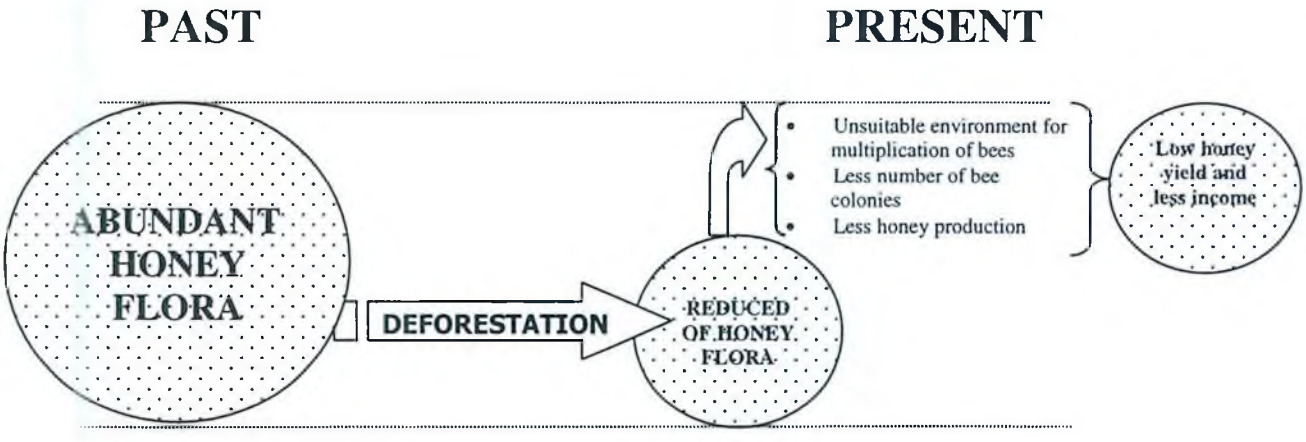
Tree type	
Local name	Scientific name
Kerero	*Aphania senegalensis*
Wanza	*Cordia africana*
Girar	*Acacia abyssinica*
Girawa	*Vernonia amygdalina*
Bessana	*Croton macrostachys*
Geteme	*Shefflera abyssinica*
Weyra	*Olea africana*
Zigba	*Podocurpus spp*
Bahirzaf	*Eucalyptus spp.*
Birbirra	*Milletia ferruginea*
Shola	*Ficus brachiopod*

3.5.4 Constraints

Income from bee keeping is declining due to the following problems:

- Ants attack on beehives.
- Attack on beehives by monkeys, baboons and the honey badgers. The honey badger is a serious threat to bee keeping.
- Farmers were worried about repaying credit on unoccupied hives. The cost of the frames was another concern.
- Reduced colony numbers and productivity due to deforestation (Figure 3.5)
- Absence of technical know-how amongst farmers on good harvesting techniques
- Inadequate market (demand) for honey. During the main harvesting season, prices plummet.

Figure 3.5 Effects of deforestation on production of honey bees



3.6 Marketing

Marketing and pricing of agricultural products is of central concern to policy makers through out the world (Hallet, 1981; Wodekin, 1982). In the past agricultural marketing system in Ethiopia was not conducive to the production of "marketable surplus" as low prices were paid to quota deliveries. After liberalisation, the prices of agricultural produce have gone up as indicated by the farmers. However many factors constrain the farmers in marketing of farm produce at remunerative prices. Improved marketing channels and market information system is necessary to assist the smooth flow of inputs and outputs. A market study to investigate these areas concentrated on two local markets, Bonga and Wushwush where farmers sell farm produce to traders and consumers directly. The farmers coming from different villages to these markets were interviewed.

A "market", as used here means a place to sell and buy farm produce and other commodities, is a very important place for rural inhabitants. Markets are visited for reasons ranging from economic to social. Farmers visit markets not only for economic reasons like, selling of farm produce or buying of household items, but also for meeting people as part of their social

obligation. Sometimes visits to market are combined with other activities so those trips are multi-purpose.

Although the nature of farming in Gimbo is subsistence farmers sell their small surplus produce to fulfil various obligations to the state, such as income tax and land rent, and family cash needs like, medicines, cloths, school fees and seeds. Both men and women visit markets to sell or buy. Generally men are responsible for selling the major farm produce like, maize, coffee, oxen, sheep and goats whereas women sell minor produce like, milk products, honey, *kocho* and eggs.

Markets are held in open, most vendors simply sit on the ground, women sometimes under umbrella. The markets are divided into sections according to goods and services. The markets visited do not have any facility such as drinking water, shelter against rain and sun, toilets and temporary storing place.

Marketing cost

The cost of marketing of farm produce was observed to be relatively high on account of the long distances to markets and levies on farm produce and livestock. Average marketing costs incurred on each trip to market is presented in Table 3.9.

Table 3.9 Marketing costs incurred on each trip

Markets	Total value of sale (birr)	Cost (birr)		
		Labour	Transport	Market levy
Bonga	168	9	2	7.2
Wushwush	72.4	7.7	-	4.0
Overall	120.5	8.4	1	5.6

Farmers spent on the average 8 hours away from their homes for marketing. They also have to pay for transport and market levy, which represents between 5 and 15 % of the value of produce marketed. All farmers (100%, n=20) find the levy charged high. Moreover, the levy is charged at multiple places. For instance, if a farmer is coming from another Woreda he or she has to first pay a levy in that woreda and again at the market before selling his or her farm produce or animal.

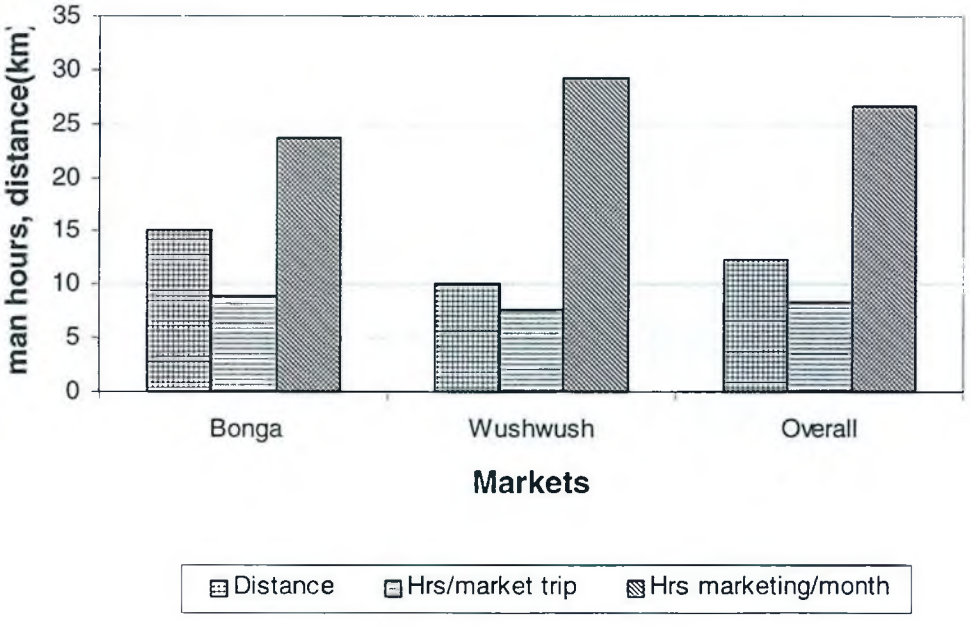
Accessibility and mode of transport

Eighty five per cent of the farmers interviewed (n=20) did not have access to lorries to transport their farm produce to market and have to travel on foot. About 30 % of these farmers use beast of burden like horses, mules and donkeys to transport their produce to the market. The rest, who do not have these animals or cannot afford to hire, head-load their produce. Pathways to some of the villages (such as from Sheika to Bonga) are so difficult because of the terrain that even horses and mules move with difficulty.

Households spend considerable time in marketing their produce and buying household needs. They travel long distances to reach markets and what they bring is sometimes of such small value that the trip seems hardly worth the effort.

On the average, farmers spent about 27 man-hours per month (Fig.3.6) for marketing activity. The reasons for spending more time in marketing are the long distance to the markets from the villages (12 km on the average), travelling on foot which takes more time and the frequent visits to the markets.

Figure 3.6 Distance to market and time spent on marketing



Price fluctuation

Market forces determine the prices of agricultural produce. Government does not provide minimum support price for any farm commodity. The bulk of farm produce is sold at harvest, as farmers do not have storage facilities. As interregional movement for most farm produce is limited, supply is more than demand during the harvesting season resulting in low prices. The farm commodities for which the prices fluctuate most are wheat, teff, maize and coffee, and sheep and goats.

Farmers' perceptions of marketing conditions

Farmers described the changes that have taken place in the marketing scene, and their future expectations (Table 3.10). They expect improvements in marketing conditions and remunerative prices for their produce.

Table 3.11 Farmers' perceptions of market conditions

Past	Present		Future
	Distant markets	Near markets	
• Few and distant markets • Poor roads and difficult pathways • Few commodities sold for cash, low prices • Poor transport facilities, low prices	• Poor roads and pathways • Increased levy on farm produce and animals • Over-supply of farm produce at harvesting time • High transport cost and price fluctuation	• Better prices • Many buyers of produce • Better roads, lorries available	• Better roads and pathways • Remunerative prices • More markets, better transport facilities • Improved transport facilities, market information flows and reduced market levies

All farm produce except honey is sold without any processing. Mostly women use honey for making the local beverage, tej. An attempt was made to organise honey marketing by the Yebito co-operative society. But the farmers could not benefit from this as the local traders reduced the price paid to them. The co-operative society is not well equipped to access other markets.

Constraints

The major constraints facing farmers in marketing their farm produce are presented in order of importance:

- Long distance to market
- High market levies
- Low prices of farm produce and their fluctuation
- Inadequate and high cost of transport
- Poor roads and pathways
- Poor market information flows

3.7 Interactions between sub-systems

Farming systems are dynamic, and this is reflected in the complex interactions that take place between the component sub-systems and units being biophysical (for example, climate and soils) or socio-economic (for example, policies, and land tenure). To generate higher income and increase farm-level productivity, it is necessary to study these interactions so that modifications on sustainable basis could be made.

The study of the interactions in the farming systems of Gimbo Woreda focussed on the interdependence of the various components and how they interact with the biophysical and socio-economic factors that are not under the household's control. Changes in any of these components influences and induces changes in the whole farming system.

3.7.1 Crop-livestock interactions

The interactions between crop and livestock are in the form of animal traction, soil fertility management and livestock feeding on crop residues.

Animal traction

The most important interaction found between the crops and livestock sub-systems was in the use of animals for traction. The terrain in Gimbo Woreda is characterised by steep slopes, which may be largely responsible for the absence of tractors for land preparation. Oxen are used for land preparation for all crops, and for weeding and thinning in maize fields.

Soil fertility management

Farmers have traditionally been using farmyard manure (cow dung and household waste) on the plots around the homestead. This land is planted with enset, coffee, vegetables, fruits like banana, papaya, etc. The soils in Gimbo Woreda appear to be inherently fertile. But farmers in cereal based farming system mentioned that the soil fertility is declining as a result of continuous cropping. As farmers can not expand their land on the more fertile forest soils, they want to use farmyard manure to maintain the soil fertility. Fertiliser use is low because of its high cost. Farmers who desire to use more farmyard manure on their fields away from the homestead plots are handicapped by inadequate labour to carry the manure. With the increased awareness on the importance of manure application, farmers might use animals like donkey and mule to carry manure to the fields on slopes. Farmers are prepared to raise more livestock to ensure more manure for crops. The question of how the livestock would be fed however remains unanswered.

Farmers, especially in the transition and deforested zones use crop residues to increase the fertility of their soil. Crop residues are left in the field after harvesting and ploughed in during the next ploughing season.

Crop residues

Farmers in Gimbo Woreda generally do not collect crop residues to feed their animals. However the crop residues from teff, beans, maize, etc. are left in the field to be grazed on by livestock. Moreover, chicken are usually free ranging, scavenging for food around homestead and gardens. Scarcity of feed resources because of shrinking grazing lands may encourage farmers to use crop residues more efficiently as animal feed.

3.7.2 Forest and its uses

The forest is an important component of the farming systems of the forest and transition zones. Many farmers have part of the forest where they collect wild coffee and spices. Farmers have access to the forest for firewood, timber for house construction and agricultural implements like plough and hoes. Moreover, the forest provides an opportunity for the farmers to be engaged in bee keeping one of the main cash earning activities in the aforementioned zones.

Though the forest plays an important role in the economy of farmers in Gimbo woreda, it also has its adverse affects on farming. It provides a conducive habitat for wild animals like baboons, monkeys and warthogs, which have become a major problem of farmers especially in the forest and transition zones. These animals cause considerable damage to crops and livestock. Since wild animals are protected under the law, farmers feel helpless to deal with the situation.

3.7.3 Common grazing lands

Common grazing lands provide the bulk of the feed for livestock. As a result of increasing population, restrictions on entry into the forests, and the expansion of crop cultivation, many communities do not have land reserved for livestock grazing anymore. Where the community have common grazing land, it is usually small for the numbers of livestock. Consequently, the use of swamps in valleys, wherein growth of grass and vegetation is high as grazing areas is common in all the zones.

3.7.4 Socio-economic interactions

The primary objective of farmers is to ensure food security for the family. Households' cash needs are met by selling wild coffee, honey, sheep, goat, chickens, eggs and milk products. Seed is the main input, which is either produced by the household itself or bought from either market or other farmers. Many farmers do not use chemical fertilisers, as it is expensive. Communal sharing of oxen and human labour is common. Availability of credit is inadequate, however the co-operative society provides loans for buying oxen to a limited number of farmers. Some farmers also get seeds and fertilisers on credit from the department of agriculture.

These interactions are presented diagrammatically in the form of bio-resource flows (Fig. 3.7 and Fig 3.8) and economic flows (Fig.3.9).

Figure.3.7 Bio-Resource flows: Forest & Transition Zones

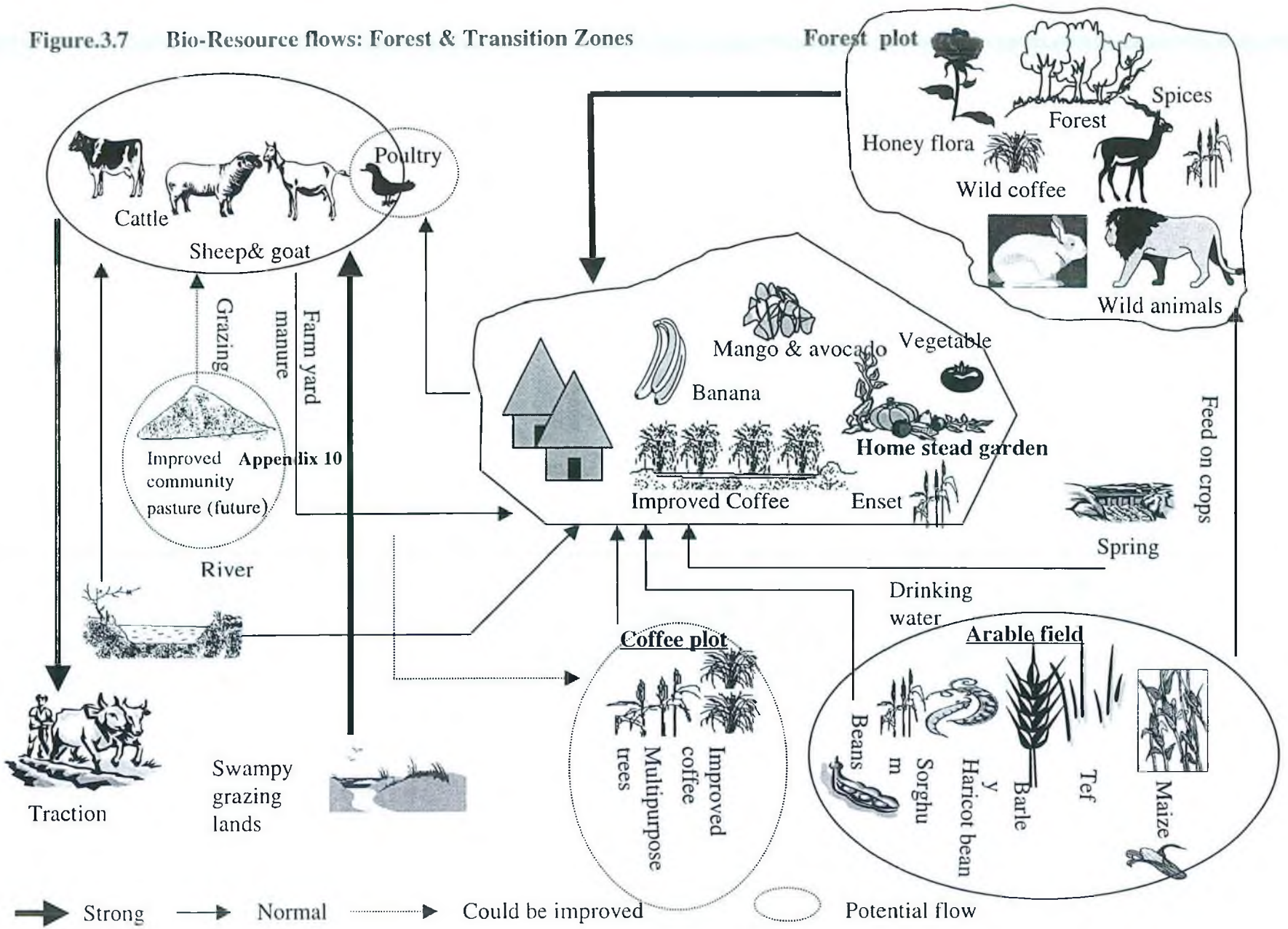


Figure 3.8 Bio-Resource flows: Deforested Zone

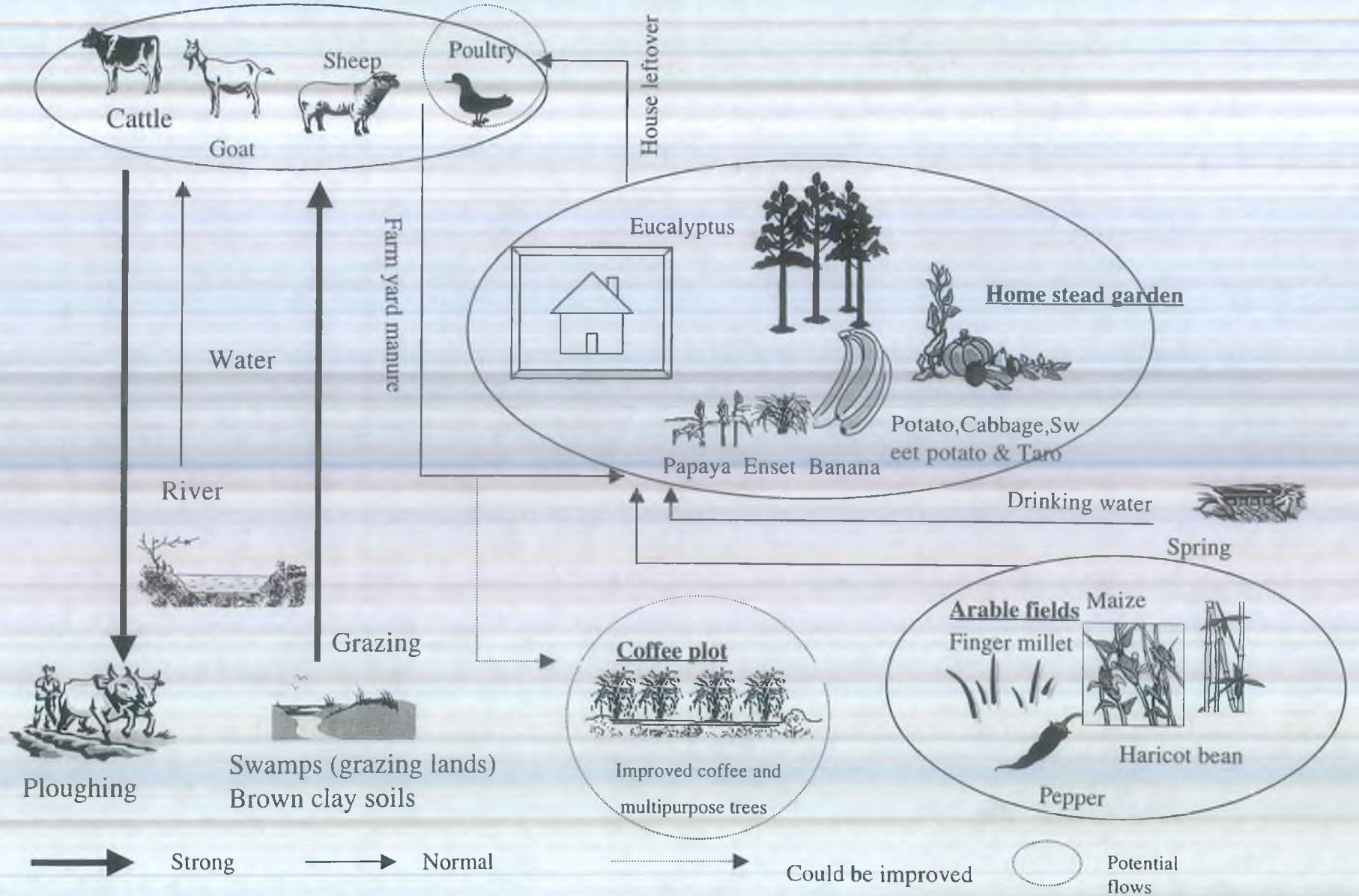
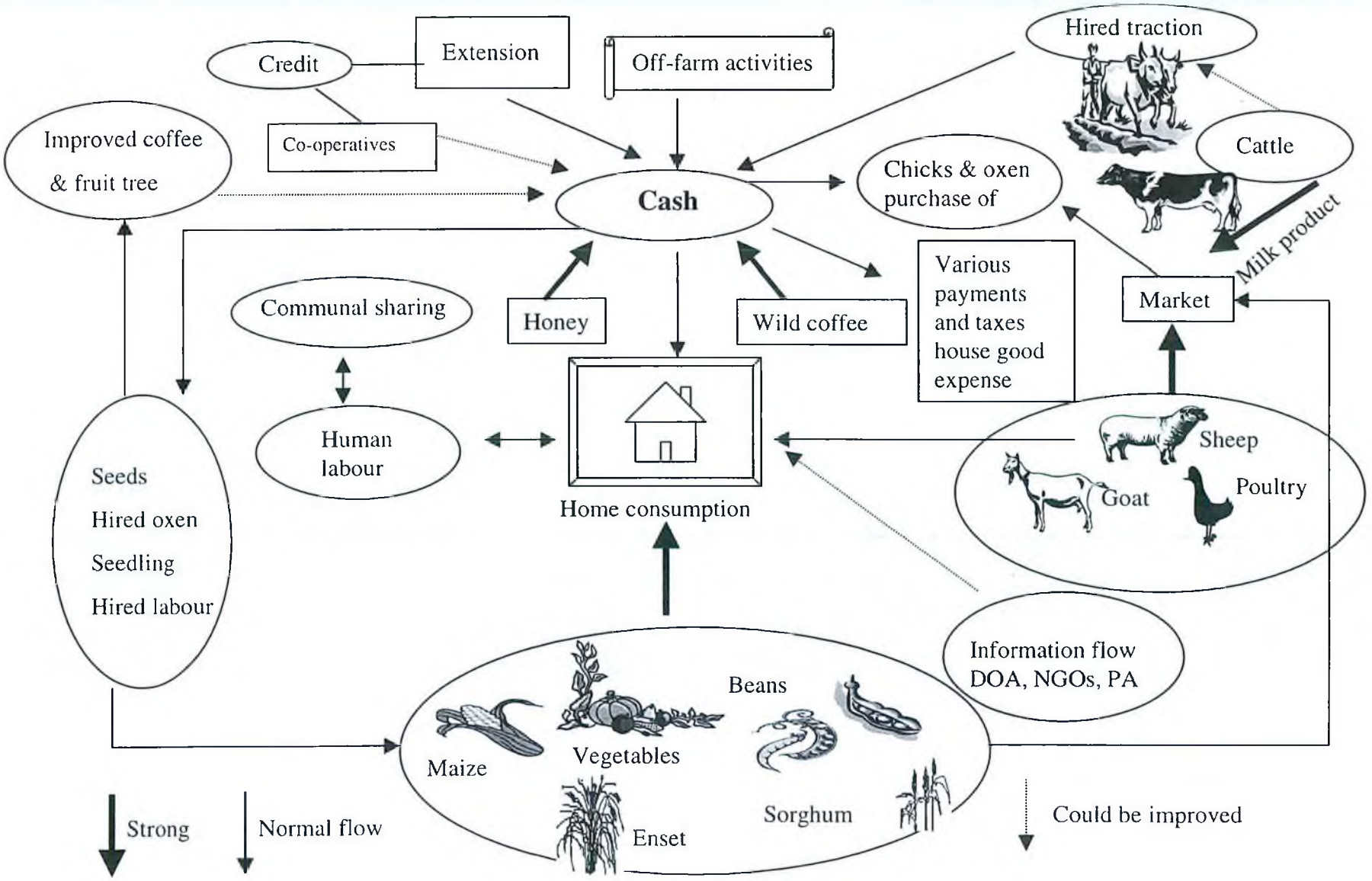


Figure 3.9 Economic flows



3.8 Changes in the farming systems

The farming systems have undergone considerable changes in the last three decades. These changes are the result of changes in the biophysical, socio-economic and political environments of the zone. In the past, the whole zone was covered with dense forest and forest gathering of coffee, spices and honey was the major activity in the rural areas. The major staple food was 'kocho' prepared from enset. Though, the rural economy is still on a subsistence level, the area under cereals, legumes, and coffee has increased considerably at the cost of the forest.

New varieties of crops (not necessarily improved varieties) especially, sorghum, maize, finger millet and pepper have been introduced. Settler farmers brought in many of these varieties from the north of the country. Awareness on the relevance of chemical fertilisers and herbicides has increased. Some of these changes have been aided by certain events. The events that have influenced changes in the forest and transition zones are presented in Table 3.11.

Table 3.11 Timeline of events influencing changes in the forest and transition zones

Year	Events	Policy influences
1975	• Arrival of new settlers began • Rapid destruction of forest began • Major fires in the forest • Attack on people and livestock by wild animals •	Resettlement programme
1982	• Cultivation of improved coffee started with seedlings from DOA •	
1985	• Villagisation commences • Massive destruction of crops and livestock by wild animals	
1991	• New varieties of teff and wheat from DOA • Improved maize varieties • Introduction of chemical fertilisers and herbicides	
1993	• Haricot bean and finger millet introduced	• Technology transfer Package
1997-98	• Planting of improved coffee materials on a wider scale	• Promotion of coffee Plantings by DOA, SUPAK-S and FARM Africa

Changes in the farming systems of the deforested zone are more prominent because of the rapid destruction of the forests and the expansion of land areas under cereals. Settler farmers brought with them many varieties of millet and sorghum and these have been incorporated (Table 3.12). The demand for improved maize varieties and herbicides is growing in the zone.

Table 3.12 Timeline of events influencing changes in the deforested zone

Year	Events	Policy influences
1975	• Arrival of new settlers began • Rapid destruction of forest began • Attack on people and livestock by wild animals	Resettlement programme Establishment of Gojeb state farms
1980	• Major fires in the forest • Introduction of peppers	
1984	• Introduction of new sorghum variety • Introduction of white finger millet • Introduction of improved maize varieties	Technology transfer Package
1991	• Severe drought	
1994	• Use of herbicides on millet • Reduced colonies of bees due to herbicides application	
1996	• Chemical fertilisers use began	Technology transfer Package
1997	• Wide acceptance of improved coffee for planting	Promotion of coffee by DOA, SUPAK-S and FARM Africa
1998	• Severe drought • Outbreak of liver fluke disease	

The changes in the farming systems are analysed below along with the factors influencing them.

3.8.1 Resettlement programme

As a policy of the government immigrants from other parts of the country were allowed to settle in the zone in the seventies and eighties. For instance, 95% of the farmers in Shombakecheb PA are new settlers from the northern parts of the country. These new settlers introduced some new varieties of sorghum and millet in the existing farming systems. Since these farmers have been involved in cereals farming in the north and were not used to forest product collection, they simply expanded the land for cereal farming at the cost of the forest.

3.8.2 Population growth

Farmers have lived in harmony with the forest for years, depending on it for food and cash income. Increasing population and resettlement of people from other parts of the country increased the demand for food and cash, and the pressure on the forest grew. This led to clearing of the forest for the cultivation of food crops especially cereals and legumes.

During this period even land on steep slopes were cultivated exposing them to water erosion. The government has banned further encroachment into the forests. Continuous cropping without the use of manure and fertilisers could pose a serious threat to soil fertility maintenance and productivity.

3.8.3 Investment activities

In recent times, the government has promoted large investments in coffee and tea plantations. Investors are permitted to clear up large areas of the forest for coffee or tea production. These activities may have negative effects on the livelihood of farmers who depend on the forest for semi-cultivated coffee, spices and beekeeping.

3.8.4 Villagisation

The grouping of the population in designated villages became national policy in 1985. The major objective of this policy was to provide basic facilities to all villagers at one central place but people were perhaps not comfortable with this change because it did not suit their farming activities. After this policy was abandoned in 1993, most farmers returned to their original farms. A farmer from Betasalem village had this to say on the villagisation policy:

> *"In the settlement areas, space around the homesteads was not sufficient to keep animals and to live. Since it was far from the fields, it was difficult to protect crops from wild animals. After returning from the settlement areas we have started keeping more animals."*

3.8.5 Cropping practices and land use

In the past most farmers were dependent on enset for food and on coffee, spices and honey from the forest for their cash needs. In the last three decades, there has been expansion in the area under cereals and pulses at the cost of the forest. Farming however, remains a low input-low output production system. Farm sizes have declined as a result of land fragmentation. Enset, maize, sorghum, faba bean and vegetables remain the major food crops with recently introduced crops such as haricot bean, finger millet and wheat becoming increasingly important. Improved varieties of maize and chemical fertilisers were introduced in the nineties, but most farmers do not use them because of their high cost. In the past, forest wild coffee received little maintenance but farmers are now investing more labour perhaps because of its favourable price in the last 5 years. Recently farmers have also started planting improved coffee seedlings and fruit trees on their fields or allotted specific plots to coffee.

3.8.6 Livestock

Much of the common grazing lands on gentle slopes have been distributed for farming leaving the swamps as the main source of grazing for the animals. Grazing in swamps, which harbour many parasites like liver fluke, exposes animals to diseases and parasites. The numbers of livestock especially sheep and goats have declined largely as a consequence inadequate feed and increased disease incidence. Vaccination of livestock against diseases such as rinderpest is said to take place regularly but many farmers called for improvements in veterinary service provision.

3.8.7 Farmers' perceptions of likely changes in future

The recent emphasis on client-oriented research by EARO, the proximity of many research institutes, and the presence of NGOs and foreign-funded development projects is expected to have a positive effect on agricultural development in the zone. The Government's agricultural-led development policies with its emphasis on commercialisation of agriculture, increased transfer of much-needed agricultural technologies to farmers, and improvement of rural infrastructure is expected to have similar effects and induce the following changes in the farming systems:

- Increased integration of improved coffee, fruits and leguminous trees
- Increased use of improved varieties and fertilisers.
- Row planting of crops such as maize and legumes
- Development of more appropriate crop rotations
- Integration of soil protecting practices like tree planting, drainage, bunding
- Increased number of oxen per household
- Increased numbers of poultry
- Better marketing opportunities

CHAPTER 4 NATURAL RESOURCES MANAGEMENT

4.1 Introduction

The main natural resources in Kafa-Sheka Zone (KSZ) are the forests, swamps, land and soils, springs, rivers and lakes. The discussion here will focus on the sustainable use of these resources and how farmer practices enhance or are detrimental to the effort to attain sustainable natural resource management.

Sustainability is considered a development perspective that combines several objectives (Fernandes, 1999):

- Increase in overall food production and in farmers' income
- Equitable distribution of the resulting benefits, with an associated reduction in poverty
- Minimal degradation of existing farm land; and
- Minimal expansion of agricultural land

The attainment of all or some of these objectives does not entirely depend on what farmers do or do not do, but also on the perceptions and roles of other stakeholders and the influences of the socio-cultural environment.

4.2 Soils and soil fertility management

4.2.1 Soil types

Soil is perhaps the most important natural resource in respect to agricultural production. Colour and texture usually distinguish soil types. Farmers base their ability to identify soils on their knowledge and experience. When soil characteristics vary considerably, farmers can describe them taking into account the colour of the top layer, texture, consistency and organic matter content (Scoones and Thomson, 1994). However, in Gimbo Woreda, soil variability seems to be less and therefore farmers just classify them into two types: black and organic soils in the cropped fields and grey and clayey soils in or near grassy-swampy areas.

Soils in Gimbo appear to be relatively fertile; rich in organic matter and many farmers do not regard declining fertility as a limiting factor. However, the perceived fertile nature of the soils may not be the case in the cereal-based farming systems where continuous cropping has resulted in progressively reduced crop yields and fertiliser use or the need for it is on the increase.

4.2.2 Soil management

Soil management by farmers is limited to few strategies aimed at maintaining soil fertility. Most farmers (97 %) use farmyard manure (FYM) and household wastes on gardens around their homesteads largely on enset, vegetables and coffee seedlings. This is because it is difficult to transport FYM to the fields further away from the homesteads. The terrain of the land also makes difficult to transport such bulky materials. In addition, it requires high labour to apply FYM on larger fields. Moreover, due to the small numbers of livestock per

household, the amount of manure is not enough. In PAs where land is relatively abundant, farmers practice either fallowing for one year or shifting-cultivation. Few farmers use crop rotation and crop residue incorporation into the soil as strategies to maintain soil fertility.

Whenever yields decline, they rotate crops with different nutrient requirements, mainly cereals and legumes. This is particularly the case in Baha PA where the inherent soil fertility is poor. Very few farmers use chemical fertilisers because of its high cost. Even where farmers are prepared to buy, its supply by the DOA is inadequate and erratic.

4.2.3 Soil erosion

Due to the porous nature of the soils, soil erosion appears not to be a major problem yet. The black organic soils have high capacity for water retention and therefore, despite the steep slopes in the cropping fields, soil erosion is still minimal. The rapid vegetative growth of weeds and other plants also helps to protect the soil from erosion. Nevertheless, erosion may become a problem in future, especially in the deforested areas where most of the trees have been cleared, if farmers do not adopt soil management practices. For instance, soils under maize are particularly vulnerable to erosion because the soil remains unprotected for up to 4 months unless there is a succeeding sorghum or barley crop. Declining soil organic matter content will make the soil less porous and more susceptible to soil erosion.

On steep slopes where there is no vegetation, farmers apply traditional ox ploughed drainage furrows along the slope with a view to reduce run-off. There is no terracing and other biological soil conservation practices. Few farmers plant some perennial trees and crops to control soil erosion, notably eucalyptus trees and *Erythrenia* spp on the slopes and enset and bananas on the bottom of the fields.

4.3 Description and analysis of current NRM practices

Farming activities have considerable influence on the management of natural resources. This is the case in Gimbo woreda where farming is the principal activity of the people and concerns about farmer practices that may have negative influences on the natural resources have been raised in recent times. An examination of farmers' farming practices and how it affects efforts to attain sustainable NRM is discussed below.

4.3.1 Farmer practices

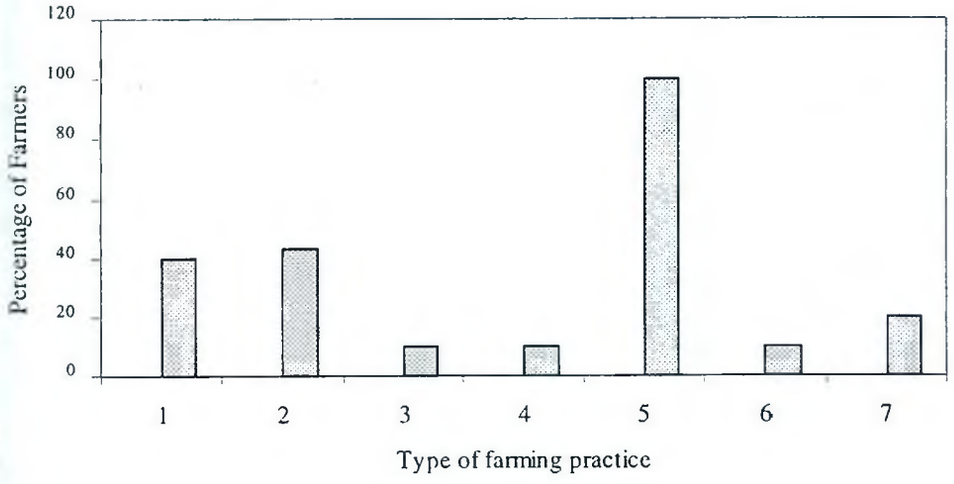
Farming practices observed amongst farming communities are usually the product of indigenous knowledge and practices, and survival strategies. Farmers try to optimise the use of the available resources, and in doing so they often unconsciously cause damage to the resource base. This does not in any way suggest irrationality on their part. Farmers are as concerned as everyone on the need to maintain the productive resource base.

Favourable practices

Efforts were made to ascertain farmer practices that enhance the efforts to promote sustainable management of natural resources. The most common practices encountered are:

1. Application of farm yard manure on crops
2. Crop rotations
3. Intercropping
4. Incorporation of crop residues on ploughed fields
5. Ploughing along the contours
6. Land fallowing
7. Planting of trees and enset along slopes

Figure 4.1 Farmer practices that enhance sustainable use of natural resources



All farmers plough their fields across the slopes, and some of them (about 40%) construct a furrow along the slope to facilitate water drainage. The use of cattle dung on crops limited to enset or vegetables in the homestead gardens. The amount of manure used varies significantly from farm to farm, depending on the number of livestock and ploughed or sown fields. Cow dung is also used for house construction, which may explain its limited use on crops.

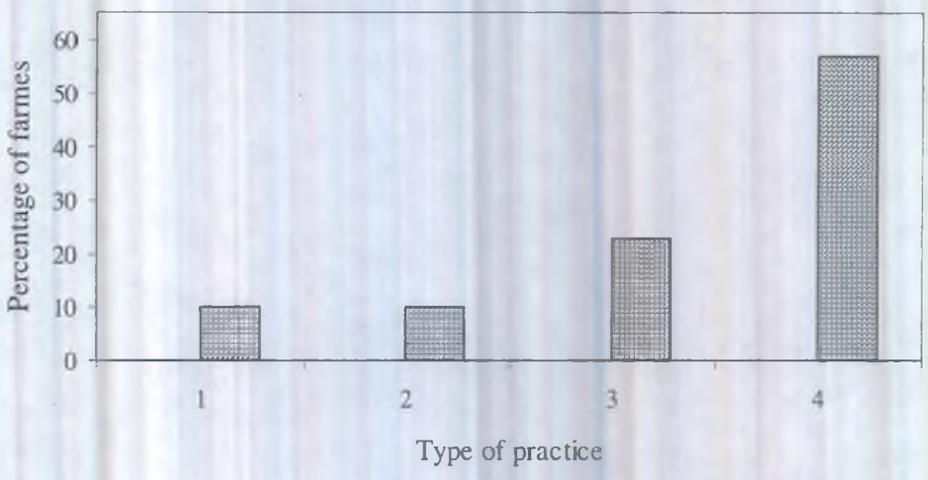
Crop rotation is another common practice but because of the predominance of monocropping (of maize), especially in the cereals based farming systems, only 43% of farmers rotate cereals and legumes. Intercropping is valuable as it improves soil stability because of the diverse rooting systems. The long period of leaf cover protects the soil from direct rainfall, reducing the risk of erosion. Land fallowing is only practised by farmers who have larger portions of land or whose crop fields are affected significantly by wild animals and therefore do not crop them every year. A smaller proportion of farmers is carrying out other practices (Figure 4.1). This however, does not reduce their relevance in the efforts to manage the natural resources in a sustainable manner.

Detrimental practices

On the other hand, there are farmer practices (Figure 4.2) that are at variance with the efforts to attain sustainable natural resources management. These include:

1. Shifting cultivation (under increasing population pressure)
2. Monocropping
3. Indiscriminate felling of trees
4. Continuous cropping

Figure 4.2 Farmer practices that are detrimental to sustainable use of natural resources



Continuous cropping is common because many farmers at present can not expand their land or acquire new land. It is a practice that is most likely to remain a key feature of the cropping system. Shifting cultivation appears to be fading away in light of population pressure and the resultant land shortage. Indiscriminate tree felling seems to be on the decline as a result of restrictive regulations. Suffice it to note that these practices are not mutually exclusive.

4.3.2 Deforestation: causes and solutions

The major causes of deforestation are:

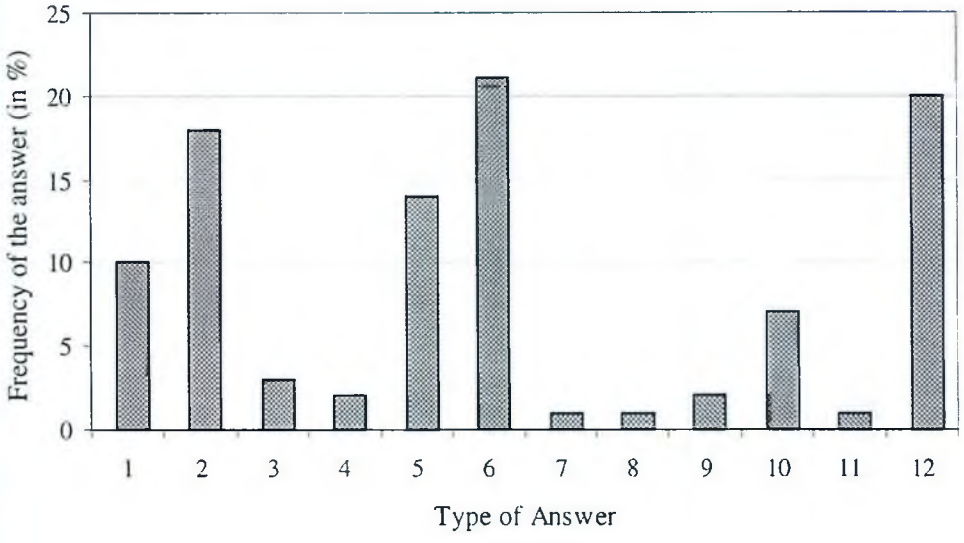
1. Population increase, which has resulted into a corresponding expansion in the area under crops
2. As a consequence of the above, there is also an increase in demand for firewood, which is the main source of fuel for domestic cooking and lighting
3. Increase in demand for timber for construction purposes
4. Occasional outbreak of wild bush fire especially during the dry season
5. Unchecked activities of some investors, who clear large tracts of forest in order to establish their plantations.

Farmers are of the opinion that deforestation could be stopped or minimised if the following measures are put in place:

1. Education of farmers on the need to preserve the forest (communal forestry programmes)
2. Encouragement of tree planting (such as eucalyptus, pines, cordia and grevillia) by all farmers to replace cut ones
3. Protection of existing forest by strict application of laws
4. Control of firewood collection from forest
5. Control of the activities of new investors
6. Encouragement of coffee planting
7. Encouragement of fruit trees planting
8. Promotion of off-farm activities to reduce dependence on the forests
9. Clear forest policies
10. More efficient protection of the forest
11. Resettlement schemes should not take place in the forest areas
12. Better use of cropping lands (so that fertility is kept) to avoid farmers moving into the forest in search of new fertile land

The frequency of these answers as given by farmers (n=76), reflecting the relative importance of these measures from farmers' perspectives is shown in figure 4.3.

Figure 4.3 Controlling deforestation: farmers' perspectives



As figure 4.3 indicates, farmers are of the opinion that encouragement of coffee and other trees plantings, increasing productivity per unit area of land and general education of all on the need to keep the forest for the present and future generations would stem the tide of deforestation. The activities of investors should be closely monitored.

And what role will farmers play in the effort to control deforestation? Many farmers are already planting trees such as eucalyptus around their homesteads and in their fields to provide their fuel wood needs. Coffee and fruit trees planting are gaining momentum amongst farmers. FARM Africa and SUPAK-S are providing seedlings to farmers.

Wildlife attack on livestock and damage to crops is of serious concern to farmers. The forests harbour these animals, and whilst farmers are keen to leave the forests intact, they want to be given permission to kill these animals which are causing wanton destruction to crops and livestock.

4.4 Socio-cultural dimensions

4.4.1 Gender roles and decision making

Gender analysis was undertaken to enable the team to understand the different roles that men and women play in decision making, and how these influence their access to and control over the various productive resources.

Besides their customary reproductive roles, women are also involved in weeding, harvesting, threshing and milling of grains, marketing of crop and livestock products. Men are engaged principally in land preparation, planting, weeding, and herding of livestock. (Table 4.1)

Table 4.1 Gender division of labour

ACTIVITIES	Division of labour			Who makes the decision	
	Adult male	Adult female	Children	Male	Female
Tilling the land	***	---	**	X	
Sowing	***	---	**	X	
Weeding	***	**	**	X	
Manure application	***	---	**	X	
Harvesting	***	**	*	X	
Threshing	---	***	**		X
Marketing of crop produce	***	**	*	X	
Herding of livestock	**	*	***	X	
Milking	---	***	*		X
Marketing of livestock & its products	***	***	*	X	X
Poultry production & marketing	---	***	*		X
Bee-keeping activities	***	---	*	X	
Collection of firewood & water	---	***	**		X
Household maintenance	---	***	*		X
Off-farm activities	***	---	---	X	
Guarding of crops against monkeys and baboons	**	---	***	X	

*** = very high involvement; **= high involvement; * = low involvement; --- = no involvement

Bee keeping is an important income generating activity in which many men are engaged. Women tend to concentrate on the marketing of honey and its by-products (wax, *tej*) as they are culturally forbidden from engaging in bee keeping activities. Beekeepers climb up trees during the night to examine the weight of the beehives. This explains why it is considered socially unacceptable for women to engage in bee-keeping activities. Children play vital roles in most of these activities but are particularly active in scaring away vermin from crops during the day and in collecting firewood.

Coffee, cereals and legumes (maize, teff, sorghum, barley, wheat, faba beans, haricot beans, and peas) are seen as men's crops. On the other hand, enset, cocoyam and the vegetables (pepper, onion, cabbage, lettuce, and tomatoes) are regarded as women's crops. This assertion is not always the case. For instance, in Shombakecheb PA, pepper is an important cash crop and men dominate its cultivation. In Baha PA, enset is the dominant cash crop and is firmly in men's hands. It is apparent that men tend to engage in the main cash crops and leave the minor (low income generating) crops to women.

Men and women are both engage in marketing activities. Men tend to market bulky materials that are carried by horses, mules or donkeys. Men also generally do marketing of livestock such as cows, oxen, sheep and goats. Women market vegetables, processed enset, and livestock products such as milk, cheese and butter. Women on their backs may also bring send smaller grain harvests to the market.

4.4.2 Access to and control over resources and decision making

Men have the most secure rights and access to productive resources such as land, labour and capital (Table 4.2). Women do not own land (Pas do not allocate land to women) excepts if they inherit land from their family or are widowed or registered as independent heads of household within a peasant association. Although households appear to be very cohesive with the overall objective of sustenance, some women resent their inability to own land and control their productive activities.

Table 4.2 Access and control profile

Main resources	Access	Control
Land		
Field plots	Men	Men
Homestead gardens	Women	Women
Livestock		
Cattle	Men & women	Men
Shoats	Men & women	Men
Equine	Men & women	Men
Poultry	Women	Women
Labour		
Family	Men & women	Men
Hired	Men	Men
Sharecropping	Men	Men
Food	Men & women	Women

Men have access to additional labour when needed especially during land preparation. They use newly arrived settlers as farm labourers or use their kinship ties to secure additional labour. Women are disadvantaged in this regard because kinship ties are traced through the men's lineage line. This access to additional labour is generally unavailable to women. This may explain why women tend to have smaller farms even if they have access to a larger piece of land. They have to divide their time between reproductive activities and farm work.

Women have limited access to credit or input capital compared to men largely because their productive activities are regarded as an integral part of the household's activities, for which the man is the head. It may therefore not be surprising that it is mostly men who have benefited from DOA's credit package of improved seeds and fertilisers, since only men are registered farmers. However, FARM Africa and SUPAK-S, are targeting women for assistance. Women are being supported to start vegetable production or other farms, or start some off-farm income generating activities. About 20% of the men interviewed had received credit from the co-operative society to purchase oxen.

It emerged from the interviews in the villages that whilst men borrow freely from neighbours, friends and relatives, and have unrestricted access to the household savings, women may not have access to saved money and they cannot borrow from outside the household without the husband's approval (Table 4.3).

Table 4.3 Sources of immediate cash when in need

MEN	WOMEN
▪ Sell stored grains	▪ Sell butter or cheese
▪ Sell goat, sheep, or cow	▪ Sell vegetables
▪ Borrow from relatives	▪ Sell honey or honey beer
▪ Borrow from friends or neighbours	▪ Sell chicken or eggs
▪ In last resort, sell ox	▪ In last resort, borrow from husband

Informed decision making is vital for the survival of all households. Though men and women work for the overall benefit of the household, decision making remains nearly the exclusive domain of men. Women do not participate in making important decisions like what to produce, how much to produce and when to produce (Table 4.4).

Table 4.4 Decision making in the household by gender

KEY DECISIONS	MEN	WOMEN	JOINT
▪ Coffee production & sale	+		
▪ Cereals production & sale	+		
▪ Honey collection	+		
▪ Sale of honey, beeswax & honey beer		+	
▪ Rearing and sale of livestock			+
▪ Sale of milk by-products		+	
▪ Sale of chicken and eggs		+	
▪ Credit acquisition & use	+		
▪ Short & long-term credit	+		
▪ Adoption of extension package	+		
▪ Household maintenance			+

+ = Involve in decision making

4.5 Stakeholders perceptions

4.5.1 Key stakeholders

The key stakeholders in Gimbo Woreda with respect to the problematique are:

- Farmers, indigenous and settlers
- Zonal Council
- Department of Agriculture (DOA)
- Peasant Association (PA)
- Zonal Planning and Economic Department (ZOPED)
- Farm Africa, A British Non-Governmental Organisation (NGO)
- Co-operative society
- Sustainable Poverty Alleviation in Kafa-Sheka Zone (SUPAK-S)
- Jimma Agricultural Research Centre (JARC)
- Ethiopian Agricultural Research Organisation (EARO)

Peasant farmers mainly inhabit Gimbo. Many are indigenous to the area. There are also new settlers farmers who migrated from other parts of the country. In 1999, it had a total population of 26,121, of which 77% were living in the rural areas. Farmers are faced with a two fold dilemma: they gather coffee, spices, honey, and firewood from the natural forests, a practise that dictates that forests should be conserved as much as possible. However, in the light of the ever-growing population, they need more land to farm, the source of which is more often the forest. . It is in the interest of the inhabitants that the forest resources are managed in a sustainable manner.

DOA is the government department responsible for planning, co-ordinating and implementing activities that are geared towards the development of the agricultural sector. It has the responsibility of extending improved technologies to farmers and ensuring improvement in agricultural production while conserving the natural resource base. DOA is thus concerned about the activities, which are detrimental to the environment. It has soil and water conservation projects aimed at protecting and conserving the soil. At the PA, village and farm levels, DAs are responsible for implementing DOA's policies.

ZOPEDD is a department of the Planning and Economic Development Authority (PEDA). It is responsible for promoting the economic well being of the people. It is for instance, the main implementing agency of the SUPAK-S project. Attainment of sustainable natural resources management in the Woreda is one of its priorities.

FARM Africa, has been in Ethiopia for the last 15 years. It started its operation in the wereda in 1996 at the request of the Regional and Zonal administrations judging from its track records in Natural Resources Management projects. It has started a participatory community forest resources management project, which aims at educating farmers to live in harmony with the forest. Free seedlings of fast growing economic trees are supplied to farmers. The aim is that farmers will earn money from their own wood lots and become less dependent on the natural forest and its resources. It also has a welfare programme in which male farmers are given soft loans to purchase oxen. Female farmers get credit to start vegetable production.

PAs are village level associations of farmers. They are usually points of entry into the farming communities and wield considerable influence. They are supposed to protect farmers' interests. They are useful in any efforts to influence farmers and especially in the issue of sustainable natural resource management, they are perhaps even more important.

The co-operative society, though established by the government, is a collective society owned and operated by its members. It primarily seeks to maximise the welfare of its members. They provide training, technical support including provision of agricultural implements to its members. They also provide loans to members to purchase oxen. Women receive credit to engage in income generating activities.

There were about 104 co-operative societies in the zone, which were working under the Ministry of Agriculture until 1998. Following the government's restructuring programme, 68 of became autonomous. They receive funds from the International Fund for Agricultural Development (IFAD). The co-operative societies are willing to assist members to secure loans from the banks to go into coffee plantation development or for land improvement.

SUPAK-S is a joint initiative by the Ethiopian and Dutch governments to address poverty issues in Kafa-Sheka zone through the various departments. The project is being implemented by ZOPEDD. It has four major programmes:

- Planning for development
- Health, including provision of water supply, training and infrastructure creation
- Agriculture and rural development
- Women and development

Under each of these programmes, the emphasis is to strengthen the responsible line departments through provision of technical assistance, human resources development, provision of physical infrastructure and extension support. The table below summarises the above mentioned stakeholders and why they are key stakeholders in the issue of sustainable natural resources management attainment in Gimbo wereda.

EARO is the umbrella organisation of all national agricultural research institutes and centres in the country. It is mainly concerned with the development of research policies, strategies and technologies that address numerous problems of farmers and the environment. In Gimbo wereda, EARO is represented by JARC, which is responsible for the national co-ordination of coffee and spices research programmes. The rapid destruction of the forests is of concern to JARC because of the resultant degradation of natural resources including genetic erosion.

Table 4.5 Stakeholder identification table

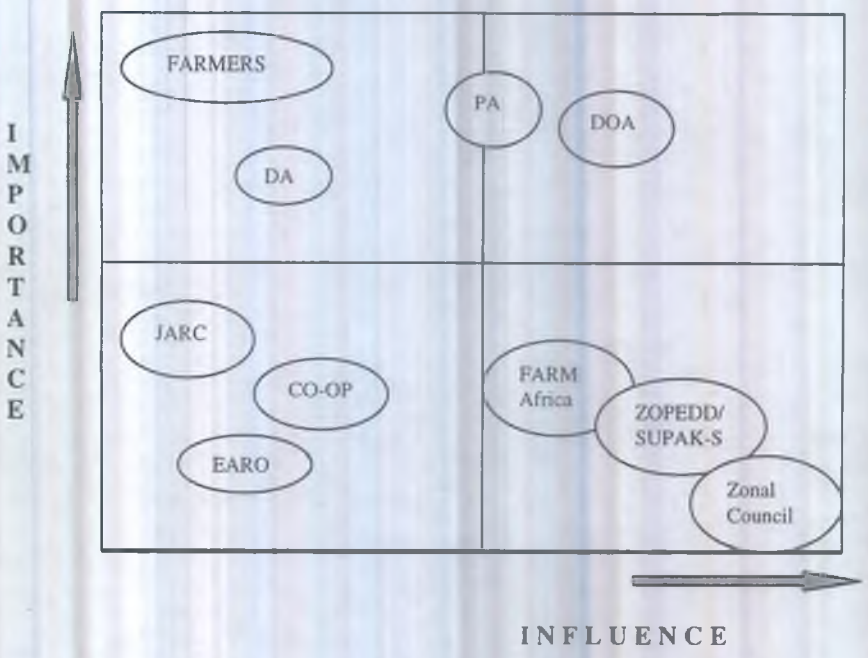
STAKEHOLDER	REASON(S) AND KEY INTERVENTIONS
Farmers	• Main users of the forests and its resources
Co-operative society	• Facilitate generation of alternative income sources. Provide farmers credit to purchase oxen and other inputs
ZOPEDD/SUPAK-S	• Promotes sustainable forest management. Provides infrastructure such as roads, portable water
JARC	• Develop relevant technologies for improved coffee, spices and other crops production
DOA	• Provide technical support to farmers. Involve in soil and water management
EARO	• Develop strategies and policies for the sustainable management of the forest and farm resources
FARM Africa	• Supports reforestation. Supports participatory community management of the forests. Implementing the Bonga forest project
PA	• Point of entry into community. • Has considerable influence on farmers. Organises farmers for collective action
Zonal council	• Ensures implementation of agricultural development policies. Supports sustainable natural resources management efforts

4.5.2 Relative importance and influence of the stakeholders

Influence here refers to the extent to which a stakeholder is able to persuade or coerce others into decision making and or implementation of actions, that is the power a stakeholder has over an area of concern to control decision making. Importance on the other hand refers to the extent to which a stakeholder is affected by the issue at stake (Table 4.6).

Stakeholder influence and importance matrix provides a framework for understanding whose interests are to be analysed and contributions sought in the planning and implementation of a project. Farmers are the most important stakeholders in as far as sustainable natural resource management is concerned because their livelihood largely depends on nature. However, they exert little or no influence in the formulation and implementation of most policies that affect their activities. On the other hand, the zonal council being the policy implementer, is the most influential organ (Figure 4.4).

Figure 4.4 Importance and influence matrix of stakeholders



4.5.3 Stakeholder linkage matrix

The stakeholders are linked in several respects but degree of the linkages vary. The matrix below explains this variation.

Table 4.6 Stakeholder linkage matrix

Stakeholder	Farmers	DOA	EARO	DA	Co-op	PA	JARC	FARM Africa	Zonal Council	ZOPEDD	SUPAK-S
Farmers		***	--	***	***	***	*	***	*	**	***
DOA			--	***	***	***	**	***	***	***	***
EARO				--	--	--	***	--	--	--	--
DA					**	***	**	**	***	*	**
Co-op						**	--	*	***	**	*
PA							**	**	***	**	--
JARC								--	*	*	--
FARM Africa									**	***	***
Zonal Council										***	***
ZOPEDD											***
SUPAK-S											

Legend: *** = very strong relationship; ** = strong relationship; * = weak relationship; -- = no relationship

Linkages between farmers and DAs and FARM Africa are very strong. However, farmers have a weaker relationship with the research institutes and the zonal council. The relationship between ZOPEDD, SUPAK-S, FARM Africa and the zonal council is very strong (Table 4.6).

4.5.4 Perceptions of stakeholders

Researchers

Researchers at EARO and JARC attribute the rapid destruction of the forest to increase in population, which has been compounded by the resettlement schemes in the area; increased demand for fuel wood in the absence of alternative fuel sources; the promotion of investment schemes (coffee and tea plantations). Some investors allegedly clear the forest but fail to follow up with any development activity.

The researchers suggested the education of farmers and other rural dwellers on the importance of natural resource management as the key to reversing the trend in unsustainable management of the forest and other natural resources. The need to increase the intensity of agricultural production and stop expansion of cultivated land at the cost of valuable forests was stressed. They believe that there is a good extension support system to back up such educational campaign. Some researchers also recommended enforcement of existing laws on forest protection and use to save the forests. Another point raised by the researchers is the need for the government to open up the rural areas by way of improved infrastructure to promote off-farm activities. At present, for the bulk of the rural dwellers, farming remains the only means of livelihood. If this situation persists, it would be difficult to control deforestation and promote sustainable farming practices.

Non-Governmental Organisation

FARM Africa, endorses participatory community forest resource management as the key to saving the forest. They believe communities must live in harmony with the forests. But this must be preceded by clear policy and policy guidelines on the use of the forests. There presently seems to be no clear-cut government land and forest use policy.
An officer of FARM Africa describes the situation in this way:

> *"'Theoretically the land belongs to the government. Practically, the land belongs to households. So long as households pay taxes, they believe they have the right of use of the forest. But once the households decide to farm the forest, the forestry people come and take them to court. No clear demarcation of what are state forests and households forests. Rural communities are suspicious of any government manoeuvres because of past policies. Villagilisation was to put people together in villages and then provide them with amenities. The amenities were never provided."*

Government and quasi government agencies

For the Department of Agriculture, the main problems of farmers are:

- Traditional farming practices
- Low productivity
- Absence of credit facilities
- Difficulty in marketing farm produce. Distances between farms and the marketing centres are very far. No motorable roads in most cases.

It is the contention of officers here that measures are being put in place to address some of these problems. They point to the SUPAK-S project as one such effort in that direction.

On sustainable natural resource management, they believe that the problem lies with farmers who have limited awareness of the need to maintain balance between the forests and other natural resources and their use. Expansion of cereal production is the main threat to the forests. One senior officer at the Bonga office dismissed the view that promotion of large-scale plantations of coffee and tea are detrimental to the natural resource base in the following words:

> *"Coffee cultivation and tea plantations do not pose any serious threat to the forests. The scale of investment is not big. Cereal production is the main threat. Farmers and especially new settlers do not appreciate the economic value of the forests."*

According to ZOPEDD/SUPAK-S, the main problems of farmers are the low level of technical knowledge, inadequate credit facilities, poor infrastructure, and low prices for agricultural produce. They attribute the rapid deforestation in the area to increasing population growth. Suggestions for sustainable natural resources management include:

- Promotion of agroforestry practices. The idea of tree planting is not alien to the people. It is the integration of trees and crops that need to be promoted.
- Promotion of integrated forest management practices
- Promotion of other income generating activities such as vegetable production, bee-keeping to reduce demand for land for cereal production
- General improvement of the farming environment

4.6 The Agricultural Knowledge and Information System (AKIS)

4.6.1 Information and its importance

Information and access to it have long been recognised as important ingredient in all development efforts. In agriculture, it is perhaps even more crucial. Farmers need to know where to obtain inputs such as seeds, simple tools and prices of their produce in various markets. In traditional societies, social networks exist through which people receive and share information. By oral tradition, knowledge is passed on from generation to generation. In some communities these indigenous knowledge is written. The recognition of the importance of indigenous knowledge dawn on researchers only in recent times.

How knowledge and information is generated and shared in communities has been variously referred to as Agricultural Knowledge System (Van den Ban and Hawkins, 1988) or Agricultural Knowledge and Information Systems (Roling, 1988) or simply information systems. In recent times there appear to be consensus amongst information workers to refer to information sources and how they are intricately linked and used in farming communities as constituting an AKIS.

Information sources

Farmers' principal information source is through exchange amongst themselves. When asked whom they consult first when faced with a farming problem, the response is always: my neighbour. They receive and share information about their farms at social gatherings, in their homes, at the market and through interactions with input suppliers (see model next page, Figure 4.5).

4.6.2 The Roles of Research and Extension

Research services

Ethiopia has an elaborate agricultural research system. At the pinnacle of the research system is the Ethiopian Agricultural Research Organisation (EARO). EARO holds the national mandate to (EARO, 1999):

- Generate, develop and adapt agricultural technologies that focus on the needs of the overall agricultural development and its beneficiaries
- Co-ordinate research activities of agricultural research centres or higher learning institutes and other related establishments which undertake agricultural research on contractual basis
- Build up a research capacity and establish a system that will make agricultural research efficient, effective and based on development needs
- Popularise agricultural research results

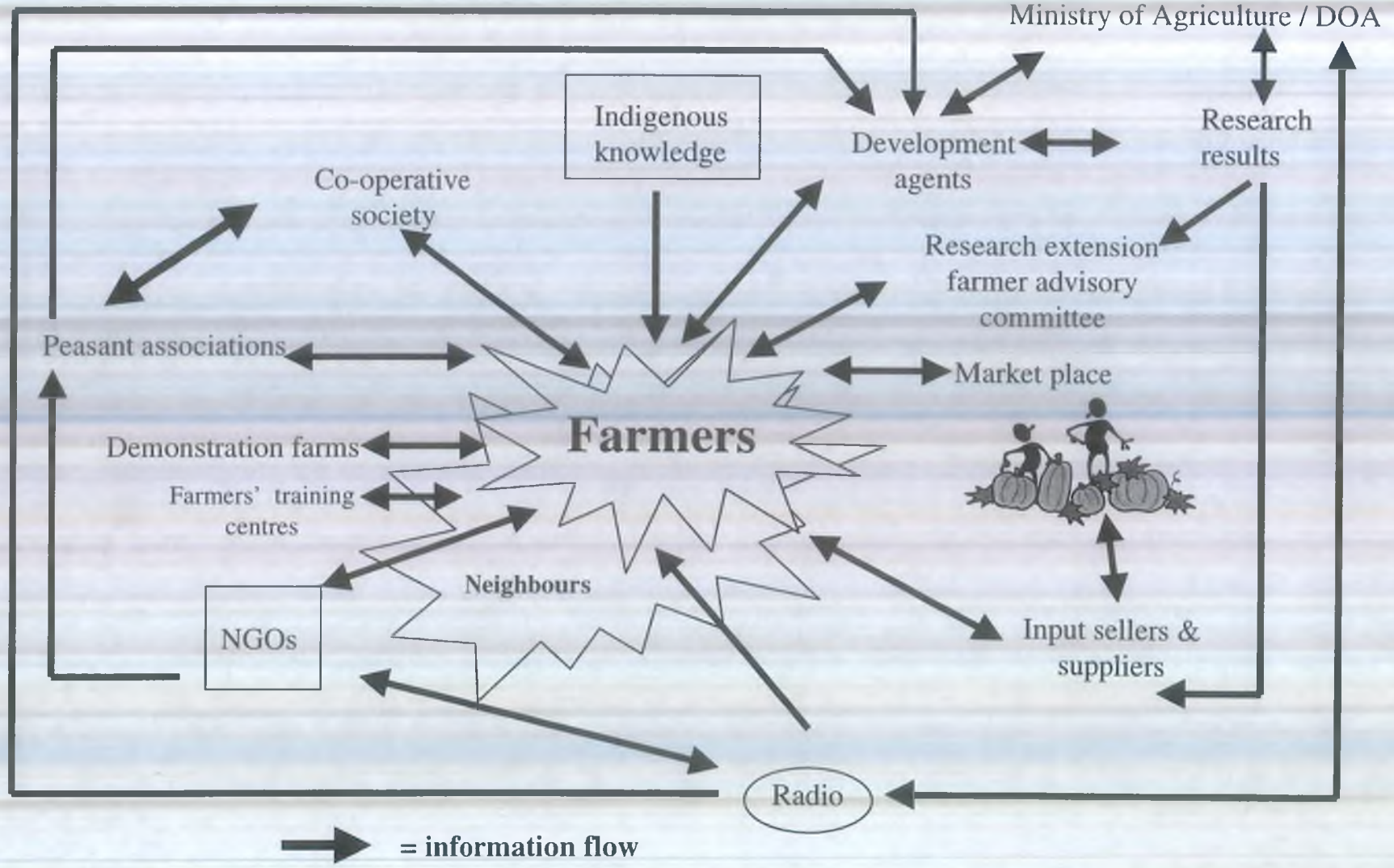
It has under its umbrella, fourteen research centres and eleven research sub-centres, which are located in different agro-ecological zones of the country. These centres carry out research on all the crops grown in the country. There are also research centres focusing on bio-diversity and conservation, fisheries, animal health and soils.

EARO has developed national research strategic programmes for all the crops (coffee, spices, cereals, roots and tubers, pulses); soils, fisheries, livestock, forestry and socio-economics. The thrust of these strategies is (EARO, 1999):

- Crop and soil improvement
- Crop protection
- Application of biotechnology methods
- Post-harvest physiology
- Popularisation and demonstration of research results
- Training of development agents, subject matter specialists, and farmers
- Development of technical and socio-economic manuals and leaflets

Many of these programmes have commenced and it is expected that they would result in the development of technologies, which are suited to the needs, concerns, and circumstances of small and resource-constrained farmers.

Figure 4.5 A model of the agricultural knowledge and information system in Gimbo Woreda



Extension services

Extension staff of the DOA provides extension services to farmers. DAs who are deployed at grass-root level provide farmers with technical information and assist them in the procurement of farm inputs. DAs are also responsible for repayment of extension package credit.

The main technologies being promoted by the DOA is a package of maize and fertilisers, and improved coffee seedlings. Gimbo has 22,926 registered farmers. Last year, only 2,526 (11%) were beneficiaries of the maize and fertiliser package (Table 4.7).

Table 4.7 Selected inputs supplied to farmers by DOA, Gimbo Woreda

Year	Inputs(kg)			N° of receiving farmers
	DAP	Urea	Improved maize	
1995	3,750	3,750	662.5	49
1996	30,700	30,700	4,525	496
1997	39,900	29,500	531.5	885
1998	125,950	n.a	7,989	2,174
1999	1,924,500	n.a	5,190	2,526
TOTAL	2,124,800	63,950	13,710.5	6,130

Source: Department of Agriculture, Gimbo office
DAP = Di-ammonium Phosphate; n.a = not available

It emerged that many farmers received the package (maize and fertiliser) with little instructions and understanding of when and how to apply. The result is that the expected benefits (increase in maize yield) never materialised and farmers become saddled with debts. The package does not come cheap. A 50kg bag of urea cost 153 birr (about US $19); 50 kg improved maize seeds cost 225 birr (about US $ 27). Ironically, farmers sell 50-kg bag of maize grain for 25 birr (about $3)! (DOA, Bonga office, unpublished data).

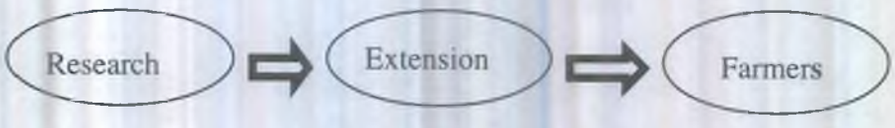
DOA is poorly equipped to manage an efficient extension delivery system. Transport and other logistics are inadequate. Its staff, especially the DAs are poorly trained. Many have received only six to nine months of formal training in agricultural production. They are poorly motivated. They lack means of transport but are expected to serve five hundred and twenty farmers or one *kebele* (extension unit, 400 ha). Many of these farmers live in scattered huts covering wide areas with no accessible roads. In Gimbo Woreda, for instance, the landscape is characterised by undulating steep slopes. To reach certain farming communities, DAs have to walk several kilometres. It is therefore not surprising that only few farmers (so-called model farmers) receive regular technical information.

The provision of veterinary services to farmers is inadequate. Unlike the DAs, animal health assistants do not reside in the villages. They appear before farmers as visitors often without drugs to treat sick animals. For some communities, sick animals have to be moved over long distances to the service centres. For instance in Yebito PA, most farmers have to travel for more than fifteen kilometres to reach the nearest animal health centre.

4.6.3 Research-Extension-Farmer Linkages

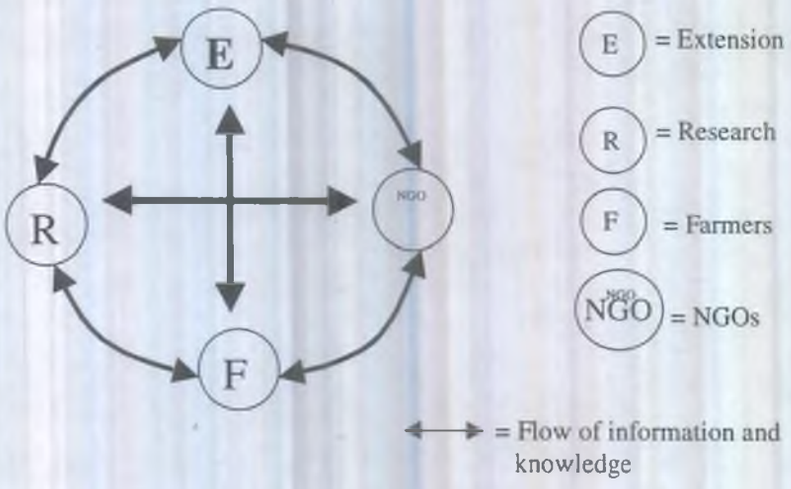
Until recently, the linkage between research and extension has been weak. The now rejected Transfer of Technology (TOT) model of information flows was the norm. Under this model, technology transfer was approached through a one-way process (research produces innovations which are passed on to extension which in turn passes them on to farmers) and thus, there was little or no feedback and researchers had no direct contact with farmers (Figure 4.6).

Figure 4.6 Transfer of Technology (TOT) model



EARO is changing all this. It has strengthened the research extension divisions of all the research centres to enable them to work directly with farmers and extensionists. On-farm verification and demonstration trials are a feature of all the strategic research programmes. This is to ensure that researchers interact closely with farmers and receive feedback on the technologies being developed. Jimma research centre for instance, has established a Research-Extension Advisory Council (REAC), a platform to train development workers and work closely with farmers and other stakeholders (see chapter 5). There is thus a concerted effort to move away from the compartmentalisation of research and extension towards a knowledge and information system (Figure 4.7)

Figure 4.7 AKIS



4.7 Institutional and policy issues

Agricultural production is influenced not only by environmental factors but also institutional and policy issues. This sub-section examines the influence of key policy and institutional factors.

4.7.1 Land tenure

Land in Ethiopia is vested in the state. The Government guarantees the right of use, lease and inheritance to land by farmers. Farmers' feel that the land belongs to them since they have inheritance rights over it. At community level, the peasant associations administer land policies. They preside over allocation of land to households and collect rent that accrues from it. The peasant associations also ensure that farmers do not encroach on restricted forestland. There has not been land distribution since 1993.

4.7.2 Credit

Farmers have limited access to institutional as well as informal credit. The co-operative society and the extension department provide credit in kind to farmers. The co-operative society provides credit for oxen for a 4-year term. The extension department usually gives seeds and fertiliser on credit to be repaid in the same year.

Many farmers want credit to buy oxen and other inputs to increase productivity of land. However, only 20% of the interviewed farmers had received credit from the co-operative society to buy an ox over the last 3 years, as compared to 11% who had received the DOA credit package. FARM Africa, SUPAK-S (through DOA) also provides input credit.

4.7.3 Investment schemes

Investment in agriculture in the zone has been given high priority by the government. The investment policy allows interested investors to establish coffee and tea plantations in the forests. However many farmers resent this policy. Farmers associate the activities of investors to their declining fortunes in bee keeping. The removal of forest trees is decreasing the number of bee colonies.

CHAPTER 5 DISCUSSION AND RECOMMENDATIONS

5.1 Introduction

The focus of this study or `system of interest' is the attainment of sustainable natural resources management in Gimbo wereda. The issues raised and discussed in this chapter represents the convictions of the team that they are important if sustainable natural resources management is to be attained. They have been discussed from the team's own perspectives considering the body of information it had gathered from all stakeholders and elsewhere. A number of implementable recommendations, which the team believes, provide entry points for addressing the issues raised are made.

5.2 Threats to sustainable natural resources management

A number of issues or factors are threatening the efforts to sustainably manage the natural resources of Gimbo. These include deforestation, soil erosion and loss of biodiversity. Farmers' practices represent an integration of their indigenous knowledge and coping strategies. Cereal production provides farmers their much-needed food, but may have negative consequences on the natural resource base (Edwards *et al*, 1999). Teff for instance, requires the preparation of fine seedbeds, which loosens the soil, exposing it to erosion. Continuous cropping or monocropping of cereals without a proper soil fertility management practices result in low crop yields. Increased cereal production has been achieved at the cost of the forest. Farmers are aware of these consequences but are often incapable of taking action because of resource constraints. Farmers need to be supported by research and extension agencies to understand the consequences of some of their practices.

5.2.1 Deforestation and its causes

Deforestation is the wanton removal of the forest cover without a conscious effort for replacement. It is a problem which has reached catastrophic levels in Ethiopia (Hurni, 1988). It is estimated that over 150,000 ha of forestland are lost annually. The destruction of trees and shrubs for fuel wood, construction, agricultural implements and other uses sets the pace for accelerated soil erosion and progressive deterioration of the productive capacity for food and energy supply.

In Kafa-Sheka zone, deforestation is accelerating changes in the farming systems and farmer practices. The zone was noted for coffee and timber production. Uncontrolled removal of the forest cover is turning large areas of the zone into treeless plains of cereals with the loss of several plant species endemic to the forests. Concerted efforts are needed to stem the tide.

Population growth

Population growth is often a major cause of environmental degradation (FAO, 1986; Siegfried *et al* 1990,). A growing population needs more firewood, arable land, and timber to construct houses, furniture and cultivation tools (Figure 5.1 next page). An increasing population requires more food and where productivity per unit area is low, this would mean increasing the land area under cultivation. In Gimbo Woreda, this translates into encroachment into the forests with consequent negative effects on the environment and natural resource base.

Increasing demand for firewood and lumber

A consequence of increasing population is increased demand for fuel wood and lumber for construction activities. Firewood remains the principal source of fuel for cooking. The reality is that the present use of wood exceeds the rate of wood production from the existing forests. Efforts must be made to provide rural dwellers with alternative fuel sources like biogas, or optimal firewood using stoves like *Lorena* stoves being promoted by the FAO in several developing countries. Alternatively, farmers must be encouraged and supported to grow their own trees for fuelwood and lumber. It is heartening that many farmers are already doing this. Insofar as there are no alternative fuel sources. protecting the forests from wood hewers would be difficult.

There must be sustainable use of forest resources, and community involvement in vital. FARM Africa's community forest management project, which seeks to transfer forest resources management to farming communities, is therefore a step in the right direction.

5.2.2 Soil erosion and its effects

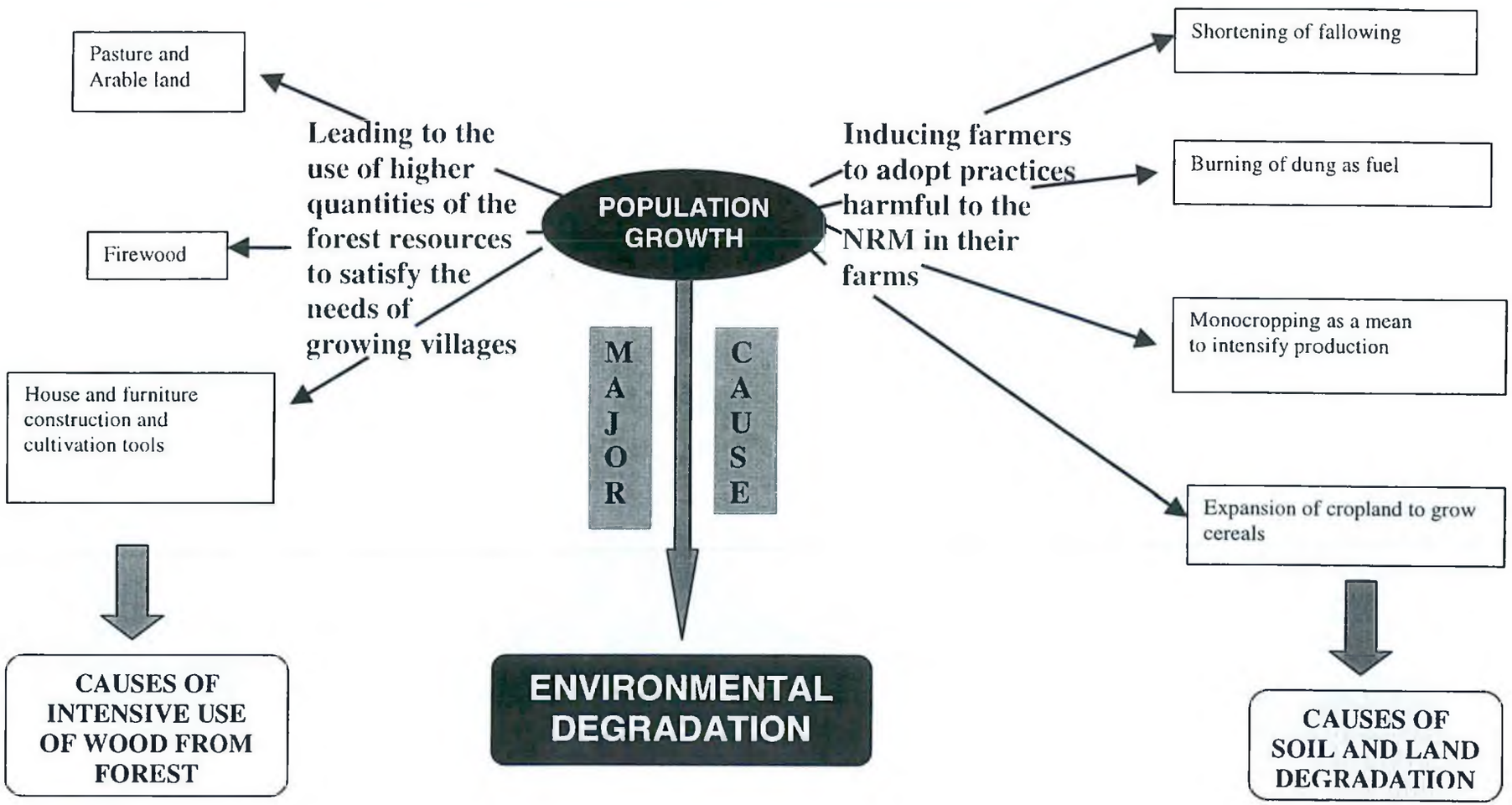
Causes of soil erosion

Deforestation increases runoff, which leads to erosion and reduced infiltration. In severe slopes where the vegetation have been cleared soil erosion is very noticeable. When permanent vegetation is removed from arable land it creates longer uninterrupted slopes where water flows build up and soil particles are washed out causing erosion. Increased runoff and reduced infiltration cause streams to become more intermittent with lower water tables, both of which increase the time, required collecting water in the dry season.

Soil degradation will become an important environmental problem for Gimbo Woreda in the coming years unless the current community based forest protection programmes are strengthened. The loss of soil and the deterioration in fertility, moisture storage capacity and structure of the remaining soils all will reduce the district's agricultural productivity.

This is for instance, the case in the highlands of Ethiopia where deforestation and detrimental soil management practices have resulted in reduced soil infertility, loss of moisture capacity and deterioration of soil structure (Wood, 1990). While the areas in greatest need of conservation at present are in the northern and eastern Highlands of the country, the major areas of current agricultural expansion are in the south (e.g. Gimbo wereda) and west where the potential erosivity is high. Many of the soils in these areas are nitosols, which are prone to erosion and show a rapid decline in yields once erosion begins.

Figure 5.1 **Population growth and environmental degradation**



Effects

There is increasing pressure on the natural resources especially soils as the area under crops expands. The demand for pastureland is also increasing as livestock numbers swell. Overgrazing causes pasture deterioration, soil compaction and reduced productivity. On steep slopes, where the soil is bare, the effects of erosion are more marked. This is especially the case in the cereals based farming systems, where much of the trees have been removed.

In Ethiopia, soil erosion reduces food production by an estimated 1-2 per cent per annum in addition to the 1 per cent decline due to the reduction in the humus content (Wood, 1990). Erosion and the decline in the humus content of the soil reduce both effective rainfall, and soil moisture storage. These problems undermine the ability of crops to withstand drought and to exacerbate variations in crop yields.

Uncontrolled erosion may worsen farmers' plight by reducing overall yields. Soil conservation management practices should be pursued by organisations that are linked to agricultural and rural development in the district. Intercropping, crop rotations and incorporation of cow dung and green manure are practices that need to be promoted.

5.3 Existing opportunities for strengthening sustainable NRM within the tree and crop sub-system

Promotion of improved coffee planting

Coffee cultivation is the key to efforts to halt the environmental degradation taking place in Gimbo. Coffee is money, and households with forest plots from which they collect semi-domesticated coffee are relatively better off. Households with coffee plots, that is fields of improved coffee are even wealthier. There are also opportunities for strengthening coffee cultivation. JARC, which has the national mandate for coffee research is close to the *wereda.* Farmers (especially grouped as FRGs) can easily obtain improved planting materials and technical support. SUPAK-S is already assisting farmers with cheap improved coffee seedlings. Coffee is planted under shade. Suitable shade trees could enhance the beekeeping activities of farmers, who are worried by the rapid disappearance of many bee flora. The promotion of improved coffee cultivation would halt the rapid transformation of the transition zone into the deforested zone.

Crop diversification

Any crop diversification effort should focus on improved coffee cultivation. Maize, teff and sorghum dominate the arable fields. However, the agro-ecologies of the area are suitable for the cultivation of many crops such as taro, cassava (*Manihot esculenta*), enset, bananas, sugarcane, mango, avocado, papaya, groundnut, linseed, soybeans, horse bean, ginger, turmeric and long peppers. The level of cultivation (area and management) of these crops at present is very low.

Diversification of crop production to encompass the crops mentioned above has the advantage of reducing the risk of crop failure, promoting the efficient utilisation of available farm resources including land, labour, capital, soil moisture, nutrients and light. Besides providing cheaper and alternative nutritional sources to farmers and providing farmers with alternative sources of income. Crop diversification results in better protection of soils especially on sloppy lands because of the soil protecting nature of many tree and root crops. Through diversification, the benefits that accrue from a well-integrated crop-livestock system will be reaped. However, farmers need planting materials and extension support to cultivate these crops.

Planting materials

Efforts to promote improved coffee cultivation are being hampered by inadequate planting materials. The majority of the farmers use their own seeds, local crop varieties as planting material. Despite the long years of adaptation of these land races to the ecology, their yield levels are low. This may be attributed largely to the changes in climatic and soil conditions.

To solve this problem, considerable efforts have been made by DOA, SUPAK-S and FARM Africa to distribute improved planting materials of crops such as hybrid maize (BH-660), tef, and CBD-resistant coffee selections to farmers. JARC is also screening new coffee materials for KSZ. This study has suggested (see Chapter 6) starter activities for JARC and other stakeholders for improving the supply of improved coffee planting materials to farmers.

To ensure adequate supply of improved planting materials at affordable prices, the active involvement of the private as well as public sector institutions is recommended. Experience elsewhere (for example India, Uganda, Ghana) shows that seed production and distribution by public sector agencies has to be augmented by the active involvement of the private sector. Farmer associations or community-based organisations (operating seed multiplication centres) could be authorised to produce seeds, which are then certified by the seed certification agency. The private sector in the beginning may use germplasm from public institutions on payment basis. The presence of such private sector is much more important in hybrid seed production especially for cross-pollinated crops.

Weeds and their control

Weeds are a major constraint to increasing crop yields particularly in high rainfall and temperature areas where their growth is favoured. This is the case in Gimbo Woreda (DOA, 1999). However, farmers do not regard weed infestation as a major constraint. This may be due the slow adverse effects of weeds on crop yields, compared to insects and diseases attack. Besides, the team's data collection was undertaken at the onset of the rains when weed presence was low. This may have influenced farmers' responses to the issue of farm constraints.

Otherwise, it is not uncommon to observe some broad leaf and grassy weeds, particularly in maize fields where farmers apply practices like "shilshallo" and subsequent slashing to control weeds. This may justify a weed identification and characterisation survey in order to assess the extent of severity of weeds on crop production, and subsequently determine their threshold levels.

5.4 Livestock, apiary production and management

5.4.1 Livestock feeds

Livestock productivity is constrained by inadequate forage. The problem has received little attention in the past. There has been little government emphasis on increasing forage production or on improving grazing / feeding management systems. Because of increasing numbers of livestock, the communal grazing lands are overstocked and overgrazed. Moreover, as the demand for grains increases due to increasing population, more grazing lands have to be converted into arable lands, which further compounds the problem.

As a consequence of the above, swampy areas are increasingly being used as grazing land. During periods of feed scarcity, even this grazing resource becomes exhausted. Pastures are grazed so intensively that plant vigour is reduced and the less productive and non-palatable species begin to dominate. The animals are not even able to meet their maintenance requirement and as a rule they lose a substantial amount of weight. Overgrazing leads to soil erosion and reduced soil fertility. The problem is particularly severe in sloping areas.

There has been little effort to provide supplementary feed to animals through fodder conservation. Use of crop residues and other crop by-products, as feed to livestock is low.
To ensure the supply of adequate feed to livestock, the following measures are recommended:

1) Improvement of naturally existing grazing land

- Peasant associations in conjunction with the farming communities could improve the productivity of communal grazing lands by undertaking the following:
- Appropriate demarcation and protection of communal grazing lands. The community should also collectively control grazing and restock with improved forage species.

2) Forage conservation

Forage conservation is very important to level feed distribution throughout the year. Fodder conservation in the form of hay and use of straw from various crops is suitable and recommended. The main crop residues are straw from teff, barley and wheat; maize and sorghum stalks. They have a low feeding value and have to be mixed with protein rich husks of beans, peas and other legumes.

3) Introduction of cultivated fodder crops

Improving animal nutrition using sown forage species is an important step in supporting and improving livestock productivity. The major thrust is toward more intensive feeding management systems, which can greatly improve livestock, production and also facilitates more sustainable cropping (ILCA, 1986).

The emphasis should be on cut and carry management rather than grazing. An integrated approach to forage development, which aims at increasing the quantity and quality of feed, is needed. Recommended strategies include:

3a) Backyard forage production

Backyard forage production is the growing of forage in the house compound. Forage plots or hedges in the backyard of the farmhouse are an easy and quick way of increasing forage production. Soil fertility in the backyard is usually high so forage plots can be very productive. Farmers should be encouraged to establish hedges. The tree legumes such as *Cajanus cajan,* Leucena, and others are suitable for backyard forage.

3b) Under-sowing and interplanting

Under sowing involves the planting of forage legumes in to another crop after the main crop has been established. The legumes are usually sown at the time of the final weeding of the main crop. The forage species are sown at low seeding rates in crops such as maize and sorghum. Under sowing is the best method of increasing forage production. The farmer readily accepts it because it does not disturb the existing cropping pattern in the farm.

5.4.2 Traditional beehive and its management

Beekeeping requires trees, which is good for NRM. The promotion of traditional beekeeping activities is therefore desirable, as it would keep the trees. Coffee cultivation requires shade trees, which could be use for beekeeping as well.

The traditional beehive has been with the people for many generations with little modification because of the little investment it demands. The people have not been presented with any low-cost viable alternatives. The modern top-bar beehives did not find favour with farmers because of its cost and greater demand for attention. What is required is improvement in the traditional beehive, particularly its structure to make it more amenable to harvesting and other practices. The mud-hive, an intermediate low-cost hive, appears to satisfy these requirements. The backyard and shed bee keeping practice though common in many parts of the country is not known in Gimbo. It has the advantage of being close to homes, allowing frequent inspection. Other advantages include:

- Control of ants and honey badgers is easier
- Because it is closer to homes, women can be involved
- Ease of storing of bee keeping equipment and materials is possible.

5.5 Institutional and Policy issues

The technologies and options for achieving higher agricultural productivity through promotion of coffee production and other intensification efforts would not be useful without effective government policies, institutions and infrastructure that promote and support them. These issues are discussed in this section.

5.5.1 Land tenure

Farmers do not have ownership rights to land but have right to use (usufructuary right), lease and inherit it. Although lack of ownership rights over land is often perceived as a major hindrance to private investment in land, farmers in Gimbo seem not to view it in this way.

However, farmers are not able to use land as a collateral security for accessing institutional credit. Access to credit is very important if farmers have to improve agricultural productivity through intensification and diversification especially at the initial stages of agricultural development. If farmers are given right to use land as collateral security for accessing institutional credit that may greatly enhance their ability to invest and improve farm productivity.

Farmers have to pay income tax and land rent to the state. Many farmers consider the land rent of about 39 birr per hectare high. In view of the subsistence nature of agriculture and its high level of susceptibility to natural calamities, this amount seems high for most farmers. Indeed some farmers' are often driven by desperation to sell off their livestock in a bid to fulfil this obligation. Consequently, farmers are left with nothing to invest in the agricultural sector. Considering the low income of many farmers and the urgent need to revamp the agricultural sector, a reduction in rent and income tax would serve as an incentive to farmers.

5.5.2 Wildlife

While attempts to protect nature are legitimate, destruction of crops and attack on livestock by wild animals was considered the leading cause of low yields and livestock numbers especially in the forest and transition zones. This calls for a more prudent scrutiny of this issue: the need to re-examine the trade off between losses to farmers and benefits that accrue from unchecked multiplication of game.

One option is to develop eco-tourism in the zone, in which the vermin constrain, could be converted into an opportunity for income generation, an effort to which farmers must be part of and benefit from. At present this possibility seems remote because of inadequate infrastructure.

There is an urgent need to determine and regulate the number of wild animals per unit area, which is only possible if a monitoring and regulating institution is established and empowered at a level low enough to permit effective regulation, preferably at wereda level.

5.5.3 Credit

Access to farm credit is necessary if farmers have to break even and produce beyond the confines of subsistence. Credit provides the highly needed capital for agricultural investment and encourages farmers to adopt new technologies. If credit is available, farmers can store their produce in anticipation for remunerative prices. The promotion of improved coffee cultivation for instance, would require inputs such as planting materials, fertilisers and pesticides. Credit provision to farmers would be most welcomed.

Formal credit institutions have not been very successful in providing farm credit because of the high interest rates, poor timing of loans, short repayment period and the need for collateral, against the backdrop of a rather volatile agricultural sector. The success story associated with most informal credit institutions could be emulated. The presence of peasant associations could provide an opportunity for a group guarantee scheme, and pave way for the establishment of community managed credit schemes.

It could be learned from the experience of the "Omo micro finance company", which provided credit to farmers, that there could be high recovery rate for farm credit to small farmers if the credit is given timely and for productive purposes. Saving mobilisation is an important part of sustainable rural financial systems. Experiences have shown that schemes, which offer saving facilities, are more successful than those who do not. Therefore it is important that savings be included in the designing of credit schemes.

5.5.4 Market and price policy

Stability in producer prices provides a strong incentive to farmers to increase their productivity. However, in the absence of public sector intervention, market imperfections often occur, which are typified by volatile price fluctuations, wide disparities between farm gate and market prices and poor integration of regional markets.

Under such conditions, interventions in product markets to stabilise prices can be justified, especially if price trends in the world market are used as the basis for the stabilisation programme. The experiences of price stabilisation programmes are far from uniform. Nonetheless, countries such as India and Pakistan have an impressive record of ensuring producer price stability in the face of rapid and unprecedented increase in food grain production in the 1970s (Byerlee, 1995). The price stabilisation could be achieved through a policy of "minimum support price" that is based on cost of production. Price stabilisation is important especially for major crops like coffee, maize, spices and teff. In addition to price policy, it is important to develop and promote small-scale agro-processing industries.

5.5.5 Investment schemes

Activities of investors as discussed in chapter 4 are many times detrimental to the forest if they are not monitored regularly. Moreover the farmers associate the activities of investors to their declining fortunes in bee keeping, and collection of wild coffee and spices. The conflict of interest between farmers and investors, and the apparent adverse consequences of the investment policy provides ample justification for its re-examination. To attain sustainable natural resource management and high investment in agriculture, it would be appropriate if investment licences are issued only for coffee and tea plantations in forest areas with sparse vegetation.

The presence of investors, however can be a blessing especially in tea production. Experience in other countries (e.g. Kenya) has shown that investors run a nucleus tea estate and processing factory efficiently together with outgrowers' programme for small farmers that benefit many households.

Forest use policies should be reviewed to discourage the "quick mining" of forests. Public investments should be directed primarily at forest conservation and land productivity rather than uncontrolled access to untouched forest. "Forest protection fund" could be created to rehabilitate the already cleared forest.

5.5.6 Input supply

Experience from other countries (e.g. India) suggest that the public sector has a role in input supply in the early stages of agricultural transition when farmers first begin to use purchased inputs, especially fertilisers and seed. In small-scale agriculture, low market value and high risk combined with poor infrastructure, initially act as a disincentive to private sector participation in input supply. The public sector has an important role in improving infrastructure, especially rural roads, which are vital ingredients in promoting private sector trade, including agricultural input markets. The challenge of the public sector is to lay groundwork for rapid transition to the private sector assumption of responsibility for input supply.

5.6 Linkages between stakeholders

Information flows and linkages between stakeholders in any endeavour is vital if synergy is to be achieved. Effective technology development and transfer to the farmer hinges on strong and meaningful linkages between research, extension and the farmer (Merril-Sands & Kaimowitz, 1989). Another argument for a closer working relationship between farmers and researchers is that it provides an opportunity for co-operation in the mobilisation of indigenous knowledge (Bell, 1979).

The absence of effective linkages between information and technology generators, disseminators and utilisers has been cited repeatedly as one of the major causes of underdevelopment of Ethiopian agriculture. There has been no forum where this linkage problem had not been raised as a result of which it has become a concern among policy makers, researchers, development workers and funding organisations (EARO, 1999).

Past efforts at building linkages

Several attempts were made in the past to strengthen the linkages between researchers, extensionists and farmers. These include:

- The establishment of Research-Extension Division (RED) in 1985 by the Institute of Agricultural Research (IAR) with financial support from the World Bank
- The establishment of the Research-Extension Laison Committee (RELC) in 1986 at the zonal and national levels to enhance horizontal and vertical integration of research, extension and farmers
- The extensive Farming Systems Research (FSR) surveys and on-farm studies with the support of CIMMYT, IDRC and the World Bank
- The Ministry of Agriculture (MOA) and Regional Agricultural Bureaux's joint adaptive and verification trials.

These efforts achieved little (EARO, 1999) because of the following reasons:

- Frequent changes in the organisational structures of MOA. This affected the functioning of the RELCs. Many members were redeployed or transferred to other areas.
- Irregular meetings. Many of the structures existed only on paper and little efforts were made to operationalise them.
- Inadequate representation of farmers on the various committees or bodies
- Inadequate logistical support and incentives for committee members.

Current efforts

Though the previous efforts were not successful, there is a renewed determination to improve the linkages between research, extension and farmers. Some of the measures being put in place include (EARO, 1999):

- The establishment of Research Extension Advisory Councils (REAC) at the federal, regional and zonal levels
- Establishment of a Federal Research and Extension Advisory Council (FREAC) to oversee the effective implementation of all linkages policies. This council will receive legal backing by the Federal government
- Signing of a memorandum of understanding between EARO, MOA and the Regional Bureaux of Agriculture (RBAs) on the institution of platforms for researchers, farmers and extensionists.

Experience has shown that having these structures in place does not necessarily translate into improved linkages between the stakeholders. The process must take place at the grass-root level with the active participation of farmers. This demands the involvement of all the stakeholders in the planning, implementation and evaluation of planned activities such as on-farm trials, the formation of farmer research and extension groups. The mandates of the research centres appear to inhibit them in taking a holistic view of the farm and its socio-economic situation. In KSZ for instance, JARC and Tepi research centre are the closest. These centres focus mainly on coffee and the spices. Farmers however, use the strategy of multiple cropping to reduce risk and maximise returns under low levels of technology and limited resources (Fernandes, 1999). The research centres therefore need to change their approach from a commodity focus to a systems orientation.

The research-extension divisions (REDs) at all the research centres need to be strengthened to enable them perform better. Many of them are under-staffed. The effective management of research-extension-farmer linkages depends on the availability of trained manpower, especially in the social sciences – rural and development sociology, anthropology and agricultural economics. The provision of trained manpower should be backed by adequate logistical support, especially vehicles to enable researchers to reach farmers.

Linkages at the zonal level

Linkages at the zonal and lower administrative levels are weak. In the past, many of the structures put in place to strengthen linkages function only in the cities and big towns. It is at the zonal and lower levels that stronger links are most needed. Researchers are not motivated enough to work with farmers at the lower levels. Demonstration of technologies was left to the DOA whose staff tends to concentrate their extension efforts on the few resource-endowed farmers (so-called model farmers).

Besides the DOA, in KSZ, there is SUPAK-S, and FARM Africa. The links between them and researchers is weak indeed. Farmers of the zone will benefit more if the activities of these agencies (SUPAK-S is a development project) and researchers are harmonised. The formation of farmer research and extension groups would provide the needed platforms for such linkages and interactions. The recently inaugurated regional research-extension advisory council for KSZ and Bench-Maji zone needs to be strengthened and supported to perform the functions for which it was set up.

An effective agricultural technology development and delivery system needs good linkage strategy, particularly between government sponsored agricultural research and extension services. Agricultural research findings are of little use if farmers do not adopt them. Agricultural research must therefore, be related to farmers' problems. Extension organisations could play a vital role in identifying farmers' problems and linking them to the process of technology generation and transfer (EARO, 1999).

CHAPTER 6 SCREENING AND PRIORITISING OPTIONS

6.1 Options for improvement

This study envisages a movement of the farming systems of KSZ towards one that is based on coffee, a tree crop that protects the environment. In the long run, tea may also become important. The intermediary forest/coffee/cereals system should become less important when coffee revenues give farmers enough cash and security to buy maize and teff grains for food from the market. Consequently, crop specialisation is envisaged. In the light of this vision, and the constraints and opportunities identified (with stakeholders' consent) a number of options are proposed. These options are categorised into three, that is, research (R), development (D) and research and development (R&D).

Research options are those for which no suitable technologies exist as yet and as such, require the intervention of research. Development options are those interventions for which suitable technologies already exist but require extension support or appropriate policy framework. Research and development options need both research and development inputs to develop appropriate and adaptive messages, which have been tested for agro-ecological, and farming systems compatibility.

6.2 Screening options

A total of twenty-seven research, development and R&D options were suggested. These options were screened with all stakeholders, including farmers. The following criteria were use to screen the options:

- Environmental sustainability: impact on natural resource
- Economic competitiveness: productivity, viability and ease of adoption
- Social equity: gender, distribution of benefits and number of producers
- Institutional capacity: technical man-power availability
- Resource accessibility: willingness of funding organisations

The options, which passed the screening test, are presented in Table 6.1

Table 6.1 Research, Development and Research & Development options for Gimbo Woreda

Research Options	Development Options	R&D Options
1. On-farm testing of varieties of coffee, spices, enset and maize	Introduction of fruit trees into the farming systems	Study of indigenous knowledge in enset production and development of extension
2. On-farm evaluation of bare-root method of transplanting coffee seedlings		
3. Evaluation of mud-hives as intermediate bee keeping technology		
4. Study of weeds and soil fertility status		
5. Study of indigenous beekeeping practices and identification of bee flora		
6. Evaluation and utilisation of multi-purpose trees		
7. Identification and evaluation of local fodder species and forage legumes		

Though all the screened options are suitable for implementation in all the three zones, the options related to coffee, spices and beekeeping are more appropriate for forest and transition zones. The enset option is more relevant to the cereal zone but the farmers from forest or transition zone would need to be involved because of their wealth of experience in enset production. Coffee cultivation provides a unique development strategy for KSZ in arresting the spate of deforestation and also raising the incomes of farmers. Coffee production should therefore be stimulated in all three zones although the content of the programme may vary according to the zone under study.

6.3 Research options

Seven research options have been screened. Of these two are dealing with on-farm testing of available technologies of coffee, spices, enset and maize. The other two are related to fodder plants/legumes and multipurpose trees. Two options relate to bee keeping, involving the documentation of indigenous bee keeping practices and evaluation of mud hives in the farmers' conditions. The other option is on weed and soil fertility (table 6.1).

The justification and essential features of each option are briefly described below.

6.3.1 Screening/on-farm testing of coffee, spices, enset and maize cultivars

Research has developed improved varieties of coffee and spices, which are now grown in many parts of the county. These need to be tested under farmer conditions in KSZ as well. Considering the genetic potential of local spice and coffee varieties, suitability of the climate and soil, and their economic potential, participatory research and development is needed to expand coffee and spice cultivation. The root system of these crops is extensive and therefore helps in protecting the soil. Moreover higher farm income from coffee and the spices would reduce arable crop production and save the forests.

Maize and enset are predominant food crops in KSZ. Use of local varieties by the farmers and poor agronomic practices are among the main causes of low crop yields. High yielding varieties (HYVs) of maize have successfully been developed and introduced to other parts of the Ethiopia. There is thus need to conduct on-farm testing of these varieties for suitability and adaptability. The prospects for double cropping maize appear to be bright, but need to be verified in light of the existing agronomic practices.

Enset production is constrained by various diseases, some of which have not yet been characterised. A disease surveillance to identify and ascertain the extent of severity is urgently required so that remedial actions could be taken.

Jimma Agricultural Research Centre (JARC), Tepi research sub-centre, DOA, ZOPED, SUPAK-S and farmers through farmer research groups are the likely key stakeholders in implementing this option.

6.3.2 On-farm evaluation of bare-root method of transplanting coffee seedlings

One of the main constraints faced by coffee farmers is access to adequate improved coffee seedlings produced under the recommended nursery management practices (Yacob, 1986). Coffee cultivation requires the raising of seedlings, as direct seeding is not recommended.

Farmers seem to prefer bareroot method of transplanting coffee seedlings to the polybag. However, there is need to evaluate the performance of bareroot coffee seedlings under farmers' conditions in order to justify their recommendation as an alternative to the proven polybag method (see details in research proposal 1). DOA is already supporting the establishment of coffee nurseries by farmers and this proposal could be integrated into that programme. DOA (with support from SUPAK-S), FARM Africa, ZOPEDD and JARC are the other key stakeholders.

6.3.3 Evaluation of mud-hives as intermediate bee keeping technology

Bee keeping is a widespread activity among families in Gimbo Woreda. Traditional log hives are widely used. The traditional hive is relatively cheap because the materials used for their construction are available in the forest and in the farms.

In spite of its low cost, the traditional cylindrical log hive has some disadvantages. Handling is cumbersome because it has only one small orifice at one side of the hive. This small hole does not allow periodic inspection and during harvesting the entire comb is destroyed. Another disadvantage is that hives are set up far away from homes making inspection and protection from badgers and ants attack difficult.

Under these conditions honey output is low. Some efforts have been made to introduce wooden frame beehives in the past. This type of hive is expensive for most farmers to manage. The mud-beehive is considered an intermediate technology. It is basically a top bar hive made out of mud which reduces its cost, and simple to construct. Besides low cost, the mud-hive uses less wood compared to other hives, making it environmentally friendly. The mud-hive creates excellent climatic conditions for bee activities. Mild temperatures and large space inside the hive are very favourable for honey production and reduction of bee aggressiveness. The material does not rot with time as wood hives, and if the mud-hive suffers any damage, it can easily be repaired. Finally, it can be inspected frequently reducing the chance of attack by predators.

Evaluation of mud hives under farmers' management conditions should be the first step to proving the suitability and feasibility of this technology.

6.3.4 Study of weeds and soil fertility status

The climatic conditions of Gimbo Woreda favour the rapid growth of weeds. Farmers however, do not consider weeds as a major crop production constraint. This may stem from the fact that the data collection phase of this study was conducted before the main rains when weeds presence is low, and thus influence farmers' responses. Farmers' perceptions of weeds as a constraint may also have been influenced by the fact that weeds effects on crop yields may be less dramatic compared to pests or diseases.

Farmers again consider their soils inherently fertile and therefore undertake little or no soil improvement practices. This assertion may be the case in the forests and perhaps transition zones where the soils are deep and fertile, benefiting from organic matter addition in the form of leaf fall. In the deforested zones, where continuous cropping or monocropping of cereals with little or no nutrient replenishment is the norm, the fertility of the soils has been declining. The declining fertility may also be due to soil erosion.

It is imperative that the status of weeds and the degree of fertility of soils in the district are assessed to guide the recommendation of new crop production technologies. The implementation of this option will provide this much-needed information.

6.3.5 Study of indigenous bee practices and identification of bee flora

Farmers in this region have practised beekeeping since time immemorial, which implies that they have accumulated a lot of experience and knowledge in it. During the field study, it was noted, as a case in point, that farmers use various indigenous methods to protect beehives from their enemies like ants. Farmers are equally aware of the naturally growing trees and shrubs, which are valuable sources of nectar. Unfortunately, most of these tree species and indigenous practices are not documented and therefore fast disappearing. There is ample evidence to suggest that these practices are not homogeneous across the regions of Ethiopia.

In light of the above, there is need to compile indigenous beekeeping practices and to identify and salvage the valuable bee flora from extinction. This information will form a springboard on which any interventions in apiary should rest on. It would also have a major impact on recommendations to be issued on which trees should be used as shade trees in newly established coffee plots.

Some stakeholders are already directing their efforts towards promoting honey production amongst farmers. The proposed study is expected to complement such noble efforts, and in combination, contribute towards enhanced honey production.

6.3.6 Evaluation and utilisation of multi-purpose trees

Trees are an inalienable component of any farming system. Besides being a source of wood for fuel and construction, trees can provide fodder for animals, and can help in protecting and maintaining soil fertility. However, the potential benefits that would accrue from such interactions are often not optimised. Integration of trees into the farming systems is particularly important in the environmentally fragile zones. As a result of population pressure, deforestation has rendered most areas highly vulnerable to erosion and its adverse effects.

Since farmers plant coffee under shade, there is need to promote the growing of reliable shade trees, especially in the deforested areas like Shombakecheb. Some farmers have planted leguminous fodder trees like, cordia and grevillia on the boundaries of their plots, which demonstrates the existence of a tree planting culture among the farmers that can be harnessed. The district has an enormous potential for development of apiary, which is at present largely threatened by deforestation.

This calls for a need to evaluate alternative multi-purpose trees, which are useful for fodder, fuel, soil fertility and bee keeping, for their suitability, utilisation and acceptability. Specifically, how trees can be integrated into the farming systems. JARC and Jimma Agricultural College can take up this project along with DOA.

6.3.7. Identification and evaluation of local fodder species and forage legumes

Livestock is one of the major sources of livelihood of the farmers in the study area where there exist a strong linkage between livestock availability and crop production. Dry season feed shortage is however, a major constraint in all the zones of the study area that affects livestock performance. Poor livestock nutrition leads to low livestock productivity low traction potential and subsequently, low level of income. At the same time livestock represent a crucial cash source to meet farm inputs requirements, rent payments and all other farm household expenditures. Shortage of feeds results in overgrazing on small areas with insufficient biomass, which in turn causes degradation and compromised resilience of the land to regeneration.

There are many naturally occurring fodder spices, which are used to feed livestock. Some of them may have very high nutritional values especially those which are used by farmers for fattening sheep and goats. In spite of their importance, these fodder spices have not been properly identified and evaluated for their nutritive value. There is the need to study the suitability of such fodder species (especially for system compatibility) so that their further use in livestock improvement can be promoted.

Forage legumes have the dual advantage of providing fodder for livestock as well as improving soil fertility. The land constraint in the area also exacerbates the problem of fodder, ruling out any possibility of private pasture development. Forage legumes, on the other hand can be introduced as food crops such that some amount of fodder can be put aside for the lean season.

6.4 Development options

6.4.1 Introduction of fruit trees into the farming systems

Gimbo is richly endowed with fertile soils and a climatic pattern that favours the growth of fruits. Fruits are relatively less labour intensive and most of them, being multipurpose in nature are potential sources of income as well as useful in conserving the environment. Fruit trees such as avocado and mangoes that suite the agro-climatic conditions have the advantage of being cost friendly. In spite of this potential, these fruit trees are not popular in Gimbo, having been poorly promoted into the farming systems.

The introduction of these fruit trees in Gimbo is therefore proposed as a low cost innovation into the system. The NGO's and DOA, could liase with the relevant research centre in order to identify suitable and compatible fruit tree species.

6.5 Research and development options

6.5.1 Study of indigenous knowledge in enset production and development of an extension manual

Enset is a perennial root crop that is endemic to Ethiopia. It is particularly important in the enset/cereal based farming system, where it contributes significantly to household income, besides being a staple food crop. In spite of this, there is no enset production manual for DAs. In order to develop a relevant production manual, it is necessary to conduct an inventory into the indigenous enset production technologies and to evaluate them against the recommended/released technologies. In order to target a wider audience, the production manual should be written in both Amharic and Kafinono.

6.6 Prioritising Options

Invariably, more research and development options are identified than could be implemented with the available resources. It is therefore necessary to prioritise the recommended options in order to identify their potential impact on the natural resource base and to increase the efficiency of research. The options/ recommendations were prioritised using the following criteria:

- Economic efficiency: economic surplus generated in terms of value of production
- Environmental sustainability: improved natural resource management
- Social equity: gender, number of farmers benefited
- Probability of success: chances of success of the project with available resources

Each criterion was given a weight, reflecting the importance attached to it by the stakeholders. The weights were allotted in consultation with all stakeholders. Economic efficiency and environmental sustainability were considered equally important and these were also given more weights than the other two criteria. Social equity and probability of success were also given equal weights. Then for each criterion some measurable indicators were identified in order to arrive at a score for each option.

Contribution to economic efficiency was estimated based on expected economic surplus generated by each project and then relative scores were given. Environmental sustainability is measured in terms of improved natural resource management like "number of hectares of erosion prone land that may be positively affected by the results of the project". Expected benefits of the project for male and female farmers, small and large farmers, and total number of farmers benefited are measured for social equity. Probability of success of the project is estimated based on availability of resources (technical and material) and willingness of the stakeholders to take up the project.

Table 6.2 Priorities for different research options

Options/ Recommendations	Effect on			Probability of success	Total weighted score	Priority Rank	Time to effect
	Economic efficiency	Environmental sustainability	Social equity				
	$W_{1=0.3}$	$W_{2=0.3}$	$W_{3=0.2}$	$W_{4=0.2}$	Y_1		
On-farm testing of maize, coffee, spices and enset	5	5	3	4	4.4	II	Short/ mediu m
Bare-root method of transplanting coffee	4	5	5	4	4.5	I	Short/ mediu m
Mud-hives for bee keeping	3	4	4	3	3.5	V	Mediu m
ITK in bee keeping and bee flora	4	4	3	4	3.8	IV	Short
Weeds and soil fertility	3	4	3	4	3.5	V	Short
Multi-purpose trees	3	5	2	3	3.4	VI	Long
Local fodder and forage legumes	3	4	3	3	3.3	VII	Mediu m
Fruit trees	3	4	3	4	3.5	V	Mediu m
ITK in enset	4	5	4	4	4.3	III	Short

W_{is}= Relative weight for different criteria; Scale of scoring = 1 to 5; 5 is highest score and 1 is least score for an option

After the evaluation, the first two options, that is, on-farm evaluation of the bare-root method of transplanting coffee seedlings and on-farm testing of coffee, spices, enset and maize varieties were developed into research proposals in consultation with JARC, DOA, ZOPEDD and SUPAK-S.

6.7 Research proposals

These proposals have been developed with stakeholders from JARC, DOA and SUPAK-S officers. The proposals as presented here only represent the framework. Details of methods, budget and other modalities would be worked out by a steering committee of the stakeholders as agreed at the final workshop.

The implementation of the proposals demands the active involvement of farmers. The demands of client-oriented research (endorsed and being promoted by EARO) requires the selection of representative villages and farmers in the various zones and farm types. It is recommended that implementation of the proposals includes the formation of farmer research groups (FRGs) who would play active roles in farmer managed-farmer implemented (FMFI) on-farm trials. In ARD, the farming systems perspective is important, and is only fully incorporated in FMFI trials. It is also expected that the newly formed zonal REAC would also be involved in the project implementation and monitoring.

Proposal 1 is relevant for all the three zones and is particularly targeting farm types with access to forest or coffee plots. The coffee, spices and enset components of proposal 2 are targeting all the three zones. The maize component is more relevant for the transition and deforested zones, and is targeting farm types with large arable fields.

6.7.1 Research Proposal I

Title: On-farm evaluation of bare-root method of transplanting Coffee (*Coffea arabica* L.) seedlings.

Executing Agencies: Jimma Agricultural Research Centre (JARC), and the Department of Agriculture, Bonga.

Project Team:

- Tesfaye Shimber, Coffee Agronomist/Physiologist, JARC
- Taye Kufa, Coffee Agronomist/Physiologist, JARC
- Admassu Shibru, Socio-Economist, JARC
- Niguse Efa, Research-Extension, JARC
- Seyum Fulas, Agronomist, DOA, Bonga
- Beshir Abdella, Extension department, DOA, Bonga

Goal: To raise the income of farmers through coffee cultivation.
Project Location: Gimbo Wereda.
Commencement Date: September 2000
Duration: Four years.
Estimated Total Budget: 67,289 Birr
Proposed funding source: JARC and SUPAK-S (through the DOA)

Background and Justification:

JARC, which holds the national mandate for coffee research, SUPAK-S, a Dutch bi-lateral aid project and DOA, Bonga will implement this project. Coffee is an important cash crop in the Kafa-Sheka zone, the homeland of arabica coffee. Farmers have depended for many years on the naturally occurring coffee under the forests. This coffee receives little maintenance and hence yields are low. Coffee cultivation requires the raising of seedlings, as direct seeding is not recommended. At JARC, several nursery management practices have been recommended to promote the expansion of coffee production (Tesfaye *et al.*, 1998; Yacob, 1986). Accordingly, DOA, FARM Africa and SUPAK-S are trying to supply polythene raised improved coffee seedlings. However, one of the main constraints faced by farmers is access to adequate and timely supply of improved coffee seedlings.

Taye *et al* (1999) reported the production of high quality coffee seedlings using polybag method as compare to bare root. In the same report, differences in survival rates were noticed comparing polythene with barefoot methods with values of 92.92 % and 64.44 % respectively. The polybag method is however labour intensive. Preparing the media and filling the polythene is time consuming. Transporting polybag seedlings is difficult especially if the nursery site is far from the field. It is not uncommon to see farmers removing the polythene bags from the seedlings for easy transportation. The polybag itself is beyond the financial reach of many resource poor farmers.

To circumvent these problems, farmers pick self-sown seedlings under the mother trees and plant them or raise seedlings on raised beds especially near rivers and streams. Such seedlings when ready for field transplanting, are uprooted with a "ball of earth" mimicking the polybag. Survival rates of such seedlings are comparatively high.

The on-station nursery technologies developed at JARC, including transplanting methods have not been exposed under farmers' conditions to justify their recommendation as alternatives to the proven polybag method. On the other hand, on-farm experimentation should only be contemplated after a careful diagnosis of farmers problems and consideration of possible solutions (Mettrick, 1993). This study seeks to fill this information and provide on-farm recommendations on the use of bare root method of raising and transplanting. It is further anticipated to give insights into an alternative method and reduce over dependence on the imported polythene bags to expand coffee production in the area.

Specific Objectives

- To document the various indigenous farmers knowledge of bare root methods of transplanting Arabica coffee seedlings
- To evaluate the early performances of these seedlings under farmers' conditions against polybag seedlings
- On the basis of the above, generate recommendations on the use of optimum methods of raising and transplanting coffee seedlings.

Methodology

In year 1, an in-depth survey will be made to collect information on farmers' traditional methods of raising coffee seedlings and identify the potentials and constraints. Literature will be studied resulting in a review report. In year 2, on-farm experimentation will be conducted by taking in to account the performances of bare root and polythene raised and transplanted coffee seedlings. All the other non-experimental variables (soil media preparation, sowing technique, mulching, shade regulation, watering, pest control and other operations) both under nursery and field conditions will be kept uniform among farmers. The farmer will apply all practices and the required information will be collected in collaboration with the researchers. Seeds will be prepared from a known improved and adaptable coffee cultivator in the area. Time of sowing and field transplanting will depend on the rainfall situations and farmers practice.

Representative PA's from three identified zones (based on scale of deforestation and altitude) will be selected, from which not more than twenty farmers will be selected. Farmers research group will be formed and farmer to farmer-cross visit and farmers led workshop will be arranged in the course of the study.

Data to be collected

1. Farmers evaluation criteria (to be developed with FRGs)
2. Survival counts, emergence rate, mean days to emergence
3. Growth parameters (height, girth measurements and canopy diameter)
4. Comparative costs (labour and other inputs)

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Table 6.3 Research Proposal 1: Estimated Budget (Birr) by year

Particulars	Year 1	Year 2	Year 3	Year 4	Total
Equipment • Polythene sheets • Coffee seeds	4,500	4,725	4,961	5,109	19,295
Manpower Allowances	7,200	7,560	7,938	8,235	30,933
Transport • Fuel • Vehicle maintenance	2,500	2,625	2,756	2,894	10,775
Sub-Total	14,200	14,910	15,655	16,408	61,173
Contingency (10 %)	1,420	1,491	1,565	1,640	6,116
Total	**15,620**	**16,401**	**17,220**	**18,048**	**67,289**

Table 6.4 Research proposal 1: Logical framework

Narrative summary	Objectively verifiable indicators	Means of verification	Assumptions
Goal: ▪ Raise farmers' income through coffee cultivation.	▪ Increased contribution of coffee to household income by at least 20% by the end of the project ▪ Increase acreage under coffee by xx % by the end of the project	▪ Central statistical authority and KSZ-Statistical Abstract ▪ National census figures	
Purpose: ▪ Increased use of bare root as an alternative method of transplanting coffee seedlings.	▪ Increased number of farmers using bare root transplanting by 35 % by the year 2004.	▪ Report on adoption	
Outputs: ▪ Farmers exposed to alternative nursery practices. ▪ Criteria for formation of Farmer Research Groups developed ▪ Recommendations on the use of bare root method generated. ▪ Farmer practices documented	▪ Number of farmers involved and nursery practices evaluated ▪ List of recommendations made available to farmers. ▪ In-depth survey report published		
Activities: ▪ In-depth survey and literature review ▪ Farmer and site selection ▪ Formation of Farmer Research Group ▪ Farmer/DA training ▪ Purchase & distribution of inputs ▪ Establishment of trials ▪ Monitoring and evaluation ▪ Data collection, analysis and report write up	▪ Number of farmers participating ▪ Number of FRG formed ▪ Inputs purchased & distributed ▪ Number of trials established	• Project progress & annual reports	• Funds are available timely. • Farmers co-operate • Platform for stakeholders remains in place
Inputs/Resources: ▪ Farmer resources(land, labour) ▪ Seeds ▪ Polybags • Resource persons	• Project inputs and allowances provided.	• Reports	• Effective linkages/collaboration exist between stakeholders. • Logistics provided.

6.7.2 Research proposal 2

Project title: On-farm testing of coffee, spices, enset and maize cultivars

Executing Agencies: Jimma Agricultural Research Centre (JARC) and the Department of Agriculture, Bonga.

Project Team:

- Tesfaye Shimber, Coffee Agronomist/Physiologist, JARC
- Taye Kufa, Coffee Agronomist/Physiologist, JARC
- Gibramu Temesgen, Coffee breeder, JARC
- Eshetu Derso, Pathologist, JARC
- Dr. Tesfa Bogale, Field crops agronomist, JARC
- Leta Tullu, Field crops breeder, JARC
- Wondifraw Tefera, Horticulturist, JARC
- Girma HaileMicheal, Horticulturist, Tepi ARC
- Admassu Shibru, Socio-Economist, JARC
- Niguse Efa, Research-extension, JARC
- Seyum Fulas, Agronomist, DoA, Bonga
- Beshir Abdella, Extension department, DoA, Bonga

Goal: To raise the income of farmers through the use of improved crop varieties and cultural practices.

Location: Gimbo Wereda
Commencement date: September 2000
Duration: Two to four years.
Estimated total budget: 145,255 Birr
Proposed funding source: JARC and SUPAK-S (through DOA)

Background and Justification

The ICRA/EARO study revealed that most of the farmers rely on local crop varieties often produced under their own management practices, which contributes to the low crop productivity in the area. The local materials, especially the late maturing varieties are not suitable to farming practices especially double cropping practices because of changes in weather conditions. Increase in population has resulted into shortage of arable land, which is aggravated by the fact that expansion into the natural forests is restricted. Given the fixed nature of their land holdings, the alternative is for farmers to increase productivity, which is dependent on such factors as crop types, soil fertility status, pest and disease prevalence, and other socio-economic conditions.

Research has generated and recommended improved technologies (IAR, 1996). This is particularly the case of field crops (Tilahun and Tesfa, 1998), spices production (Edossa, 1998) and on coffee (Yacob *et al.*, 1996). However, these remain largely out of farmer's reach.

Therefore, links between agricultural research institutes and their clients-farmers and technology transfer agencies are vital for successful technology development and delivery. More over, direct links with farmers, developed through on-farm research ensure relevance and rapid feedback (Merrill-Sands and Kalmowitz, 1990).

This proposal therefore seeks to undertake to evaluate the performance of improved maize, coffee, spices and *enset* production technologies under farmers' conditions, especially in the traditional mixed cropping practices predominant in the area (Westphal, 1975)

Specific Objectives

- To test the already available improved technologies (varieties and management practices) under farmer's conditions
- To generate on-farm client-oriented research recommendations to guide research, policy and extension.

Methodology

Surveys and literature review will form an integral part of the activities during the first year. Crop varieties and management practices (for coffee, monitoring & evaluation of DOA supplied cultivars; maize-pepper double cropping systems) will be evaluated under farmer's conditions. Collaborating farmers will be selected from each identified zone, farming system and farm type by through an informal survey. Farmers will be selected to conform to the recommendation domains that include groups of farmers who farm similar types of land, crop and have access to similar resources and thus relatively potential users of the same recommendations. FMFI trials will be the focus of this study, and will involve FRGs. All the improved treatments will be compared against farmers' practices and their full involvement will be ensured as elaborated above in proposal I.

Part I: Crop varieties

- Coffee (disease resistant and high yielding
- Cardamon, ginger and turmeric (for adaptation, yield and quality)
- *Enset* (disease resistant and adaptable varieties)
- Maize (early and medium maturing)

Part II: Management practices

- Maize-bean intercropping/relay cropping
- Sequential cropping/double cropping of maize (with pepper)
- Intercropping young coffee with enset and/or spices

Data to be collected

- Growth and yield parameters
- Comparative costs (labour and other inputs)
- Farmers evaluation criteria.

References

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Table 6.5 Research Proposal 2: Estimated Budget (Birr) by year

Particulars	Year 1	Year 2	Year 3	Year 4	Total
Equipment Planting material	4,000	4,200	4,410	4,630	17,240
Manpower Allowances	21,600	22, 680	23,814	25,005	93,099
Transport Fuel Vehicle maintenance	5,000	5,320	5,512	5,788	21,620
Sub-Total	30,600	32,200	33,736	35,423	131,959
Contingency (10 %)	3,060	3,320	3,374	3,542	13,296
Total	**33,660**	**35,520**	**37,110**	**38,965**	**145,255**

Table 6.6 Research proposal 2: Logical framework

Narrative summary	Objectively verifiable indicators	Means of verification	Assumptions
Goal: • Raise farmers' incomes through the use of improved crop production technologies.	• Increased contribution of coffee, maize, spices and enset to household income by at least 20% by the end of the project • Increase in acreage under coffee, spices and enset by xx % by the end of the project	• Central statistical authority and KSZ-Statistical Abstract • National census figures	
Purpose: • Increased use of improved coffee, maize, spices and enset technologies.	• Increase in the number of farmers using these technologies by xx % by the year 2004.	• Report on adoption	
Outputs: • Suitable improved cultivars selected and recommended • Complementary cropping systems identified and recommended.	• List of recommendations made available to farmers.	• Progress reports and annual reports	
Activities: • Survey, literature review • Farmer and site selection • Formation of Farmer Research Group • Farmer/DA training • Purchase & distribution of inputs • Establishment of trials • Monitoring and evaluation • Data collection, analysis and report write up	• Number of farmers participating • Number of FRG formed • Inputs purchased & distributed • Number of trials established	• Project progress & annual reports	• Funds are available timely. • Farmers co-operate • Platform for stakeholders remains in place
Inputs/Resources: • Farmer resources (land, labour) • Seeds, other planting materials • Resource persons	• Project inputs and allowances provided.	• Reports	• Effective linkages/collaboration exist between stakeholders. • Logistics provided.

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APPENDICES

Appendix 1 Terms of reference (TOR)

Institutional framework

The field study will be carried out as a joint activity of the zonal Kafa-Sheka administrative council in the South Nations, Nationalities and People (SNNP) Region, the Sustainable Poverty Alleviation project in the zone (SUPAK-S), Department of Agriculture (DOA) and Planning and Economic Development Department (PEDD) of the zone, Jima Agricultural Research Centre (JARC), The Ethiopian Agricultural Research Organisation (EARO) and the International Centre for development oriented Research in Agriculture (ICRA). The Zonal Administrative Council of Kafa-Sheka, SUPAK-S and the JARC will host it.

The JARC has a national mandate for coffee and spices research in Ethiopia. The centre also collaborates with eight other national research programmes. It has four sub-centres and four testing sites, with a total number of research staff of 2 PhD, 16 MSc, 21 BSc and 37 Diploma holders.

Period

The field study will be conducted from 9 April to 9 July 2000. Data collection will cover about 5-6 weeks. The rest of the period will be allocated to data processing and analysis, scaling up of the results, organisation of workshops (for presentation and scaling-up of results) and the writing of draft and final reports

Topic of the study

Towards Sustainable Natural Resource Management in the Farming Systems of Kafa-Sheka Zone in Ethiopia: Constraints and Opportunities for Research and Development

Justification

The Kafa-Sheka Zone has been and is still known for its forest cover, forest products and spontaneously growing coffee and spices. However, the area covered by forests is decreasing, probably because of population pressure (incl. new settlements), agricultural commercial investments (e.g. tea and coffee estates) and expansion of crop production. This practice may not only contribute to changing climatic conditions, but it may also seriously damage the genetic diversity of flora and fauna living within the ecosystem (genetic erosion).

Hence, an attempt has been made by the government to control the process of deforestation and conduct afforestation programmes on open and marginal lands. However, this attempt has not been as successful as intended and the misuse and clearing of the vegetation cover is rather becoming an increasingly serious issue in the area.
As the livelihood of the farmers living in the forest areas directly or indirectly depends on forest products, there is a need to develop strategies to plan and manage the available natural forest resources on a sustainable basis. However, sustainable management of natural resources is of equal importance in the already cleared and cultivated areas. An integrated approach taken into account the diversity of problems and opportunities in the area is called for.

There appears to be a large difference in natural resource and agricultural management practices between farmers living in traditionally settled areas and those living in newly settled areas. The new settlers have introduced different cropping systems (more cereal-based). As their cereal-plough system is less compatible with agro-forestry practices, deforestation seems to occur more rapidly in the newly settled areas.
Natural resource management and agro-forestry practices such as the management of traditional forest produce (wild coffee and spices) and the cultivation of coffee, fruit trees, root crops or enset, are much better integrated into the systems of the traditional inhabitants.

However, nowadays the differences between the two systems are not so clear cut anymore as many transitions are developing. So, it is better to consider current systems to operate somewhere on a deforestation scale that runs from a natural forest area (gatherers/hunters) to a completely deforested area (farmers in the maize belt).

Geographical area and target population

Geographical area

The study will be conducted in Kafa-Sheka Zone of SNNP Regional State. It will cover Ghimbo Wereda, 23 km from Bonga (105 km from Jima town), the main town of the zone. The wereda is known for its distinct agricultural potential and is characterised by forest-coffee-cereal/ livestock-based farming systems.

Conventionally, the zone is divided into three major climatic zones. These comprise "Dega" (cold, 2500-3000 m.a.s.l.), "Weina-Dega" (semi-cold, 1500-2500 m.a.s.l.) and "Kolla" (hot, 500-1500 m.a.s.l.). The larger part of the area is situated at altitudes between 1500 and 2500m and, consequently, enjoys a favourable and moderate "Weina-Dega" climate. The majority of the people live in, or adjacent to, this favourable "Weina-Dega" thermal zone. Available information indicates that average annual temperature varies from 16 to 20 °C while mean annual rainfall ranges between 1,600 and 2,200 mm. The relief of the area comprises steep slopes and mountainous terrain that favours erosion in case the land is not properly managed. It is quite obvious that the area is relatively richly endowed with natural forest cover, forest products and spontaneously growing coffee and spices. However, forests are under pressure as a result of uncontrolled fire, fuel wood extraction, timber production and steady extension of crop cultivation area. In addition to the regular growth of population in the area, the development of new settlement schemes and the planning/promotion of agricultural investment schemes (e.g. tea estates) in the Zone have aggravated deforestation.

Farmers in the study wereda are practising agriculture in a variety of farming systems. As explained before cultural preferences (ethnic background) and the situation on the deforestation scale are major determining factors. Crops and livestock play a dominant role in some of the farming systems, but in other farming systems the collection of forest produce still plays a dominant role. In current cropping systems several crops in different combinations play a role; the main crops are: cereals (teff, maize, wheat, barley, finger millet, sorghum), legumes (haricot and horse beans), coffee, enset and a number of minor crops (e.g. root crops). Main sources of cash income include: sale of animals and their by-products; sale of cereal produce (mainly maize grain); extraction of fuel wood from natural forests; production of charcoal and timber from natural forests; and the collection of non-timber forest products such as wild coffee, spices (e.g. Korarima) and honey.

Site selection

The team will be based at Bonga town. The selected wereda, Ghimbo (with Ufa as capital at 23 km distance from Bonga) is accessible via an all weather road. The Ghimbo sites to be surveyed are concentrated within a radius of less than 50 km from Bonga town. These sites have been purposely selected to represent the different farming systems in the area. The situation on the scale of deforestation was an important criterion in the selection process. Each site has a specific farming system where households combine and manage the three components of the agricultural production system (viz. crop cultivation, livestock production and forest produce collection/farming) in a different way. The importance of the ethnic background of households in determining the way they manage the three different components of the agricultural production system has not yet been quantified. It may be that differences between villages are far more important than differences within villages due to the presence of different ethnical groups (settler villages versus villages with mainly traditional inhabitants). But the opposite may be true as well in villages were different ethnic groups of traditional inhabitants are living together each having a specific task or niche to sustain its livelihood.

The rural population of the Ghimbo wereda is estimated to be 88,000 persons with 20,900 households organized in 28 Peasant Associations (PAs). As explained above, a household may be involved in forest farming (in a shared large forest area and/or in individual forest patches) and in agriculture on previously farmed land and/or on cleared former forest land. Such a practice is common around Bonga town (PAs on the road from Bonga to Wushwush or to the west and to Diri town to the east). However, there are also crop dominated systems involving a variety of crops grown around homesteads and on larger open fields sometimes adjacent to small forest patches (PAs on the road from Diri to Ufa town and then to Boginda forest area including settlement sites). In addition a cereal-dominated system (especially maize) exists (PAs in the maize belt from Diri to Gojeb project).

The field study will focus on six PAs in Ghimbo and its surrounding areas representing the above mentioned different farming systems. It is important to realize that these sites were selected to represent areas along a scale of deforestation.

The PAs suggested by the TOR Task Force (with representatives of the zonal DOA, PEDD, SUPAK-S and JARC) are:

- Yeibito: for forest farming systems
- Wushwush: for forest farming systems
- Awasho: for the coffee-based farming system (although the PA is in Decha Woreda, the site is only at 5 km distance from Bonga town)
- Sheika: for the enset dominated system
- Zingaj: for the mixed cropping system
- Shombakecheb: for the cereal dominated system in the maize belt

The field study team will identify two representative villages from each PA. For scaling up (extrapolation) of the survey results, the team may also wish to visit a few selected PAs in Chena and Decha Weredas. These Weredas are adjacent to Ghimbo, accessible from Bonga town and within a 50-km radius.

Target group selection

The study will focus on the livelihood systems of smallholders.

As explained before there are substantial differences in farming systems within the target area. How this heterogeneity is related to differences in ethnic background is yet unclear. Based on secondary data, field reconnaissance and detailed studies in the selected representative sites, the team may decide to sub-divide the target population in more homogeneous categories of households (development of a farm typology). If circumstances demand, the team may focus its study on a selected number of categories within the developed farm typology.

Team composition

The field study team will be composed of 5 researchers; 2 Ethiopians (one from JARC and the other from zonal DOA) and 3 expatriates. The Ethiopians will be specialist in agronomy (from JARC) and in livestock production (from zonal DOA as the study area is known specially for its local Bonga breeds of sheep and bee keeping).

The expatriates in the group will have a different disciplinary background, preferably a socio-economist, a natural resource management specialist and a forest management/tree crop specialist.

Objectives of the study and expected results

The following objectives are to be achieved by this field study:

- To assess the possible causes associated with the increasing rate of deforestation or reduction in the natural forest cover
- To identify and analyse the farming systems of Ghimbo Wereda in Kafa-Sheka Zone focusing on differences in their potential to incorporate sustainable natural resource management practices (e.g. agro-forestry) and taking indigenous traditional practices and existing conditions strongly into account.
- To identify constraints and opportunities for a more sustainable management of natural resources in the farming systems of the study area.
- To analyse and prioritise R & D options and develop participatory research proposals for sustainable NRM in farming systems to be implemented by government institutions (e.g. DoA, JARC) in collaboration with NGOs (e.g. SUPAK-s, FARM Africa) and farmers in the field study area
- To formulate recommendations for participatory sustainable management of the available natural forest resources in the Wereda and Zone.

Main guiding questions and expected outputs

The main guiding questions on which the field study will focus and the related outputs that will be produced in response to these questions are presented in the following table:

Guiding questions	Outputs
Clarifying development context and identifying stakeholders	
What is the broader development context of the central theme? Who are the stakeholders involved and what are their interventions and linkages in these systems?	"Rich picture" on the forest and agricultural production and management systems in the target area List of stakeholders and their interests, concerns and linkages
Within this broader context, what is the relevant system of interest that the team will study in detail? How can it be demarcated?	Definition of the relevant system of interest based on the above analysis Criteria and indicators for demarcation
Analyzing the system of interest	
Is there a relationship between differences in the original natural environment and the existence of current farming systems What farming systems are existing in the target area? How have the farming systems changed? What are the major factors influencing these changes? How are these farming systems likely to change in the future? What types of sustainable and non-sustainable natural resource management practices are existing within each of the current farming systems Which of these practices can be influenced or changed and can become leverage points for R&D interventions that contribute towards a more sustainable management of natural resources? Is there a generally accepted field typology (used by farmers in relation to e.g. toposequence or land use type) in the target area that can help to better target the R&D interventions	Maps to compare Agro-ecology with current Farming Systems Farming systems' description and zonation map Timelines of changes Analysis of factors influencing past and future changes Outlook into the future? Description and analysis of current NRM practices per system. Diagrams indicating the leverage points for each farming system separately and showing the differences in leverage points between farming systems Analysis and description of local field typology for better targeting of R&D recommendations
How strong is the relationship between ethnic group and the farming system it practises? Do additional differences (e.g. access to resources, oxen, land) between farms within a farming system or ethnic group call for different R&D interventions regarding NRM practices?	Initial farm typology within or between villages Refinement of the farm typology Differentiation (if required) of the leverage points for R&D interventions according to farm types identified
What (opportunity) costs and benefits are involved in the proposed NRM practices in tree crops, other crops and animals in the different farm production systems? Who 'pay(s)' those costs and to whom do the benefits accrue? How do farmers' objectives and costs and benefits and their distribution within the household and between households influence the decision making process regarding sustainable NRM practices	Matrix showing costs and benefits (and balance between these) for different farm types Matrix showing the effect of objectives, and intra- and inter-household distribution of costs/benefits on the decisions regarding NRM Refined farm typology (if required)
Identifying, screening and prioritizing Research & Development options	
What are the research & development options for a more sustainable management of natural resources in the identified farming systems and farm types? What are their potential effects on social equity, environmental sustainability and economic competitiveness? What options should have the highest priority What criteria should be used to determine the feasibility of these options? Who are the stakeholders necessary for implementation of these options?	"Future R&D scenarios" Checklist grid and stakeholder pay off matrix Matrix showing criteria, weights and values used to rank feasibility by order of priority for research & development Prioritized list of research and development options
Formulating research and development proposals	
How can the Department of Agriculture (DOA) and the Planning and Economic Development Department (PEDD) of the Zone and the Jima Agricultural Research Centre (JARC/EARO) with the assistance of SUPAK-S start a collaborative effort to increase the contribution and effectiveness of their joint research and development efforts in relation to NRM issues in the local farming systems. On what priority NRM issues should the collaboration focus? How can the collaborative effort be best organized?	R&D proposals (with logical frameworks) to shape and focus further collaboration

Form of the final product

Before leaving the country, the team will produce and hand over a report with an executive summary, an abstract and a main text of not more than 100 pages including figures and tables. This report will be submitted to the various stakeholders directly or indirectly involved in the field study and to the host institutions.

Other interested institutions

Besides those institutions listed in section 1 (institutional framework), other parties which are likely to benefit from the field study and use its results are the Regional Bureau of Agriculture and NGOs operating in the study area, such as SUPAK-S, KaShFoP, FARM Africa/FARM Ethiopia. The team will interact with these institutions in all phases of the field study.

Specifically the 'Kafa-Sheka Forest Project (KaShFoP)' is supporting stakeholders at a community level to organise and develop capacity (new knowledge and skills) to plan and manage forest resources based on the interest of the different stakeholder groups in the area. The zonal DOA implements the project with technical support from FARM Ethiopia (FARM Africa).

A list of major research programmes and development efforts to which the field study is relevant includes:

- Enset improvement program
- Maize improvement program
- Teff improvement program
- Root crops improvement program
- Pulse crops improvement program
- Forest and minor forest products improvement program
- Fruits and vegetables improvement program
- Coffee and spices conservation and improvement program that focus on wild grown and traditionally managed stands
- Plantation coffee improvement program
- Poultry improvement program
- Dairy cattle improvement program
- Bonga sheep breed improvement program
- Fodder conservation and improvement program
- Natural Resource Management and its sustainable utilisation (for both shared large areas with forest and individual forest patches)

Field study process

Upon arrival in Ethiopia, the team will present its field study plan at a joint meeting of JARC, EARO Head Quarter and Regional Bureau of Agriculture for SNNP in Addis and at introductory workshops in Jima (involving JARC) and Bonga (involving Kafa-Sheka Zone DOA and PEDD as well as NGOs operating in the target area). The responsible ICRA National Coordinator and Regional Facilitator (Dr. Aberra Deressa and Ato Tesfaye Shimber, respectively) will assist the team in organising the presentations and in the incorporation of useful comments in the field study plan.

At the mid-term workshop, involving farmers, researchers from JARC, ICRA reviewer and representatives of Kafa-Sheka zonal administrative council, DOA, PEDD and NGOs active in the zone, the team will present a brief report of its findings including the methodology it has used and various options of issues on which the team could focus in the second phase of its study.

Final results of the field study will be discussed at the final workshop (at JARC) involving the same audience as that of the mid-term workshop and some other invited guests from the Regional Bureau of SNNP. This workshop will be held approximately 10 days before the end of the field study to allow incorporation of useful comments into the final version of the report before the team leaves Ethiopia. An international expert appointed by ICRA will review the field study in two visits of approximately 10 days each. The first visit will be after 5-6 weeks in the field to participate in the fieldwork and in the analysis of first findings. The second visit will be scheduled to assist the team in organising the report and conducting the final workshop. The final report will be ready and submitted before the team leaves Ethiopia.

Field study responsibility

The team is collectively responsible to JARC, Zonal Administrative Council, EARO and ICRA for respecting the terms of reference. The team will maintain regular contacts with the ICRA National Coordinator and Regional Facilitator based at Melkassa and Jima Agricultural Research Centres, respectively. One of the Ethiopian participants in the team will be the team's liaison officer for Ethiopian institutions. The Zonal Administrative Council and EARO/JARC will each appoint a contact person for the interaction with the team.

The team is expected to manage its own affair. Within the limits specified in the TOR and in the budget, the team is free to decide its own approach, methodology, tools and work programme as well as the way how it makes use of resources provided for the field study. Important questions concerning the TOR arising during the implementation of the field study will be immediately clarified in a discussion with the ICRA National Coordinator and Regional Facilitator and the contact persons in the zonal council and JARC/ EARO.

Means

ICRA, EARO, JARC and Zonal Administrative Council (SUPAK-S, ZDOA, ZPEDD) are responsible for the provision of to the team the means specified in the Memorandum of Understanding (MOU). In addition, these institutions will provide the team with the required secondary data, reference materials and long term trial results upon request during the course of the field study.

Appendix 2 List of participants at introductory workshop, EARO Headquarters, Addis Ababa, 10 April 2000 (All are EARO Staff)

NAME	DISCIPLINE/POSITION
• Kedir Nefo	• Agronomist
• Girma Taye	• Biometrician
• Tilahun Zenedah	• Agricultural Biotechnology
• Tesfaye Shimber	• Agronomist
• Fantahun Abegaz	• Soil and water
• Engida Mersha	• Agro-meteorologist
• Abebe Kirub	• Information Services
• Dr. Demese Chanyalew	**Project Planning**
• Dr. Paulos Dubale	• Director, Soil and water research
• Tesfaye Zegeye	• Agricultural Economist
• Dr. Geletu Bejiga	• Plant Breeder
• Dr. Aberra Derresa	• ICRA Coordinator
• Dr. Aberra Debelo	• Deputy Director General, EARO
• Dr. Seifu Ketema	• Director General, EARO
• Dr. Kidane Georgis	• Director, Dryland Agronomy
• Dr. Zinash Shileshi	• Livestock Research Director

Appendix 3 List of participants, introductory workshop, Jimma Agricultural Research Centre (JARC), Jimma, 13 April 2000. (All are staff of JARC)

NAME	DISCIPLINE/POSITION
• Gibramu Temesgen	• Coffee Breeding
• Windyifraw Tefera	• Horticulture
• Paulos Desalegn	• Agricultural Economics
• Endale Taye	• Agronomy/Physiology
• Admasu Shibru	• Socio-economist
• Girma Adugna	• Pathology
• Amsalu Nebiyu	• Horticulture
• Negussie Efa	• Extension
• Solomon Endris	• Soil and water management
• Mohammed Worku	• Coffee Agronomy
• Mesfin Kebede	• Coffee Agronomy
• Dr. Tesfa Bogale	• Field crops Agronomy
• Welde Michael Woelore	• Coffee processing
• Alemseged Yilma	• Coffee Agronomy/physiology

Appendix 4 List of participants at introductory workshop, Bonga, 17 April 2000

NAME	ORGANISATION	POSITION
• Gonfu Getachew	• Dept. of Agriculture (DOA)	• Acting Head
• Gezahegn Petros	• Farm Africa	• Project Sociologist
• Dirk Hoeustra	• SUPAKS	• Senior Advisor
• Wondwosel Terefe	• ZOPED	• Senior Officer
• Tahir Smahili	• ZOPED	• Senior Officer
• Alemuyehu Alemu	• DOA	• Acting Head
• Engida Mekonnen	• DOA	• Expert
• Seyoum Fulas	• DOA	• Agronomist
• Bishaw Woldeyohannes	• Zonal Council	• Advisor
• Firehiwot Getahun	• Zonal council	• Advisor
• Yonas Abate	• ZOPED	• Head

Appendix 5 List of participants, mid-term workshop, Bonga

NAME	INSTITUTION	POSITION
• Girma Hailemichael	• EARO, Tepi	• Centre Manager
• Wondyifraw Tefera	• JARC	• Head, Horticulture Division
• Girma Adugna	• JARC	• Pathologist
• Wondwosen Tefera	• ZOPEDD	• Agric. Engineer
• Frehiwet Getahun	• Zonal Admin. Council	• Administrator
• Moses Tekle	• DOA	
• Agdew Bekele	• DOA	• Coffee Agronomist
• Gezahegm Petros	• FARM Africa	• Sociologist
• Dirk Hoekstra	• SUKAK-S	• Senior Advisor
• Tahir Satil	• ZOPEDD	• Economist
• Beshir Abdella	• DOA	• Extension Co-ordinator
• Tadesse Eshetu	• JARC	• Weed scientist
• Teame Gebrezgi	• JARC	• Pathologist
• Driek Enserink	• ICRA-Reviewer	• ICRA – Senior Officer
• Yonas Abate	• ZOPEDD/SUPAK-S	• Head
• Tesfaye Shimber	• JARC	• Coordinator, Coffee &Spices
• Ayalneh Abawa	• Co-operative Office	• Head, Planning
• Alemayehu G\Silasei	• DOA	• Head

Appendix 6 List of participants, final workshop, Bonga

Name	Institution	Position
▪ Wondyifraw Tefera	▪ JARC	▪ Head, Horticulture
▪ Negussie Efa	▪ JARC	▪ Head, RED
▪ Zebene Mikru	▪ JARC	▪ Head, Soils & water
▪ Admasu Shibru	▪ JARC	▪ Head, Socio-economics
▪ Girma H/Michael	▪ Tepi Research Centre	▪ Centre Manager
▪ Asrat Mekuria	▪ DOA	▪ Head, Decha woreda
▪ Yonas Abate	▪ ZOPEDD	▪ Head
▪ Aberra Deressa	▪ EARO	▪ National ICRA coordinator
▪ Moges Tekle	▪ DOA	▪ Specialist
▪ Bishaw W/yohannes	▪ KSZ Council	▪ Advisor
▪ Tesfaye W/Michael	▪ KSZ	▪ Head
▪ Tesfaye Shimber	▪ JARC	▪ Team Leader
▪ Dirk Hoeustra	▪ SUPAKS	▪ Senior Advisor
▪ W/Gebriel Irago	▪ DOA	▪ Specialist
▪ Moses Tekle	▪ DOA	▪ Specialist
▪ W/Gebriel Irago	▪ DOA	▪ Specialist
▪ Daniel Dauro	▪ Awasa Research Centre	▪ Centre Manager
▪ Habtamu Argaw	▪ SUPAK-S	▪ Public Health Advisor
▪ Endrias Geta	▪ Areka Research Centre	▪ Centre Manager
▪ Driek Enserink	▪ ICRA	▪ Senior Officer
▪ Beshir Abdella	▪ DOA	▪ Extension Co-ordinator

Appendix 7 Yields of major crops, KSZ (1997-2000)

Crop	Altitude (m.a.s.l)	N°. of farmers	Av. Yield (kg/ha)
Maize	1100-2400	166	6500
Teff	1400-2800	168	800
Wheat	1800-2800	136	2600

Source: DOA On-farm trials records, Bonga.

Appendix 8 Checklist used during reconnaissance and in-depth studies

Questions for Policy Makers

- What are the policies of EARO for the promotion of Sustainable NRM in KSZ?
- What are the land policies of the government as they affect KSZ?
- How do these policies influence NRM in KSZ?
- What are the objectives of the investment schemes of the Government?
- What changes do you foresee in the farming systems of KSZ in future?
- In what ways have land tenure arrangements affected farmers' attitudes towards NRM in KSZ?
- If these attitudes are not positive, what efforts are being made to ensure that farmers have security of the lands on which they work (like title deeds)?

Questions for Researchers

- What have been the research interventions in the KSZ in the last 5 years?
- What are the main problems of farmers in the KSZ?
- What has been the role of researchers in addressing these problems?
- What distinct farming systems are identifiable within KSZ?
- What changes, if any, have taken place in the farming systems of KSZ over the years?
- What changes do you foresee in the farming systems of KSZ in future?
- What linkage mechanisms exist between researchers and farmers and extensionists/extension and NGOs?
- What is the relationship between indigenous farmers and settlers in KSZ?
- What cultural farm practices could result in land degradation?
- What farm practices being practised by farmers enhance sustainable resource management?
- How can farmers raise their incomes without causing land or environmental degradation?
- How can sustainable NRM be attained in KSZ?

Questions for Extensionists/Extension Organisations/NGO's

- What are the major farm enterprises in KSZ?
- What are the main problems of farmers of KSZ?
- What technologies are you promoting in KSZ?
- What difficulties do you have in working with farmers?
- What has been the impact of the investment schemes (tea, coffee) on farmers and on the environment in KSZ?
- Do you provide any form of credit scheme for farmers in KSZ? Explain
- Are the different ethnic groups in KSZ engaged in different farm enterprises? If this is the case, how does the different activities influence NRM?
- What has been the relationship between indigenous farmers and settlers in KSZ?
- What is the relationship between your organisation and potential investors interested in NRM in KSZ?
- In your opinion, why is the area under forest in KSZ declining?
- How can the rapid deforestation being witnessed in KSZ be halted?
- What role is extension/your organisation playing in the promotion of sustainable NRM in KSZ?

Checklist used for interviewing farmers

1. Objectives

- What are your objectives as a farmer? (That is, what do you hope to get out of farming?)
- Have these objectives change in the last 10 years? How?

2. Farming

- What is the average size of your land?
- Do you have ownership right (title deed) to your land?
- What crops do you grow? When?
- Area under each crop?
- Where do you obtain your planting materials?
- Have you introduced new crops or varieties into your cropping system in the last 5 years?
- How do you prepare the land to plant your crops?
- Has the way you prepare your land and grow your crops change in the last 10 years? If yes, how?
- What factors are responsible for these changes?
- If there have been no changes, do you expect changes in the next 10 years? Why?
- How do you think the way you grow crops will change in the next 10 years?
- Do you have livestock? If yes, what type of livestock and for what reasons are they kept?
- Do you keep bees? How do you keep them?

3. Natural Resource Management

- What farm practices promote proper management of the soil?
- What farm practices are harmful for the proper management of the soil?
- How do you maintain the fertility of your soil?
- If you do not have title deed to your land, how does this affect your attitude towards management of the land? Explain.
- Do you see deforestation as a problem in the area? If this is the case,
- Who is responsible for the rapid reduction in the forest area of KSZ?
- How can this trend be reversed?
- What will be the role of farmers in such a process?

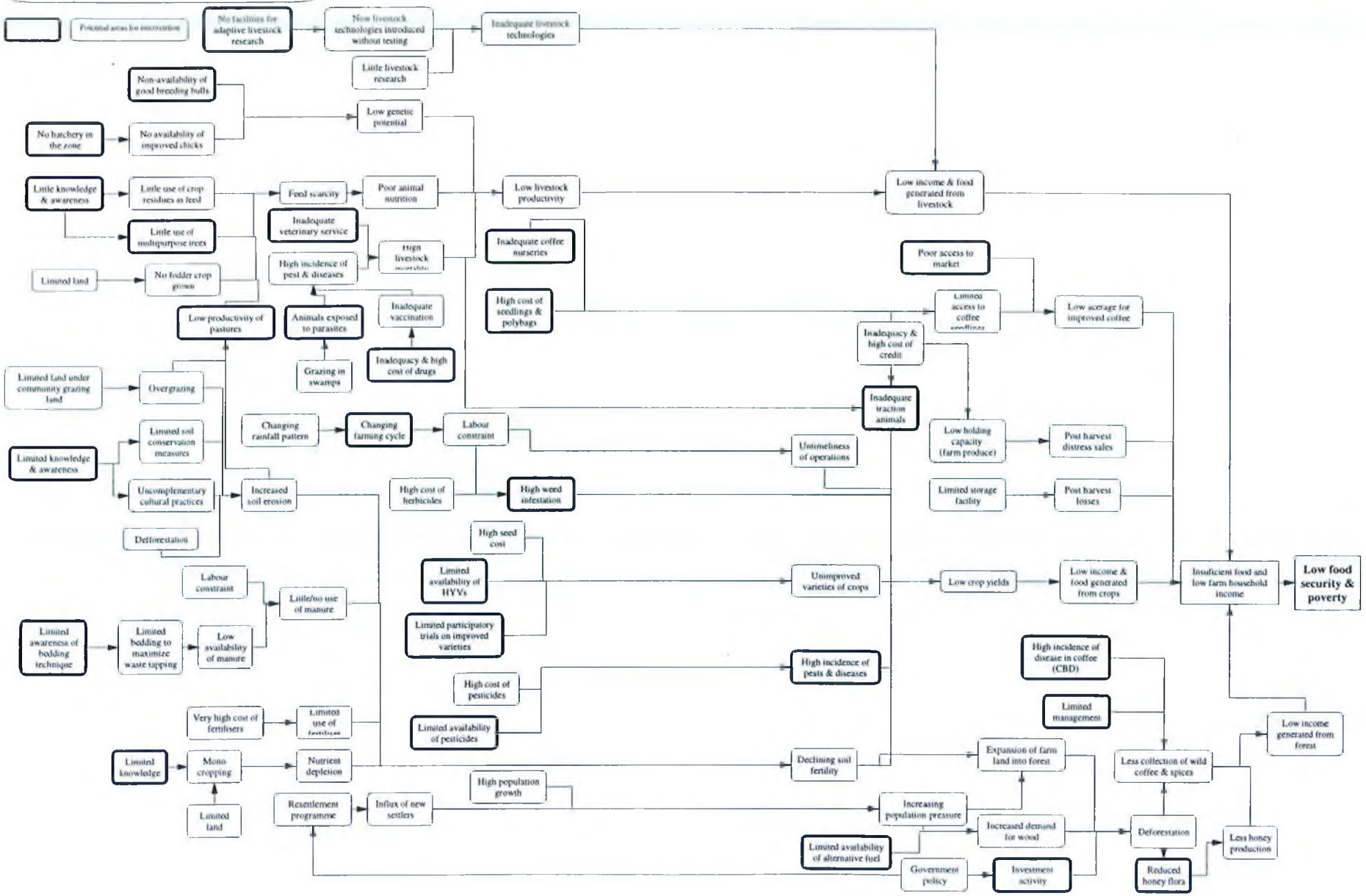
4. Credit and Marketing

- Where do you obtain credit for investment activities in your farm?
- What is the cost of obtaining such credit?
- Where do you market your farm produce?
- How do you sell your farm produce?
- What problems do you face trying to market your farm produce?

5. Problems

- What problem do you have as a farmer and how can these be solved?
- If you have problems on your farm, whom do you go to for assistance?
- Have you received any form of assistance from researchers, extensionists or NGOs? If yes, what form was it?
- What do you expect researchers/extensionists to do to address the problems you face?

APPENDIX 9: PROBLEM CAUSAL TREE



APPENDIX 10 REFLECTIONS

Introduction

These reflections express team's feelings throughout the whole seven-month ICRA training programme. The emphasis, however, is on the planning phase carried out in Wageningen, The Netherlands, and on the fieldwork conducted in Gimbo Woreda, Kafa-Sheka Zone, Ethiopia.

Reflections on the planning phase

It is not the team's intention to describe exhaustively the different tools and methods used from the beginning of the training programme, rather to explain the team's feelings regarding the usefulness of them through the phases where they were applied on. The team members, although not in every way, agree that one of the shortcomings of the knowledge acquisition phase was the poor feed back of the prestigious resource persons on the outputs of the various assignments and presentations in workshops. ICRA participants expected more feed back about errors committed during preparation and presentation of outputs and on clarifications of the assignments' objectives.

The effectiveness of the team's organisation phase was tested when the team began to develop its work plan three weeks before travel to Ethiopia. The team developed appropriately and on time its team contract, work plan, proposed outline, milestones, and other important elements to be used during the field study. It was the first team in accomplishing its task during the preparatory phase. Even the reviewer pointed out, after his first visit to Bonga that the reason why team either did not have delayed works or needed to be put on track, was its strong and adequately developed preparatory phase.

Tools like system analysis, rich picture, stakeholders' analysis and others were also timely utilised by the team. This was reflected during the team's presentation (first workshop) of its work plan to the research institutes (EARO and JARC) and other organisations like ZOPED-SUPAK-S and DOA during the first week of the team's stay in Ethiopia. The team used most of the tools taught during the knowledge acquisition phase in the field study, except few methods of screening and prioritisation which have the same objectives than the ones used by the team.

The ARD procedure in general was well assimilated by the team during the first and second phases of the training programme. This good understanding was reflected on the fieldwork, otherwise the outcomes presented in this report would have not been possible to achieve.

Reflections on the Field Work

With regard to the importance and seriousness of the field study, one of the ICRA staff stated: *team has the right to make mistakes during the knowledge acquisition phase but during the field work the team will not have the right to make mistakes*. This message was deeply comprehended by the team from the beginning, and if mistakes were committed, they were so negligible that they could not affect the team's outputs. Since the beginning of the field study, the team not only worked in unity but also put all its members' skills and professional experience into the field work. Most of the activities, planned during preparatory phase were attained, beginning from the first week upon arrival in Addis Ababa till the last day in Bonga.

The crucial testing moment of the team's cohesion was during the in-depth study (primary data collection). Fortunately it was overcome without major problems and the information collected was timely analysed by utilising data sheets. Screening of data and irrelevant information was successfully conducted with the data sheets. The team focused on the system of interest to avoid getting off track and to narrow down the multiple research, development and research and development options.

The quantity and quality of the collected information was equally balanced by using both approaches: soft systems methodologies (SSM) and hard methodologies. The latter was used only to satisfy the clients' expectations of quantitative outcomes. Task division was the key to achieve outputs within the team. The team members' expertise in different fields (social, economic, agronomic, livestock husbandry and natural resource management) and computer matters were appropriately exploited. Writing up the several chapters of the report was favoured and facilitated by the previous experience of team members in writing reports and papers at their working places. Positive attitude and social contact were widely applied by the team to obtain feed back and strengthen relationship with key stakeholders. Strong respect for the team contract was another key point to avoid potential conflicts during fieldwork. The team facilitator fostered openness and communication between team members. Group meetings were periodically held and all kind of issues were often included to avoid future misunderstandings.

The analysis of results was also divided although team members' initiative was not excluded. Exchange of drafts was a rule and all team members were assigned and encouraged to put their comments, observations and opinion on the drafts. Team members were allowed to relax but deadlines were usually not overlooked and due to the team members' professional attitude drafts were well done and finished on time.

The field study has been a very difficult objective to achieve because of family separation, cultural differences (for expatriates) and isolation. However, it helped the team to understand the complex dynamics and interactions of farming systems in Gimbo Woreda, the constraints local farmers are dealing with, and the culture of the friendly Ethiopian people. Furthermore, beyond the ICRA training objectives and the professional output reached in this field study, the team members have gained a unique experience of working together and sharing good and bad moments. Team members will hardly have a similar experience in future because the field study was long enough to attain all the objectives originally proposed and short enough to developed a great friendship.

Conclusion

As a team we believe that the objectives of both the preparatory planning phase and the field study phase were achieved. Team members believe that whatever has been achieved during this field study and is presented in this report is a culmination of three main essential elements: *hard work, trust and respect.*

ICRA

LIST OF PUBLICATIONS

WORKING DOCUMENTS SERIES

1 Analyse du système de production agricole du territoire d'Elavanyo, Plateau de Dayes, Togo, Juin 1988 (Version française du Document de Travail no. 2)

2 An analysis of the farming system in Elavanyo Territory, Plateau de Dayes, Togo, June 1988

3 Household reproduction and community requirements: Analysis of the agroecosystem of South Chirumanzu Communal Area, Midlands Province, Zimbabwe, June 1988

4 A study of farming systems in the South-East of Bombali District Sierra Leone, June 1988

5 Coffee based farming system of Tlapacoyan, Veracruz, Mexico, July 1988

6 An analysis of the farming system in the Tarime Highlands, Tanzania: Implications for research and development, June 1989

7 Opportunities for diversification in a rainfed drought prone rice based farming system: Donchedi District, Suphan Buri Province, Thailand, June 1989

8 Population, food security and farming systems: Agricultural research and development priorities for maintaining food security of the rural population on de degraded "Terres de Barre", Togo, June 1989

9 Changing farming systems in a migrant labour economy: Masvingo South Communal Area, Masvingo Province, Zimbabwe, June 1989

10 Agricultural research and extension: a contribution to understanding of the linkages with small-scale farmers. A case study in Kumba Corridor Agro-ecological Zone, South West Province, Cameroon, July 1990

11 An analysis of agricultural and livestock production systems in Usagara Division, Tanzania, July 1990

12 Constraints to and opportunities for agricultural diversification of a rice-based farming system in the Lower-Northern Region of Thailand. Phitsanulok Province, Bang Ra Kam District, July 1990

13 Contribution à l'étude des stratégies de production dans le système agricole de la zone d'Agou, Togo, Juillet 1990

14 Productivity and sustainability of the farming systems in two upland villages of Central Java, Salitaga, Indonesia, July 1991

15 Analysis of the coffee based farming system in the Matengo Highlands, Mbinga District, Tanzania, July 1991

16 An analysis of agricultural and livestock production systems in Misungwi Division, Lake Zone, Tanzania, July 1991

17 Problématique de changement des systèmes d'exploitation agricole traditionnels dans la zone couverte par la SRD Buragane, Makamba, Burundi, Octobre 1991

18 Baisse de fertilité et crise cotonnière au Nord-Cameroun. Etude de cas des villages de Djalingo et de Mayo Dadi, Département de la Bénoué, Cameroun, Octobre 1991

19 Organisations villageoises et stratégies de production agricole dans quatre villages de la région des Savanes au Togo, Dapaong, Togo, Octobre 1991

20 Analysis of the farming system in the Hadejia Jama'are floodplain, Northern Nigeria, July 1992

21 Coming down the mountain: A study of agriculture on the slopes of Mount Kilimanjaro, Tanzania, July 1992

22 Analysis of constraints and potential for rural diversification in rainfed rice-based farming systems, Nakhon Sawan Province, Thailand, July 1992

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