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ASSISTANCE TO LAND USE PLANNING

E T H I O P I A

A R U R A L L A N D U S E P L A N
O F T H E H O S A I N A (S H E W A) A R E A

MAIN REPORT

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This technical report is one of a series of reports prepared during the course of the UNDP/FAO Project identified on the title page. The conclusions and recommendations given in the report are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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1:50 000 Land Use Plan of the Hosaina (Shewa) Area (Four Sheets)

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ABBREVIATIONS

AEZ	Agro-Ecological Zone
AIDB	Agricultural and Industrial Development Bank
AISCO	Agricultural Inputs and Supply Corporation
AMC	Agricultural Marketing Corporation
CBE	Commercial Bank of Ethiopia
CFSWCD	Community Forestry and Soil and Water Conservation Department
CSO	Central Statistical Office
DAP	Diammmonium Phosphate Phosphate
EB	Ethiopian Birr
EHRS	Ethiopian Highlands Reclamation Study
ESC	Ethiopian Seed Corporation
FLDP	Fourth Livestock Project
GOE	Government of Ethiopia
IAR	Institute of Agricultural Research
ILCA	International Livestock Centre for Africa
lw	live-weight
LUPRD	Land Use Planning and Regulatory Department
MOA	Ministry of Agriculture
N	Nitrogen
P	Phosphate
PA	Peasant Association
PADEP	Peasant Agricultural Development Programme
PC	Producer Co-Operative
SC	Service Co-Operative
T&V	Training and Visit
TLU	Tropical Livestock Unit (250 kgs lw)
TYPP	Ten Year Perspective Plan
WFP	World Food Programme

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. Background and Introduction.

1.1 The Hosaina Land Use Plan covers the third of three agro-ecologically representative areas of the Ethiopian Highlands covered by the second phase of the Assistance to Land Use Planning Project (ETH/82/010) funded jointly by UNDP and GOE with FAO as the executing agency. The area was selected to represent a high potential, densely populated, perennial crop zone with examples of extensive areas of highly degraded land.

1.2 The Plan area comprises two parts: Hosaina North (107 544 ha) and Hosaina South (122 062 ha) located in south-west Shewa astride the Ethiopian Highland Plateau and the Rift Valley. They encompass a wide range of agro-ecological zones and farming systems. In much of the area "enset" (Enset ventricosum) forms an important component in the farming systems. Because of the high carbohydrate and livestock feed output per hectare, the enset systems have been able to support extremely high human and livestock populations. However population support capacity analysis revealed a general worsening of the situation under the present high population growth rates. Currently some 141 Peasant Associations (51%) can support their population. By 1994 this number will fall to 84 (38%), and to only 18 (8%) by 2009 if the present crop, livestock, and fuelwood production methods remain unchanged. Severe land degradation has already affected 35 000 ha (35%) beyond restoration for cropping with an additional 48 000 ha at severe risk. A further 920 000 ha (40%) is susceptible to significant hazards of sheet erosion. Only 32 PAs (14%) have adequate forage supplies for their current livestock numbers. Severe shortages of fuelwood occur over much of the area with the burning of dung and crop residues which has important ramifications for maintenance of soil fertility and livestock feed.

1.3 The Plan draws upon six project documents which are records of studies made between 1983 and 1987 by the Land Use Planning and Regulatory Department on the Soils, Agro-ecology, Socio-economics, Agronomy, Livestock, and Land Evaluation. A rigorous analysis was made of the agricultural development constraints and potential; and potential interventions, improvements, technologies, and land management practices identified which might relieve the constraints and also take

advantage of the potential. Overriding considerations were that agricultural development and land usage were to be ecologically and economically sustainable, conformable, and applicable to the current individual farm systems and the community land use systems found in the Plan area; based where possible on tried and locally tested technology and practices; and that cropping, livestock, and fuelwood production be integrated as far as was possible.

2. Scope and Scale of the Land Use Plan.

2.1 The Hosaina Land Use Plan forms a comprehensive programme of activities for sustaining, intensifying, and expanding agricultural production; increasing rural incomes; and providing improved physical access to improved agricultural inputs and technology, and basic needs. The Plan sets the recommendations in a spatial rather than temporal framework. It thus differs from the conventional "project document" with its set sequence of annual activities within a defined timeframe. Whilst the Plan analyses individual components in terms of financial costs and benefits, no attempt is made to aggregate these for the project area, nor to attempt a total cost benefit analysis using efficiency prices. Whilst components are set within three orders of priority: immediate (2 years), medium term (5 years), and long term (25 years), no attempt is made to sequence these on an annual basis. In this way the Plan may be seen as a flexible "rolling" programme rather than a "Master" or "Blueprint" Plan providing a logical framework for agricultural development programming and sequencing at the sub-regional level, and for articulating and formulating detailed development plans for Service Cooperatives at the community level.

2.2 The recommendations are in most cases indicative rather than site specific. This is partly a function of the scale (1:50 000). The smallest measurable unit on the map is 1 sq.cm. which represents 25 ha on the ground. A complementary factor is the inherent complexity of the farming systems with individual farmers cultivating a number of crops in fields often only 0.2 ha in area. However the Plan area has been divided into nine Planning Zones (PZs) each homogeneous in terms of agro-ecology and farming systems, as well as being conformable with PA boundaries. Each PZ has its own set of constraints, potentials, and recommendations. This will allow users to target appropriate technologies, components, and land management practices to specific agro-ecological zones, farming systems, soil-land units, Service Cooperatives, and Peasant Associations.

3. Potential Users of the Plan.

3.1 Potential users of the Plan are the Project Management Unit of the South Shewa Conservation and Rural Development Project; the Fourth Livestock Project; Zonal, awraja, and woreda Co-Ordinators of MOA; NGO's involved in development activities at the SC level; and IAR and ADD for agricultural research planning. The Plan should also provide useful background data for social service planners, particularly in the fields of nutrition and health.

4. Development Strategies, Technologies, and Components.

4.1 The National Ten Year Perspective Plan provided the macro policy framework for the Land Use Plan. In addition the following strategies were also adopted:

(i) no fundamental changes in the short and medium term to the cropping, livestock, and land allocation systems,

(ii) implementation of the Hosaina Land Use Plan within the framework and programme of the South Shewa Rural Development Project, with components implemented by the Fourth Livestock Project, the Dairy Rehabilitation Project, and the Kale Heywot Church under the co-ordination of the SSRDP,

(iii) a phased and co-ordinated approach to implementation would be adopted with well proven and simple technology which would have the maximum impact being introduced initially, gradually introducing more complex technology as experience builds up,

(iv) the continued targeting of PCs whilst resources and improved inputs are in short supply, but with the rapid expansion of coverage to PAs as these improve,

(v) the use of labour intensive and draught power methods and technology where ever possible; the initial use of small mechanical units (mainly for processing) with the introduction of larger units only after the establishment of an awraja level mechanical capability,

(vi) the identification of as wide a range of technologies, components, and land management practices for specific improved land uses in order that individual farmers and communities can select those which will suit their own individual or communal requirements and aspirations.

4.2 Within the framework of the preferred general development strategies outlined above the specific strategies, priorities, and technologies related to individual components of the Plan were identified, tested, and evaluated. They are summarised below:

(i) increasing the availability of and access to improved crop inputs through increased and timely fertiliser supplies, seasonal credit, and local production of improved seed by selected PCs and SCs;

(ii) the intensification and risk reduction of annual rainfed cropping with a combination of short term varieties, dry seeding, intercropping, and water harvesting and conservation techniques;

(iii) the intensification of annual cropping in the upper Dega and lower Wurch zones with sequential and relay cropping of potatoes and field pea and horsebean, and possibly wheat and barley;

(iv) expansion of the area under selected cash crops (peppers, tobacco, sugar cane, ginger, sisal, and oil seeds) by combining and linking improved marketing with processing facilities;

(v) an urgent programme of enset research to identify wilt tolerant, productive, and palatable varieties, and to identify an appropriate fertiliser/manure regime to reduce manure requirements;

(vi) the design and implementation of a number of smallscale irrigation schemes in the Kolla zone of PZ 1 and the Woina Dega zone of PZ 5 to expand the area under annual crops and reduce risk;

(vii) increasing yields of current coffee planting and expanding area under trees through provision of pruning and improved husbandry advice, fertilisation, fungicide application, improved and CBD resistant varieties, and establishment of washing facilities at the SC level;

(viii) stabilisation of active land degradation, stripping, gulleying, and mass movement with physical and vegetative measures; and the productive rehabilitation through closure, grass and tree planting of existing stabilised badlands;

(ix) where communal grazing lands are restricted to cut and carry charges would be levied by the PA for such forage thereby taxing the large livestock owner;

(x) promoting the adoption of conservation-based crop husbandry methods by combining the implementation of physical conservation measures with improved crop husbandry and varieties, and the development of undersown legumes and row planted tree legumes, and the productive use of grass strips and bunds (with plants producing forage, fuel, and fruit);

(xi) implementing land improvements, in particular surface drainage on soils subject to ponding and topsoil waterlogging;

(xii) increasing reliance on manure application and undersown legumes, and decreasing reliance of chemical fertiliser for soil fertility maintenance;

(xiii) closer integration of livestock with crop production through increased use of untreated and treated crop residues, undersown and row planted legumes, increased use of manure on crops from dung saved by increased supplies of fuelwood, better nutrition with better and readily available draught power for land preparation;

(xiv) the increase of natural forage production through the institution of grazing management schemes;

(xv) the introduction of planted forage on individually owned grazing areas and controlled communal grazing and cut and carry areas;

(xvi) improved physical access through the construction of dry weather roads with community labour and minimal technical assistance;

(xvii) more equitable access to land for land short PAs by careful examination and adjustment of boundaries and possible amalgamation and redistribution of land between farmers

(xviii) a more equitable access to land by aspiring new PA members in those PAs currently not conforming to the spirit and letter of Proclamation 31 of 1975 through intervention by the Regional Peasant Association;

(xix) more equitable access to draught power for zero ox-owning farmers through targeted credit to these farmers in the main cereal producing zones where draught ox shortages occur;

(xx) improved access to water supplies through the construction of low cost and simple structures;

(xxi) improved fuel and construction wood supply for home consumption and for sale through the initial provision of seedlings and subsequent introduction of farmer-produced seedlings, for planting by individuals as field boundaries and homestead wood lots, or as communal woodlots on closed areas:

5. Plan Impact.

5.1 An analysis was made of the Plan's impact on (i) production, (ii) economics, (iii) the environment, and (iv) the social well-being of the area's inhabitants.

(a) Production

(i) Crop Production:

5.2 Estimates of incremental production of crops, forage, livestock, and fuelwood production have been made for individual components on a unit (hectare, animal, herd) basis. In a number of cases estimates were made of the potential aggregate project area incremental production using assumptions as to possible farmer or community adoption rates.

5.3 Incremental cereal yields due to (i) fertiliser and improved seed, (ii) DAP and undersown legumes (in lieu of urea) on red (non-vertic) and black (vertic) soils, and (iii) broadbeds with fertiliser on vertisols are estimated as follows:

Crop	(i) Fertiliser		(ii) DAP+Legume		(iii) Broadbeds
	red	black	red	black	black
	(kgs per hectare)				
teff	265	240	190	260	370
wheat	780	750	340	380	1090
sorghum	800	1410	440	720	1600
barley	945	150	360	315	350
maize	1015	1410	645	630	1485
Pulses	175		N/A		N/A
Oilseeds	175		N/A		N/A
chillies	400		N/A		N/A

5.4 Assuming a 70% fertiliser adoption rate across the project area with application confined to cereals, an estimated aggregate incremental cereal production of 8 000 mt would be possible. An additional 800 mt of cereals would result from the construction of broadbeds and furrows. Targeting the ox purchase credit scheme to approximately 60% of the zero ox farmers would enable an estimated 3 000 mt of additional cereals and pulses to be produced on land currently not cultivated because of the lack of ox power.

5.5 The impacts on crop production of the physical conservation measures (when implemented in conjunction with the measures above) are difficult to isolate. It is suggested that because the volcanic derived soils of the project area have relatively uniform fertility levels down the profile measurable production losses will occur only when soil losses due to erosion reduce the soil depth and thus the soil water holding capacity below a threshold value of approximately 90 cms and 60 cms for short season crops (eg teff and wheat) and 70 cms and 40 cms for long season crops (sorghum) on red (non-vertic) and black (vertic) soils respectively. Thereafter an estimated 1% annual drop in yield would occur for every 1 mm of red soil and 2 mm of black soil lossed. Bunds on red soils with slopes of 20% and an annual soil loss of 4 mm (50 mt) would reduce an annual production decline from 4% to 1.2 % assuming a bund efficiency of 70% in soil retention. Approximately 23 000 ha of crop land is below, at, or just above the critical threshold depths, indicating an estimated accumulating annual loss in crop production of 500 mt which can be prevented with physical conservation measures.

5.6 In the Kolla and drier Woina Dega Zones bunds have increased maize and teff yields by 50 % due to increased soil moisture retention, indicating a potential incremental production of 12 000 mt of maize and 3 500 mt of teff is possible.

(ii) Forage Production:

5.7 The potential per unit annual forage production from the various improved technologies and management practices are estimated as follows:

Tree Legumes:

- 0.5 mt per ha
- 50 kgs per 100 m
- 10 m spaced alley system
- 1 m wide strip as field boundary, strip, bund, or terrace

Undersown Legumes:

- 0.5 mt per ha	- from legume
- 1.3 mt per ha	- increased maize/sorghum residues*
- 0.5 mt per ha	- increased wheat/barley residues*

(* due to increased soil N)

Crop Residues:

- increase in residues proportional to increase in grain yields due to fertiliser, drainage, etc

Grazing Management:

- Unused cropland	- 40% increase in DM
- Wetland	- 10% increase in DM
- Hillsides	- 150% increase in DM

Temporary Closure (1 to 3yrs) and Reclaimed Badland:

- 2 to 3 mt DM per annum
- additional 0.5 mt DM possible from low density sown tree legumes

(iii) Livestock Production:

5.8 The impact of improved nutrition from increased forage production is difficult to estimate. Using relatively small decreases in calf mortality and increases in calving, lambing, and kidding rates it is estimated that annual cattle offtake rates could increase from 3% to 6 - 9% and small ruminants from 17% to 19%. Given the 50% rise in livestock prices over the past five years these increases could be absorbed and herd sizes could remain static.

5.9 Given the current rate of output of crossbred cows the proportion of such animals in the total herd is only likely to rise from 0.3% to 2% by 1992. A major negative impact on communal livestock resources is not expected. However individual owners may experience shortages. Individual milk production per lactation will increase by 300 - 500%.

(b) Economics.

(i) Crops:

5.10 Positive incremental gross margins at both AMC and open market prices are obtained from the use of fertiliser for all

cereal crops with teff exhibiting the lowest and maize the highest increments. However pulses and oilseeds appear to have negative incremental margins at AMC and open market prices. Major cash crops (coffee, chillies, and sweet potatoes) all have substantial positive incremental gross margins.

5.11 The incremental values of annual total farm crop production due to use of fertiliser on cereals and cash crops (valued at AMC prices) is positive for all farming systems. The enset dominant system is the lowest (EB30) and the purely cereal (ie non-enset) systems the highest (EB344). Increases in disposable cash income follow a similar trend (EB21 to EB530).

(iii) Livestock Production:

5.12 The annual incremental value of livestock products per farmer due to lower mortality and higher calving rates is estimated to be EB58 for draught herds and EB72 for milk herds. Financial analysis of a two crossbred cow herd indicates an annual net income of EB1000 - 1400 at full production and a rate of return over a ten year period of 26%. This drops to 1% when benefits are risk adjusted for current non-conception and calf mortality rates.

(c) Environment.

5.13 No negative environmental impacts are expected from the proposed modest increased use of fertiliser or chemical pest control measures. Improved drainage of vertisols and the proposals for undersown legumes will enable a longer period of crop cover thus reducing soil losses. A major positive environmental impact will result from the stabilisation and reclamation of 35 000 ha of badlands for forage and fuelwood production. A further 48 000 ha at serious risk would be protected for cropping and grazing. The planting fuelwood lots will enable an increase in the application of manure to crop fields enhancing soil physical and chemical properties.

(d) Social.

5.14 Population support capacity will be increased enabling the project area to sustain the projected population increase well beyond 2007. Access to land, working capital, draught oxen,

and improved inputs and technology will be increased. Selected disadvantaged PAs and farmers will specially targeted. Income distribution will be made more equitable by the targeting policies mentioned above. Access to basic needs will be increased through the provision of roads, water supplies, and fuelwood planting. Women and children will benefit from the proposals for improved food processing, closer proximity of fuelwood and water supplies, and the whole range of proposals to increase crop and livestock production which will lead to increased and more secure food supplies.

CHAPTER 1.

BACKGROUND AND INTRODUCTION

1.1 BACKGROUND TO THE PLAN

The first phase of the Assistance to Land Use Planning Project (ETH/78/003) developed a macro level data base, and established a national capability for land use planning. The second phase of the same project was (inter alia) to produce land use plans at a scale of 1:50 000 for "comprehensive integrated watershed and sub-watershed development" covering 900 000 ha. Three areas were selected to represent respectively the following highland types:

i) a low potential highly degraded cereal area

ii) a high potential cereal area, less undulating, less degraded and with good soil depth,

iii) a high potential, highly populated, perennial crop area with a long growing period, with good soil depth, but with some highly degraded areas.

This report concerns the third of these sites, Hosaina, which is located in southern Shewa.

The plan draws upon five project documents relating to the project area:

- Soils of the Hosaina Area (Shewa):Field Document 13
- Socio-economic Evaluation of the current land use in the Hosaina Area (Shewa):Field Document 14
- An Inventory of Climate, Vegetation, and current Land Use in the Hosaina (Shewa) Area: Field Document 15
- Land Evaluation in the Hosaina (Shewa) Area: Field Document 20
- Potential Framing Systems for Hosaina (Shewa). Field Document 21

These are records of studies made between mid 1983 and December 1987 by the Land Use Planning and Regulatory Department (LUPRD) of the Ministry of Agriculture (MOA). Additional sources were also used and these are referenced in the text.

1.2 SCOPE AND SCALE OF THE PLAN

The Hosaina Land Use Plan forms a comprehensive programme of activities for sustaining, intensifying, and expanding agricultural production; increasing rural incomes; and providing improved access to basic needs (including fuel, water, health and education). The Plan comprises a written report containing a set of recommendations for agricultural interventions, improved management practices and technologies, land amelioration techniques and works, badland reclamation techniques, and improved physical access linked to agro-ecologically homogeneous and administratively coherent areas ("Planning Zones"). These are supplemented together with other recommendations regarding implementation priorities and the necessary organizational, institutional, and policy requirements for plan implementation. A physical land use plan (in map form) provides spatial expression of the proposals and recommendations.

The Plan provides an overall framework of land management and development recommendations and standards within which the South Shewa Rural Development Project Sub-regional management unit and the awraja MoA staff can formulate and articulate detailed local development plans for Service Cooperatives. The Technical Field Documents listed in section 1.1 provide Subject Matter Specialists with detailed technical data specific to the project area.

The land use recommendations are in most cases indicative rather than detailed and site specific. This is partly a function of the scale of the surveys (1:50,000) which do not permit site specific recommmendations. The smallest measurable unit on the map at this scale for which information of reasonable accuracy is available is 1 square cm which represents 0.5 X 0.5 kms (or 25 ha) on the ground. A second and complementary factor is the inherent complexity and variability of the farming systems, with individual farmers growing a number of different crops located in fields often only 0.2 ha in area.

Potential users of the Land Use Plan thus include all MOA staff involved in SC/PA planning, ONCCP Zonal Offices involved in villagisation planning, RRC and NGO's involved in relief and rehabillitation planning, AMC staff in quota setting and crop marketing, and IAR staff in agricultural research planning. The plan will also provide useful background data for social services planners (particularly in the fields of nutrition and health).

1.3 PLANNING OBJECTIVES

The planning objectives of the Hosaina Land Use Plan may be summarised as follows:

(i) to briefly describe the extent and distribution of the natural, human, and economic resources of the Hosaiana area,

(ii) to briefly describe the current land use systems and determine the constraints and problems to their sustained development,

(iii) to evaluate the development potential of these resources, and develop alternative strategies and land use systems to realise this potential whilst resolving the identified constraints, problems, and conflicts.

(iv) to determine through consultation and analysis prefered strategies and land use systems, and to outline proposals for single or multiple land uses, and land development, reclamation, and management techniques, standards, and inputs,

(v) to provide an integrated agricultural development plan to enable the detailed spatial and sequential programming and coordination within a logical framework, of all aspects of rural development including agriculture, settlement, infrastructure, and social services,

(vi) to determine the production, economic, environmental, and social impacts of the land use, reclamation, development, and management proposals,

(vii) to make recommendations regarding the order of priorities for the implementation of the proposals,

(viii) to determine the organisational, institutional, and policy requirements; and the follow-up programming, performance monitoring, and impact evaluation proceedures

1.4 PLAN TIME-FRAME

The national Ten Year Perpspective Plan (TYPP) covers the period 1984/85 to 1994/95 with three time frames:

- Immediate priorities :first two years
- Action Plan :first five years
- Perspective Plan :period of ten years

Because of the extent and time required for implementation, the Ethiopian Highlands Reclamation Study (EHRS) took a twentyfive year time-frame, with a breakdown into the first two, the first nine, and the whole period of twentyfive years.

The Hosaina Land Use Plan also adopts a twentyfive year time frame for full implementation and for all the impacts to work through. A timeframe of two years is taken for the implementation of those proposals with the highest priority, and which could form the basis of an Action Plan. Those proposals which will take five years to implement, and which could form the basis of a medium term Development Plan for the proposed South Shewa Rural Reclamation Project (RRP) are placed into an intermediate timeframe. Twentyfive years is the period estimated for the full impact of all the proposals to be realised and should be used in any cost-benefit analysis.

By placing the land use plan into three inter-locking timeframes, each with its own set of priorities, enables the Plan to be seen as flexible "rolling and indicative" plan rather than as a "blue-print or master" plan. This flexible and indicative approach leaves the community level Sewrvice Cooperative consultative planning process to work out in detail the on-site

activies, components, projects and programmes, within a logical framework of soundly based land use and management recommendations, with sufficient flexibility to adjust to new or changing circumstances and new technology.

1.5 THE CONSULTATIVE PROCESS

Because the Land Use Plan is the link between the TYPP at the national level, and the participatory planning at the local level, consultation between both levels is critical. LUPRD has sought to maximise this in the following ways:

(i) with discussions and liason with MOA Zonal, Awraja, and Wereda staff, and the Peasant Association authorities and members at the same levels, through out the survey, the evaluation, and the planning phases,

(ii) through a field survey of 96 farmers and 37 PA committees in the project area, not only to determine the socio-economic characteristics of the rural population and their land use systems, but also to determine the peoples' own perceptions of the land use problems, constraints, and conflicts. In addition to the field survey, consultative meetings were held with MOA and with Peasant Association committees and individual members as proposals were being formulated.

(iii) it has been possible to relate landuse proposals to the identified land use problems in a more effective way. by dividing the Hosaina project area into nine planning zones (PZ's) which are as far as possible conformable with PA boundaries as well as homogeneous with respect to agro-ecological conditions and the farming systems,

(iv) by circulating all the relevant field documents to MOA and other GOE staff.

(v) by circulating a draft of the Land Use Plan to Zonal and Awraja MOA staff,the Zonal ONCCP office, and the Awraja administrative office, for comments , discussion, and feed-back.

1.6 REPORT STRUCTURE.

The national rural development objectives, strategies, and priorities, and the national and regional agricultural setting are established in Chapter 2. There follows a brief summarised description of the project area. Chapters 4 and 5 contain a detailed specification of the major land use and development problems, constraints, and the potentials; and strategies and technical proposals for increased agricultural production in the Hosaina area. These form the basis of detailed components and activities for each of the nine Planning Zone. The production, economic, environmental, and social impacts are examined in Chapter 7. Proposals regarding priorities and phasing, and the institutional support requirements (including programme monitoring and impact evaluation) to implement the Plan are contained in Chapters 8 and 9.

CHAPTER 2.

NATIONAL AND REGIONAL SETTING

2.1 NATIONAL RURAL DEVELOPMENT OBJECTIVES,STRATEGIES,AND PRIORITIES

The national rural development objectives ,strategies, and priorities are set out in the Ten Year Perspective Plan 1984/85 - 1993/94. These have been elaborated in a Three Year Agricultural Development Plan 1985/86 - 1988/1989, and both form the basis of the Hosaina Land Use Plan.

2.1.1 Development Objectives:

The national objectives are all-embracive, and the following is a summary of the relevant objectives:

(i) to accelerate economic growth through the expansion of the country's agricultural productive capacity to a level of self-sufficiency in the long term; but in the short term emphasis to be given to staple food crops (teff, wheat, barley, maize, and sorghum)

(ii) to ensure structurally balanced development by expanding the production of industrial crops (bread wheat, malting barley, tobacco, cotton, oil crops)

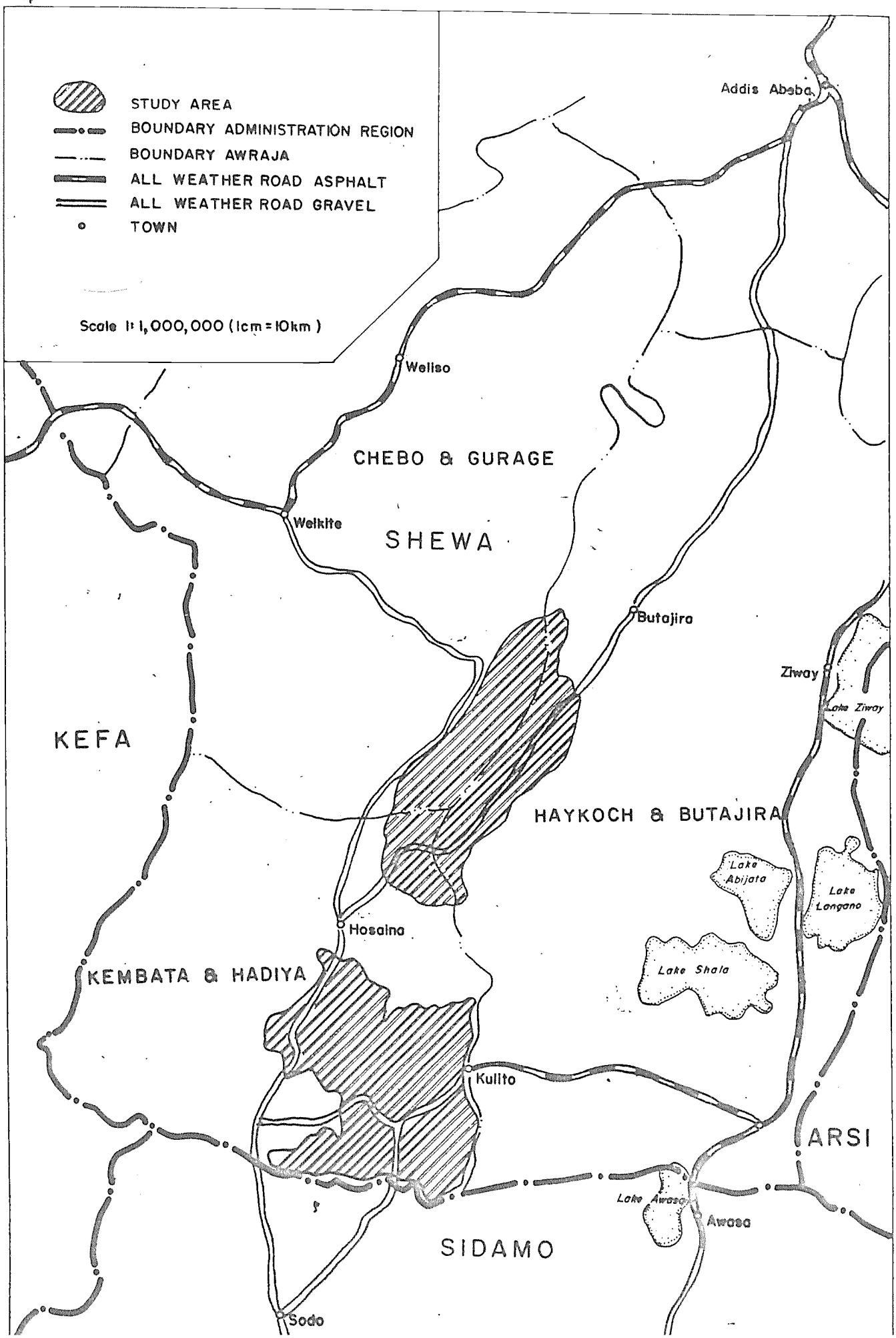
(iii) to expand the production of exportable commodities (coffee, sesame, haricot beans, lentils, hides and skins)

(iv) to conserve and exploit rationally the natural resources of the country

(v) to expand and strengthen the socialist production relations

LOCATION OF STUDY AREA

Map I



(vi) to ensure a balanced and proportional development of all regions, by promoting development in each region according to each region's specific comparative advantage in terms of natural resources, and through an equitable distribution of economic and social infrastructure.

2.1.2 Strategies:

The TYPP and the Three Year Agricultural Plan established a number of strategies by which these objectives were to be achieved. Those relevant to the Hosaiana Land Use Plan are summarised as follows:

(i) to catagorise awrajas and weredas according to their potential to produce crop surpluses, with preferential allocation of inputs, credit, and mechanisation to those surplus producing areas,

(ii) irrigated farming to be given priority in moisture stress areas

(iii) to expand the coverage of the Training and Visit system of extension,

(iv) improved seed is to be produced by the Ethiopean Seed Corporation (ESC) and by PCs on contract, with SCs cleaning and distributing,

(v) villagisation and cooperativisation to remain the standing strategy of rural organisation,

(vi) natural resource conservation and afforestation to be expanded and based on appropriate land use studies,

(vii) to employ where possible labour intensive techniques in agriculture, construction, and rural industries.

The EHRS supplemented these strategies by the following:

(viii) Conservation-based Development: which proposed that soil conservation works be totally integrated with agricultural, social, and infrastructural development,

(ix) Consultative Community Planning: which proposed an intimate involvement of local people in the planning of conservation based development projects.

These have been accepted by government and are currently being incorporated into the Rural Development and Reclamation Projects in North Shewa,in South Wello, and the South Sewa projects. The basic unit at this planning level is the Service Cooperative.

2.1.3 Priorities:

The TYPP clearly places agriculture as the leading sector and as "the foundation of the country's economy" and playing a major role in "generating financial surpluses for funding the country's long term industrial programme". Within the agricultural sector the following were listed as the main priorities:

(i) the expansion of food, industrial, and export crops

(ii)the expansion of irrigation in moisture deficit areas

(iii)the raising of standards and quality of livestock production

(iv)the conservation of water ,soil, and wildlife

(iv)the cooperativisation of peasants and the expansion of the Extension Service.

The Three Year Agricultural Plan has accorded priority to "growth with equity", with relative emphasis being given to food crop production, but with emphasis also on industrial and export crops. In geographical terms awrajas and weredas which are surplus producing will receive priority in terms of scarce resources including improved seed, fertilizer, mechanisation, agro-chemicals, and credit. Some 31 surplus producing and 14 potentially surplus awrajas have been identified nationally. Within the project area Sike, Angacha, Limu, and Dalocha weredas are designated as surplus producing.

MAP 1

LOCATION OF THE STUDY AREA

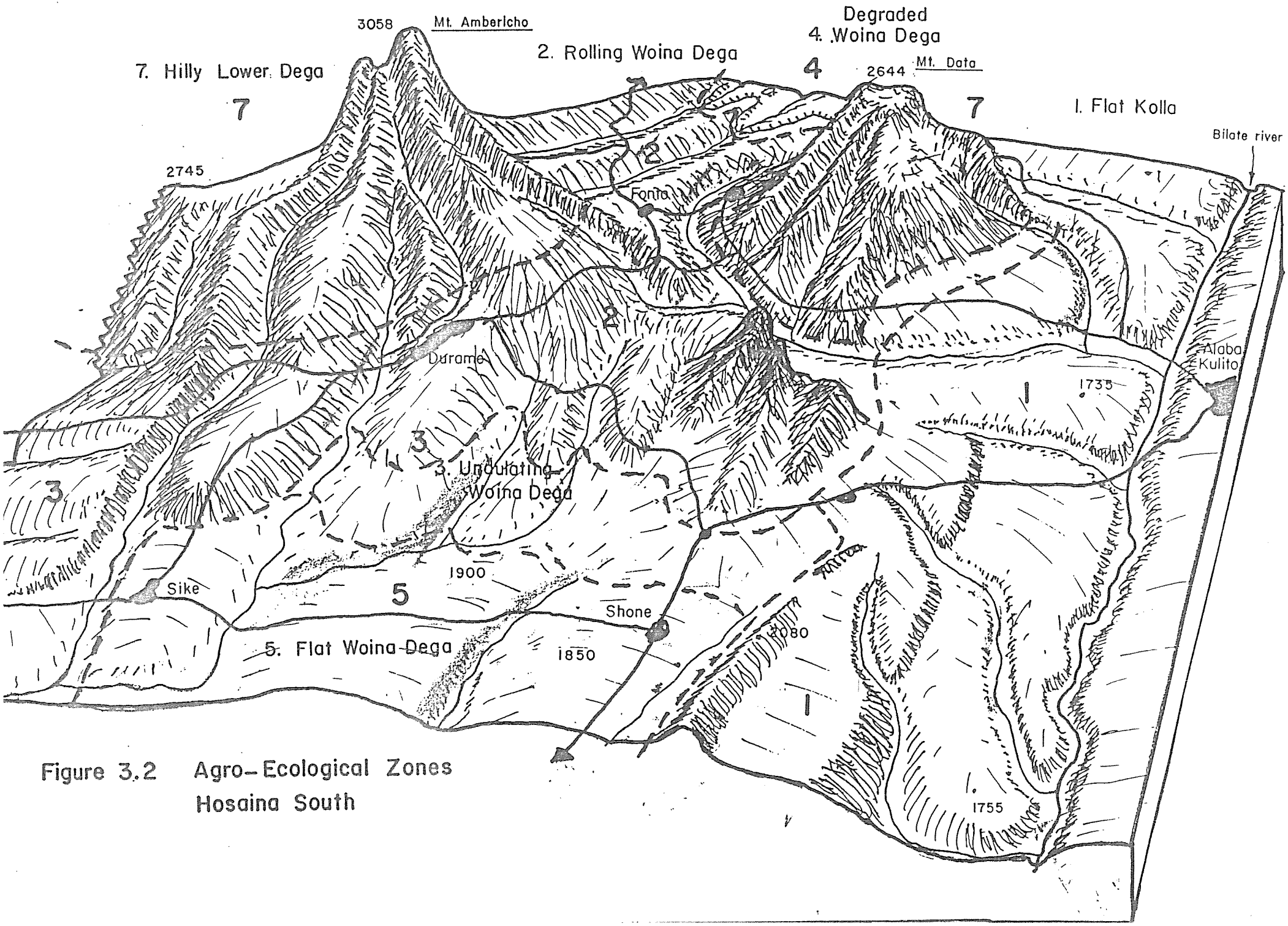
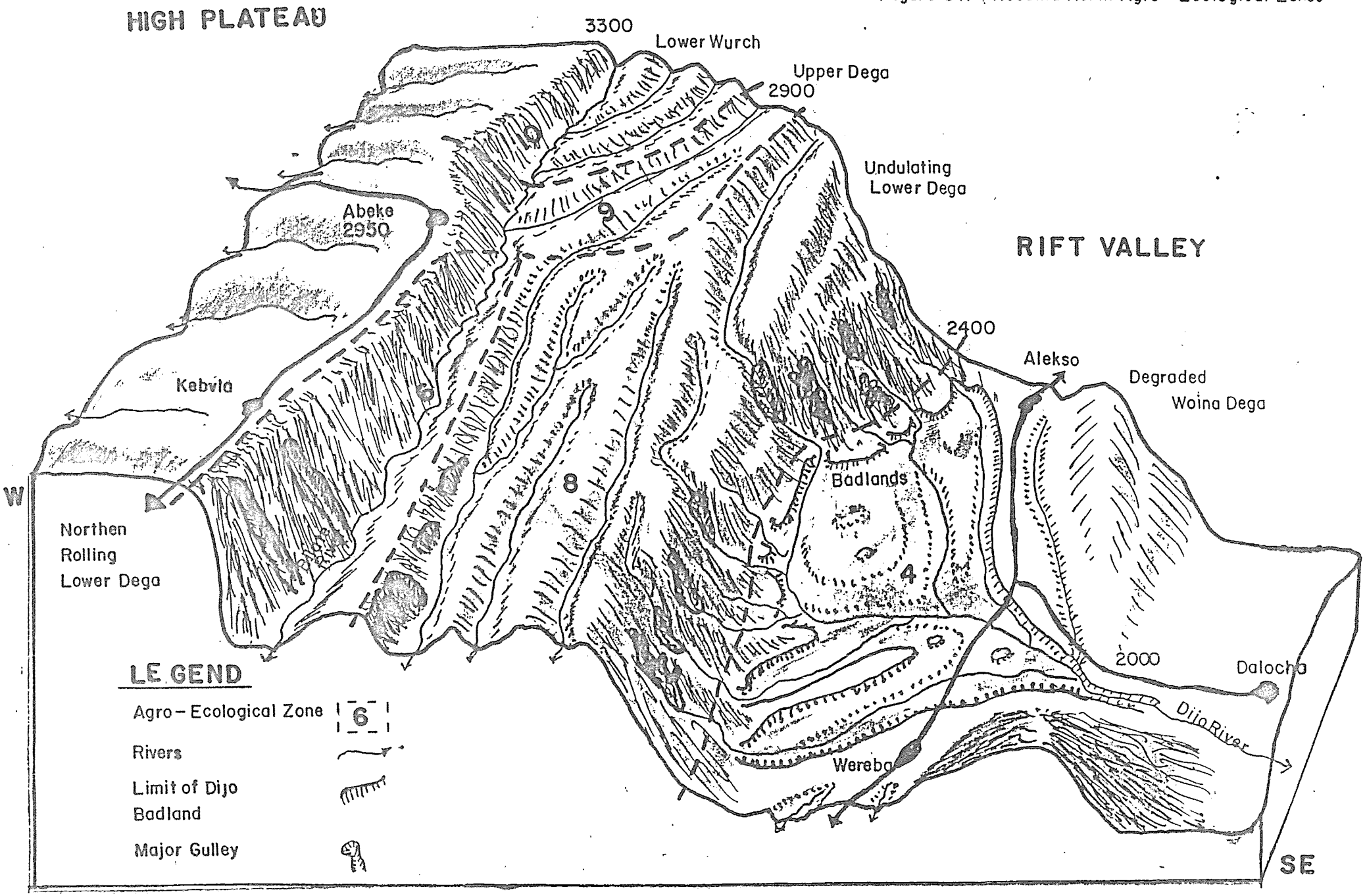


Figure 3.2 Agro-Ecological Zones
Hosaina South

Figure 3.1 Hosaina North Agro- Ecological Zones



2.2 REGIONAL SETTING

Shewa province forms the Central Region of Ethiopia. It comprises a high plateau which in the east terminates at the Rift Valley and in the northwest at the Abay (Blue Nile) gorge. Northwards the plateau continues into the northern Ethiopian highlands, and westwards into the southwest highlands of Welega, Illulabor, and Kefa.

The project area is located in southwest Shewa, some 120 - 240kms southwest of Addis Ababa. It comprises two parts - Hosaina North between Butejira and Hosaina (107 544 ha), and Hosaina South (122 062 ha). Both areas lie astride the Plateau and the Rift Valley, and thus encompass a wide range of agro-ecological conditions and farming systems. Hosaina North lies within the Chebo and Gurage, and Haykoch and Butajira awrajas; whilst Hosaiana South lies within Kembata and Hadiya awraja (see Map 1).In much of the area enset forms an important component in the farming systems. Hitherto the enset-based systems have generally been considered resilient and well able to support their extremely high human and livestock populations. However the LUPRD studies (para.1.02) indicate a number of structural weaknesses emerging in a some of the farming systems which are experiencing increasing population presure. The situation is being exacerbated by the appearance of bacterial wilt in the main staple - enset. A number of the weredas have been selected as surplus producers, and yet some farmers within these are facing considerable problems in meeting the grain quotas.

2.3 EXISTING AND PLANNED PROJECTS

2.3.1 Ongoing Projects

The Community Forest and Soil and Water Conservation Department (CFSWCD) is undertaking a major soil conservation programme in the Bilate and the Dijo river catchments on a food for work basis. Works include bunds, grazing area closures, afforestation, ponds, and village water supplies. The Fourth Livestock Project (FLP) is undertaking a research and development programme into forage production, and have activities in both

Hosaina North and South. The Dairy Development Programme although not currently active in the project area have a remit in the field of dairy development.

The major NGO operating in the Project area is the Kale Heywot church based at Durame, and supported by a number of charities. Activities include improved breeding, rendering veterinary assistance, improved forage resources, soil conservation, land reclamation, and afforestation. Significant support is being provided from 6 seedling nurseries, 5 of which are located in the project area.

2.3.2 Proposed Projects

The major proposed project for the project area is the South Shewa Conservation Based Rural Development Project which forms a "high input" part of the Central PADEP to be funded by the European Development Fund (EDF). Agreement has been signed with GOE, and activities are reported to commence in early 1989. Compoents include crop and livestock development, logistical support to Extension, rural infrastructure (including roads, water supplies, storage and office buidlings).

CHAPTER 3.

PROJECT AREA DESCRIPTION

3.1 GEOGRAPHICAL LOCATION

The boundaries of Hosaiana North are delineated in the west by the crest of the Rift Valley escarpment which forms the Gibi-Rift Valley watershed. The northeastern boundary is the Dijo river watershed, and that in the southwest the Wayra river watershed. The long eastern boundary is formed by the sub-catchment watersheds of the Dija, Furturo, and Wayra rivers. In Hosaina South administrative rather than physical boundaries are used: the wereda boundaries of Angacha, Sike, and Kadida Gamela.

The rationale for using catchment, or sub-catchment boundaries in the north was that land degradation was considered to be the major land use problem, and that remedial measures could best be formulated in catchment terms. In Hosaiana South the potential for relieving development constraints was seen to be better formulated in an administrative framework. In summary the project area covers the following administrative units:

Awraja	Wereda	Capital
(a) North:		
Chebo and Gurage	Gumer(part)	Arekit
Haykoch and Butajira	Dalocha(part)	Dalocha
	Silti(part)	Kibet
Kembata and Hadiya	Limu(part)	Hosaina
(b)South:		
Kembata and Hadiya	Angacha	Angacha
	Sike	Shone
	Kedida Gemela	Durame

3.2 NATURAL RESOURCES

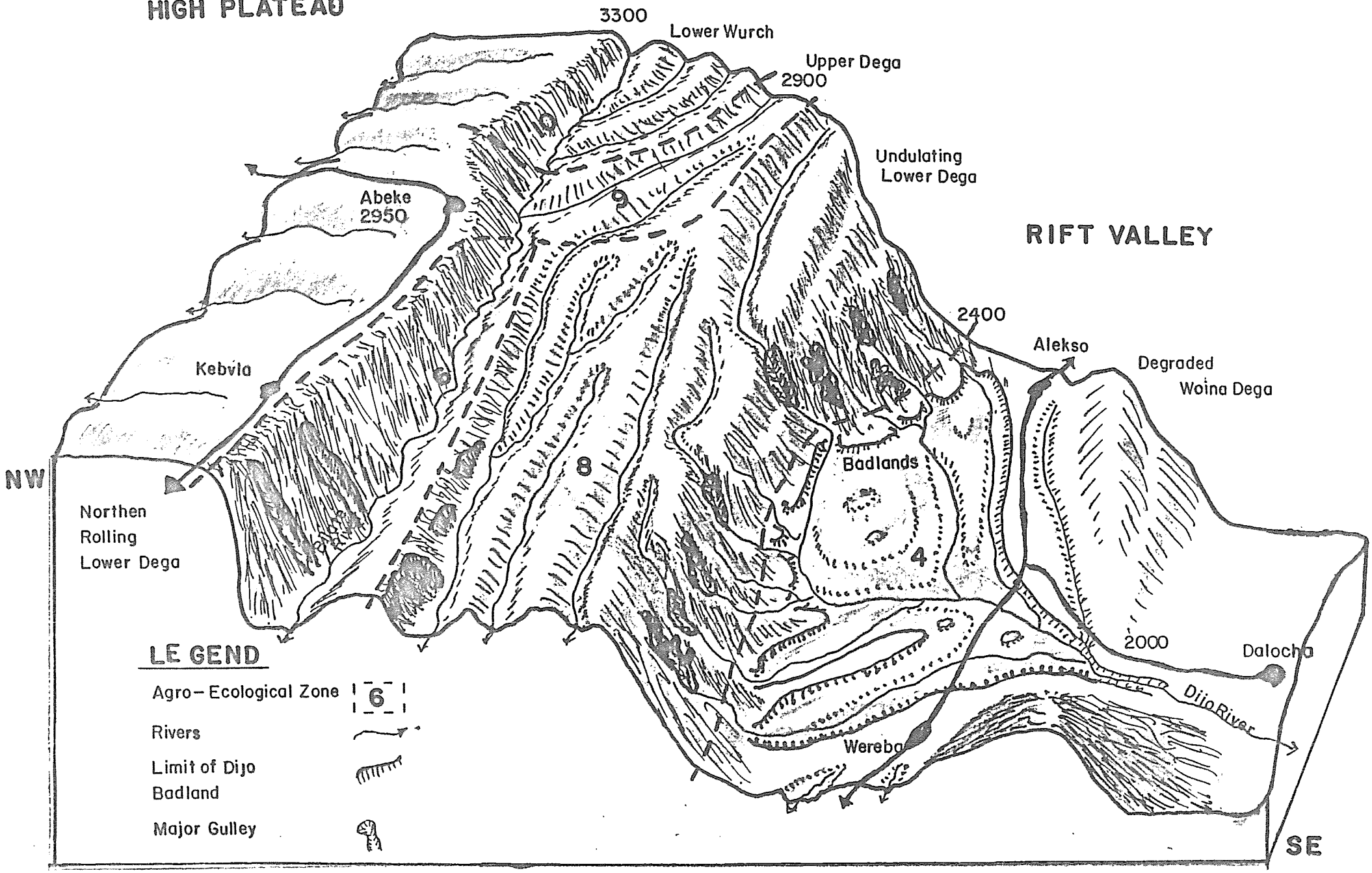
Detailed studies on the natural resources can be found in the Field Documents listed in section 1.1. This section merely provides a synthesis of these using the Agro-ecological Zone (AEZ) which comprises an area of homogeneous conditions of relief, soils, climate, vegetation, and landuse. Ten AEZs are recognised, with their limits based partly on altitude, but also on major soil types and farming systems. The macro-environment is briefly described first, to be followed by an outline description of the AEZs

3.2.1 Macro-Environment

3.2.1.1 Physiographic Framework:(see figure 1)

The main relief units follow the structural trend of the Rift Valley (SSW-NNE), although they are more clearly expressed in the north than the south. To the east is the Rift Valley floor lieing below 1900masl. Above the valley floor the land rises as a series of tilted blocks to the top of the escarpment at 3000 masl. In the south this simple linear structural arrangement is less clear, with a complex of volcanic cones and calderas rising to 2600 masl. Between the two project areas the town of Hosaina lies in a shallow col between the Rift and Gibi valleys. Most of the area is covered with layers of welded and soft tuffs (volcanic ash), except for the volvanic cone remnants which are composed of silicious lavas (andesites and rhyolites).

Figure 3.1 Hosaina North Agro- Ecological Zones



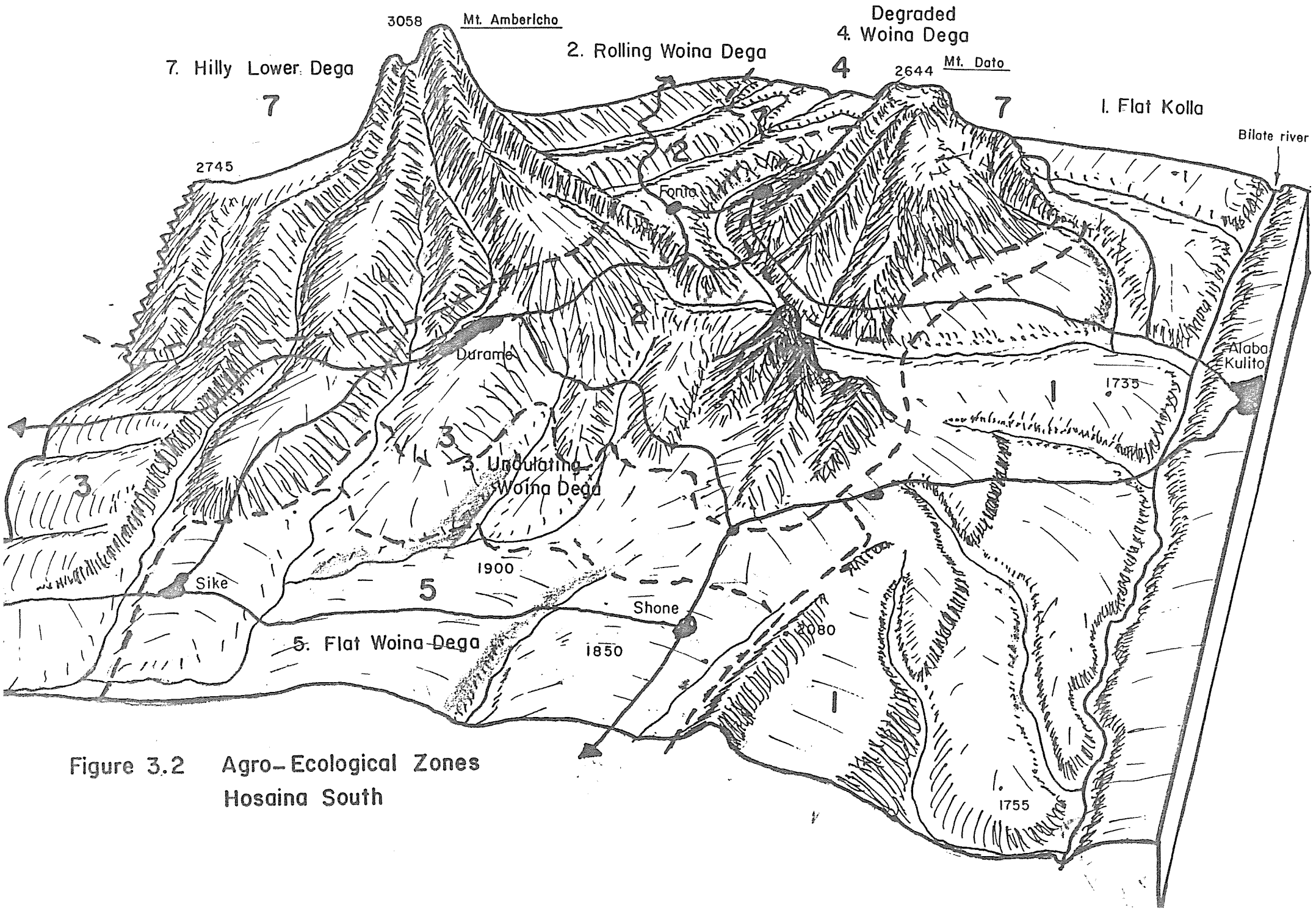


Figure 3.2 Agro-Ecological Zones
Hosaina South

3.2.2.2 Agro-climate:

The major climatic components are mainly related to altitude, although locally aspect and physiography will modify this relationship. The rainfall pattern is determined by moist air associated with the inter-tropical convergence zone, with air moving into the area initially from the southeast (in March and April), and then with the main southwest monsoon (May - September). During June-July divergence in the southwest monsoon causes a reduction in the rainfall, leading to a slightly bi-modal pattern of rainfall with peaks in March - May and in August - September. The first peak occurs in March in the north, in April around Hosaina, and May in the south. Total annual rainfall varies from approximately 800- 900mm in the Kolla, 1100-1300mm in the Woina Dega, 1300-1500mm in the Dega, and 1400-1600mm in the upper Dega and lower Wurch. The length of the main (krempt) growing period (LGP) varies between 210 days in the Kolla to more than 270 days in the higher zones.

Mean daily temperatures are highest just before the rains (March) and lowest in the middle of the rains (August). There is a good correlation between mean temperatures during the growing season and altitude (see table 3.10). Frost hazard is highest in November - January, and its incidence increases with altitude above 2 200 masl. Locally ground frost will occur at lower altitudes in depressions and hollows. Potential evapotranspiration is highest in February - April, and lowest during July - September, and increases with decreasing altitude.

3.2.1.3 Soils:

The major soil types exhibit a general relationship with altitude. In the Kolla and Woina Dega sodic "duplex" soils (planosols) are widespread on the lower flatter areas, with brown weakly developed soils (cambisols) on steeper slopes. At higher altitudes (2 200-2 700 masl) the planosols give way to black clay soils (vertisols), whilst the cambisols give way to reddish clay loam soils (nitosols). In the highest areas of the upper Dega-lower Wurch, the nitosols give way to deep well structured red clay loams with high organic levels in the topsoil (phraeozems). All soils appear to be deficient in phosphorous. The planosols generally have high levels of sodium, which coupled with the layered nature of the soil parent material gives rise to piping, slumping, and stripping.

3.2.2 Agro-Ecological Zones

3.2.2.1 Kolla (AEZ 1):

Found only in Hosaina South this zone comprises the eastern lowlands of the Rift Valley floor. Soils are cambisols on the valley slopes, with heavy planosols on the low lying plains. Slip erosion has occured along the Bilate river , with gulley erosion occuring away from the main river. Mean annual rainfall is between 800 - 900 mm with a slightly bi-modal distribution peaking in May and then August. In some years the mid-season trough can be very marked with soils approaching wilting point. In most years soils should reach field capacity by July.

3.2.2.2 Woina Dega- Rolling (AEZ 2):

Again found only in Hosaina South, this zone forms the dissected footslopes of the ring of volcanic remnants of Abericho, T'eze, and Dato. Soils are deep red clay loams (nitosols) which are slightly degraded on slopes over 25%. Mean annual rainfall is between 1 100 - 1 250mm, with a bimodal distribution peaking in May and Sepember. Planting can commence in April in most years, with field capacity being reached in May-June. The LGP is estimated to be 240 days.

3.2.2.3 Woina Dega - Undulating (AEZ 3):

Found only in Hosaina South this Zone is located on the southern footslopes of Mounts Abericho and T'eza. Soils are deep red clay loams (nitosols) which are slightly degraded on the steeper slopes along incised river valleys. Mean annual rainfall appears to be higher than other Woina Dega zones: between 1 400 - 1 600 mm. Peaks occur in May and then July-August. Planting can normally begin in March, with field capacity being attained by May. Sweet potatos are relay cropped over the dry season from October to March.

3.2.2.4 Degraded Undulating Woina Dega (AEZ 4):

This zone is found mainly in Hosaina North with a small enclave in Hosaina South. Soils are mainly "duplex " planosols, with some areas of vertisols. The planosols have suffered particularly from strip erosion, and large areas of badlands are found. Mean annual rainfall is 1 200 - 1 1350 mm, with peaks in April and August. Soils do not attain field capacity until June - July, and even as late as August if the mid-season trough is particularly pronounced. The estinmated LGP is 210 - 220 days.

3.2.2.5 Flat Woina Dega (AEZ 5):

Found on the plains beyond the undulating Woina Dega of AEZ 3 in Hosaina South. Soils are solodic planosols, but have not suffered from strip erosion as in AEZ 4. Average annual rainfall is between 1 300 - 1 450 mm, with peaks in May and in July - August, with planting possible after March. The LGP is estimated to be 270 days.

3.2.2.6 Hilly Lower Dega (AEZ 6):

This zone is found in Hosaina North, and forms the steep western escarpment, with severely degraded cambisols. Average annual rainfall is between 1 300 - 1 350 mm, with peaks in April and August. Soils reach field capacity in June, and planting is possible from April. The LGP is estimated to be 210 days.

3.2.2.7 Hilly to Rolling Lower Dega (AEZ 7):

This zone comprises the volcanic remnants of Aberiche, T'oza, and Dato. Soils are well structured phraeozems and nitosols. Land degradation is slight, although long slopes of more than 25% are being increasingly cultivated. Mean annual rainfall is probably between 1 400 - 1600 mm, with peaks in May and September. Soils reach field capacity by May, and planting is possible from March. The LGP is estimated to be 240 days.

3.2.2.8 Undulating Lower Dega (AEZ 8):

This zone is an extension to the north of the western escarpment in AEZ 6. It forms a series of parallel ridges and valleys, with severely degraded nitosols and cambisols. Mean annual rainfall is between 1 200 - 1400 mm, with peaks in March - April and in July - August. Soils do not reach field capacity until June - July, and the cessation of the rains is more abrupt than further south. The LGP is estimated to be 150 days.

3.2.2.9 Upper Dega (AEZ 9):

Lieing between 2 700 -3 100 masl in Hosaina North, this zone comprises a further extension of the parallel ridges and valleys of AEZs 6 and 8. Soils are well structured phraeozems and nitosols, which are moderately degraded on the steepest slopes. Rainfall and soils moisture patterns are similar to AEZ 8.

3.2.2.10 Lower Wurch (AEZ 10):

This zone is an extension of AEZ 9 above 3 000 masl. Soils are mainly andosols over wearthered volcanic ash. Rainfall and soil moisture patterns are similar to AEZs 8 and 9, but lower temperatures extend the growing season.

3.3 HUMAN RESOURCES

3.3.1 Population Size and Density

The toal population of the study area was nearly 605 000 according to the 1984-85 census, comprising over 103 000 households. Overall density was 270 per km^2, varying from 113 per km^2 in Silti wereda to 375 per km^2 in Angacha wereda. These are some of the highest rural population densities in Ethiopia.

3.3.2 Family Composition

The Socio-Economic Survey found family sizes much larger than those quoted in the National Census of 1984: between 6 - 9 persons compared with 4.5 persons by the census. This is possibly the result of young married men living with parents because of the non-allocation of land.

3.3.3 Ethnic Groups and Religions

Five ethnic groups are found in the project area. The Kambata are found in the Woina Dega areas of Angacha and Kadida weredas, with the Hadiya group inhabiting the Kolla zones of these and also of Sike and Limu weredas. The Silti group live in Dalocha and Silte weredas, with the Gurage to the west in Limu and part of Gumer wereda. The Welayita group are only found on the western fringes of Sike wereda. Languages mirror the ethnic groups. Christianity , Orthodox, and Protestant religions are followed mainly in the south, and Islam in the north, with traditional beliefs being practiced throughout.

3.3.4 Literacy Levels

Literacy rates vary between 33 and 67 % of the eligible age groups. Adult literacy classes are held in most PAs.

3.3.5 Labour Supply

Labour availability for each of the Farming Systems was estimated by excluding the 11-15 and over 60 age groups. Estimates varied between 2.1 and 3.7 adults per family. Where Orthodox Christianity is practiced, fast and feast days limit availability to about 20 days per month per adult. Female labour is mainly involved with food processing and manuring, whilst male labour is mainly for land preperation and inter-culturing. Weeding, harvesting, and livestock stall feeding are not assigned by sex.

3.3.6 Household Consumption Requirements

Consumption units were estimated from the household composition data. Generally a factor of 0.85 was found to be a close estimate for multiplying household numbers. Using an estimated daily requirement of Kcals 2000 per consumption unit and translating into grain equivalent, estimates of annual family grain requirement were made for each of the farming systems. These varied from a low of 1 080 to a high of 1 495 kgs.

3.3.7 Migration

Seasonal migration of young men is reported to occur from the southern area to Sidamo for employment in coffe picking. In the northern area there is a long tradition of young Gurage men moving to many parts of Ethiopia but particularly to Addis Ababa to establish themselves as small traders and shopkeepers. In 1985 there was a major migration from the southern area (5858 family heads from Sike wereda alone) for the resettlement areas in the western lowlands of Metakel.

3.4 AGRICULTURAL PRODUCTION, PROCESSING, AND MARKETING

3.4.1 Farming Systems

Ten farming systems were identified on the basis of the crop mix and livestock composition. Their areas are largely co-terminous with the agro-ecological zones described in section 3.2 above, and the same numbering system applies. A summary of their main features is presented in table 3.1 below:

Table 3.1 Main Characteristics of the Farming Systems in the Hosaina Project Area

FS No.	Farm Size ha	Crop Area ha	Crop Mix (% of crop area) Livestock
1.	1.77	1.44	Maize(71) tef(20) sorghum(4) chillies(5): cattle (for draught), sheep, goats.
2.	0.88	0.76	Maize (30) wheat(10) tef(10) sorghum(9) horsebean(14) enset(18) coffe(9): cattle (for milk), sheep, goats
3.	1.10	1.42	Maize(40) tef(12) enset(19) sweet potato(9) coffee(20) Cattle (for draught and milk),
4.	1.63	1.42	Maize(45) tef(26) sorghum(13) wheat(11) chickpea(5) cattle (for draught),
5.	0.81	0.61	Maize(29) cowpea(13) chillies(14) sweet potato(23) coffee(21): cattle (for draught and milk),
6.	0.89	0.52	Enset(69) wheat(14) (barley(13) Ethiopian cabbage(4) Cattle (for milk).
7.	0.92	0.71	Wheat(22) maize(18) barley(13) horsebean (14) fieldea(13) enset(21): Cattle (for draught and milk),
8.	1.21	0.94	Teff(33) maize(23) wheat(19) barley(13) enset(13) Cattle (for draught and milk),
9.	1.06	0.86	Barley(61) fieldpea(21) enset(18): Cattle (for draught) Sheep,
10.	1.32	0.84	Barley(76)fieldpea(19)potato(6): Cattle (for draught) sheep.

Source: Field Document 14

3.4.2 Farm Size and Fragmentation

Average farm sizes given in the Socio-economic Report for each of the farming systems are shown in table 3.1. The three non-enset and mainly cereal systems (1, 4, and 10) have larger farm areas than the enset/root crop systems. Fragmentation of farms (into seperate pieces of land no matter how used) is relatively minor, with 36% of farms having only one fragment, and nearly 90% with three or less.

3.4.3 Land Tenure

Prior to the land reform campaign ("zemetcha") of 1975-76 most of the land in the project area was the subject of tenancy arrangements between landowners and tennant users refered to as the "neftejna" system. During zemetcha land was redistributed amongst the inhabitants who were established into Kebelle Peasant Associations (KPAs). Each KPA was allocated a specified area of land with boundaries often following the old "Chika Shum" areas. Land is now allocated within the KPA by an elected Executive Committee to individual members and to Producer Cooperatives (PCs) on the basis of family size. Although every adult over 18 years is eligible for PA memebership and a land allocation, in practice only male heads are members and receive land allocations. The exception being unsupported females, generally widows and divorcees. During Plan preperation it was found that in many PAs no land allocations to new members has been made for 7 to 10 years. In the southern weredas the last allocation was made in 1978 (1971 EC). In some PAs land allocation of deceased persons are re-allocated to new members, whilst in other PAs such allocations reverted to the PAs communal farm or to the PC. In addition to individually allocated land, KPA members have access to communal areas of grazing and fuelwood.

3.4.4 Land Use

Most farming systems have between only 20-40% of land communally allocated and used , but FS 4 and 8(in Hosaina North) have 50-60% under communal use. Both these systems are subject to severe land degradation, and the relatively high proportion of communally used land will need to be taken into account when making land management recommendations. The enset dominant system (FS 6) is noticable by its relatively high proportion of individually owned grazing. This is a feature of the enset

cultivation systems which requires heavy applications of manure. Having indiviually owned grazing areas close by facilitates this system of cultivation. The relatively high proportion of individual grazing in FS 10 may in fact be fallowed crop land, whilst the very low proportions in FS1 and 4 may be due to the lack of enset and thus the need for manuring.

3.4.5 Crop Production.

3.4.5.1 Major Crops:

Maize is the dominant cereal in the Kolla and the Woina Dega systems (FS1 to 5), wheat or teff with maize co-dominant in the Lower Dega (FS7and 8), and barley dominant in the Upper Dega/Lower Wurch (FS 9 and 10). Enset is dominant in only one system (FS 6) but takes up between 10-20% of the cropped area in five others (FS 2, 5, 7, 8, and 9). Coffee is an important cash crop in the Woina Dega systems (FS 2, 3, and 5) of Hosaina South, with chillies in the Kolla systems (FS 1 and 5). In FS 5 sweet potato makes an important starch contribution to the diet, as well as being an important cash crop. Pulses are the main protein source but are replaced by Ethiopian cabbage in the enset dominant system (FS 6).

3.4.5.2 Crop Calendars:

Generally cereals are planted April-June, but teff planting is delayed almost until the second rainfall peak to ensure the soil is at field capacity. Should the rainfall "trough" be exceptionally pronounced this will result in delays in teff planting. Maize is the earliest of the cereals to be harvested: September in the Kolla and Woina Dega, and October in the Lower Dega. Other annual crops are harvested in November-December.

3.4.5.3 Cropped Areas:

The area under crops appears to be related to the proportion of enset/root crops in the crop mix. Thus crop mixes with no enset/root crops occcupy about 1.5 ha; the enset dominant

system occupies 0.5ha.; with the enset/root/cereal mixes occupying between 0.6 - 0.95ha depending on the proportion of enset/root crops.

3.4.5.4 Crop Husbandry Practices:

Land preperation for most annual crops is carried out using the maresha plough, whilst for perennial and garden crops digging ("wonicho" and "dundee") or hoeing ("kituato") tools are used. Preperation begins in Febraury-March with the onset of the belg rains. Coarse and medium grains are sown before the last ploughing, whilst fine grains (teff and finger millet) follow the last ploughing. Sweet potato cuttings and seedlings of peppers and Ethiopian cabbage are raised in nurseries and planted out into the main fields. Clones, suckers, seedlings, and cuttings are all used for raising perennial crops, raised first in nurseries before being planted out. Enset is replanted three or four times in different nursery stages. Interculturing is carried out using the maresha for maize and sorghum, and the digging and hoeing tools for perennials, cabbage, and chillies. Teff (invariably) and wheat and barley (occasionally) are hand weeded. Pulses are rarely weeded.

Perennial and garden crops are manured , with enset particularly depending on manuring. Annual crops are rotated to control weeds, rather than to enhance fertility (eg. by using legume rotations). Harvesting annual crops is carried out with the sickle. Enset is harvested following infloresence emergence, which occurs after 4-5 years in the Woina Dega, and 5-6 years at higher altitudes. The rhizome is dug out and pulped, and the pulp stored in fermentation pits along with scrapings of the leaf sheaf. The main product "kocho" is ready for consumption within 8-10 weeks, although quality improves with age.

3.4.5.5 Labour:

Both male and female labour are involved in cropping. However male labour generally concentrates on the field crops, whilst female labour concentrates on crops in the household plot and on perennials. Land preperation and inter-culturing are carried out by men, whilst women participate in manuring, weeding and harvesting. Food processing and preperation are the total preserve of women. Labour shortages occur only in the enset

systems of both male and female labour in August-October during the main period of interculturing, manuring and of kocho processing.

3.4.5.6 Draught Power:

Draught power requirements vary between the farming systems. Requirements are low in the enset systems, and increase with the increasing proportion of cereal crops in the mix.

3.4.5.7 Improved Practices:

Fertilizer usage has expanded in 1987/88 from a previous high of 420 m.t. to 5 530 m.t. as a result of extensive credit from AISCO. However the use of improved seed has remained relatively low with 417 mt. of wheat and 135 mt. of maize being distributed, sufficient for 25 % and 8 % of the planted areas respectively. Some use of herbicides and insecticides is reported, with some private traders both maintaining supplies and carrying out applications.

3.4.5.8 Yields:

Survey data for crop yields was obtained during the drought years of 1985-86. Yield estimates for a year with adequate rainfall were obtained from survey farmers at survey sites. These were adjusted during the crop suitability assessment for different soil suitability classes, and the detailed results are presented in Annex 2. Cereals generally lie in the range of 750-950 kgs per ha., except for sorghum and maize which attain yields of 1 100-1 300 kgs. Pulses generally fall in the 650-750 kgs range. Sweet potato yields vary widely from 1 400 upto 10 600 kgs per ha. Enset yields of kocho and related starch products are in the range 3 000-6 000 kgs per ha.

3.4.5.8 Production:

An estimated 141 000 ha are cropped in the project area. The production estimates of major food and cash crops are shown in table 3.2 below:

Table 3.2 Annual Production Estimates of the Major Crops in a Year of Normal Rainfall (m.tons)

AMC Traded		Other Crops	
Teff	9 700	White Potato	4 900
Barley	10 900	Sweet Potato	24 300
Wheat	12 500	Kocho	109 500
Maize	37 300	Chillies	2 200
Sorghum	7 900	Coffee	1 800
Horsebean	6 600		
Fieldpea	1 600		

Thus in a year of normal rainfall an extimated 78 000 m.t. of cereals, 8 600 m.t. of pulses, 29 000 m.t of root crops, and 110 000 m.t. of kocho are produced. Of the major cash crops an estimated 1 00 m.t. of coffee, 100 m.t. of tobacco, and 2 200 m.t. of chillies are produced.

3.4.6 Livestock Production.

3.4.6.1 Total Numbers and Types:

Total livestock population in the project area is 718 600 (or 490 300 TLUs). Kedida Gamela wereda has the highest number (182 800), although Gumer wereda has the highest density - 403 TLUs per km^2.

Overall livestock densities are 213 TLUs per km^2, which are some of the highest in Ethiopia. Cattle are the most important livestock type in all the farming systems. Amongst the small ruminants and equines, goats and asses predominate at lower altitudes with sheep and horses at the higher altitudes. Some poultry and honey bees are kept in all the systems.

3.4.6.2 Ownership Patterns and Size:

Nearly 50% of surveyed farmers have between 2-5 cattle , but only 30% own sheep, only 16% goats, and 20% equines. Only 17% of farmers have two or more oxen, whilst 48% have one, and 35% have none at all. One third of farmers own nearly two thirds of the

cattle. Surveyed ownership patterns are thus highly skewed in favour of the larger owner, and thus care must be taken when using "average" ownership values.This highly skewed ownership pattern has important ramifications for the adoption or otherwise of grazing management schemes on the communally owned lands.

3.4.6.3 Cattle Herd Structures and Dynamics:

Herd structures appear to be related to the need or otherwise of draught power. Where the need is less, as in those systems with enset and perennial crops, then the male to female ratios are much lower than those systems where draught power is important (FS 1,4, and 5). The ox:cow ratios also follow similar trends. The data on total livestock numbers is not reliable (see F.Doc. 22), and that on herd dynamics is non-existant. Estimates were made using parameters on calving and mortalitity rates from the Livestock Sub-Sector Review (AACM, 1986) and the South Shewa RRP preperation Report (FAO Investment Centre, 1987), with offtake rates calculated from sale figures in the General Agricultural Survey (MOA,1984). Annual rates of change indicate an annual net increase of between 1 - 3% for cattle, sheep and goats. However these estimates do not capture emergency or periodic distress sales during droughts. A reasonable assumption would be that in the long term herds are static or increasing at between 1 - 2% per annum.

3.4.6.4 Feed Resources and Management:

Grazing (both individual and communal) is the major feeding method, but stall feeding is also very important. Feed resources comprise natural pastures, crop residues, and aftermath (stubble) grazing. Patterns of feed availability and use vary between seasons, as do the feeding methods. During the wet season stall feeding is less important than in the dry season with two thirds of feed taken as graze. Individual (ie.farm) grazing areas are used more than the communal areas during the wet season, possibly because the shortage of labour during the main croping period precludes supervised grazing. During the dry season aftermath grazing and stall feeding of crop residues and enset leaves supply just over half the feed, compared with just one fifth during the wet season.

3.4.6.5 Livestock Production:

Offtake rates of live ruminant animals in 1985/86 varied between farming systems, from a low of 0% in FS 9 and 10 to a high of 11% in FS 5 (thought to be distress sales caused by the drought). Overall the annual offtake rate for the project area was estimatd to be 4% for that year. This compares with the MOA General Agricultural Survey's overall rate for the year 1983/84 of 12%, with Gumer wereda (FS 9 and 10) having the lowest rate of 6%. Milk products are important in the project area especially in the enset areas where draught requirements are low. Overall annual milk yields per farm were 160 litres, with considerable variations between farming systems. Yields per lactation averaged 230 litres, varying from 124 to 367 litres. In FS 2 and 7 there are cross-bred zebu-freisen cows giving much higher milk yields.

3.4.7 Production Economics.

3.4.7.1 Crop Gross Margins:

Gross margins of the major crops are shown in table 3.3 for both AMC and open market prices. Open market prices (ie. immediate post-harvest) are generally 60 - 140% higher than AMC prices which have remained static for five years. Of the cereals wheat, sorghum, and maize have the highests margins at AMC prices, whilst the order changes to wehat, teff, and maize at open market prices. Seasonal open market price changes are most extreme for teff, rising from EB60 per Q immediate post-harvest to EB85 per Q just before harvest. Teff leads when pre-harvest open market prices are used. Gross margins for the major cash crops are considerably higher than for the major food crops, and are major contributors to farmers' disposable cash income .

Table 3.3 Gross Margins of the Major Crops at AMC and Open Market Prices under Unimproved Technology in Years of Normal Rainfall in S2 and S3 Land

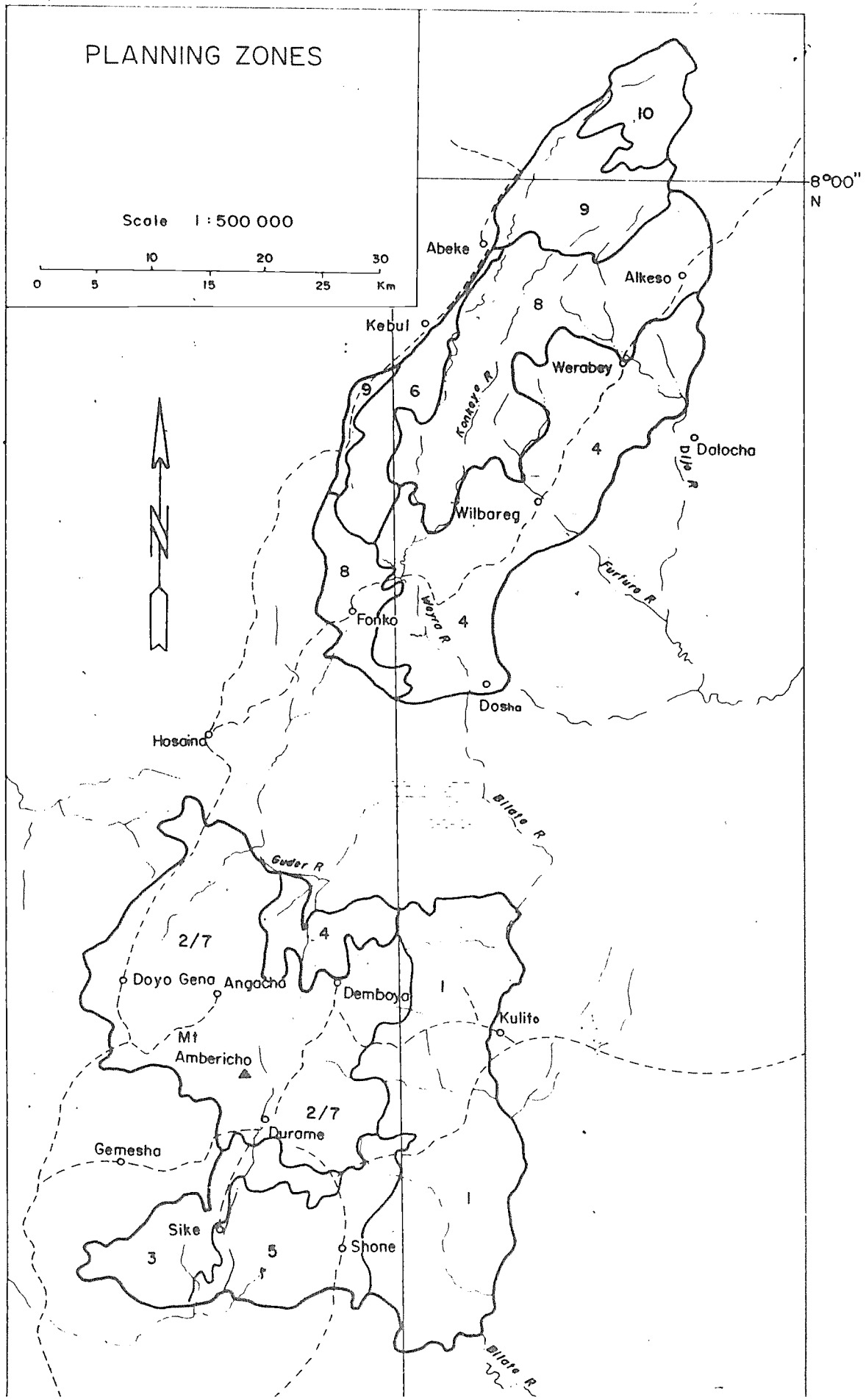
(EB/ha)

	S3		S2	
	AMC	Open Market	AMC	Open Market
Teff	188	297	263	416
Barley	176	221	247	309
Wheat	260	306	364	428
Maize	180	270	252	378
Sorghum	170	189	128	265
Horsebean	169	236	236	331
Fieldpea	194	324	272	454
White Potato	-	1350	-	1620
Sweet Potato	-	540	-	756
Kocho	-	612	-	810
Chillies	-	736	-	918
Coffee	-	563	-	788
Chat	-	756	-	756
Tobacco	-	774	-	990

3.4.7.2 Farm Crop Incomes:

Estimated farm crop incomes (for a year of normal rainfall) are shown in table 3.4 below. Total annual net value of crop production varies from EB290 - EB520. Disposable cash income was estimated by valueing quota grain at AMC prices and any surplus over consumption of both AMC and non-AMC traded crops at open market prices. The highest disposable cash incomes from crop production are from the coffee producing systems in Hosaina South. The lowest cash surpluses are from the cereal based systems in the Upper Dega and Lower Wurch of Hosaina North, where the range of food crops is narrow and there are no cash crops.

Map 2


PLANNING ZONES
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Mt Ambericho
Durame
Gemesha
Sike
Shone
Konkera R.
Dile R.
Furfura R.
Bilate R.
Gudar R.
Wera R.
10
9
8
6
4
2/7
1
5
3

Table 3.4 Estimated Net Farm Crop Income (Value of Production) at AMC prices, and Estimated Disposable Cash Income after Consumption under Unimproved Technology in Years of Normal Rainfall by Farming System

(EB)

Farming System Income	Net Farm Income	Disposable Cash
1	289	30
2	319	60
3	558	200
4	391	26
5	603	195
6	330	62
7	313	8
8	493	120
9	426	0
10	510	0

3.4.7.3 Livestock Production Economics:

Because of the highly skewed patterns of livestock ownership, the paucity of data on herd dynamics, and the variation between individual consumption/disposal patterns it is impossible to determine an "average" farm livestock income in the same way as it is with crop production. An additional factor to be considered is the function of livestock as a store of wealth as well as a production unit. The analysis therefor is carried out for the modal cattle, sheep, and goat herd sizes obtained from the project area frequency distributions of livestock ownership. The annual value of products and the standing value of livestock are indicated below in table 3.5:

Table 3.5 Estimated Annual Value of Livestock Products and Standing Value of Animals for Modal Herd Sizes of Cattle, Sheep, and Goats (EB)

	Value of Products	Value of Herd
a) Cattle:		
- Milk Herd	313	650
- Draught Herd (2 oxen)	293	510
b) Sheep:	14	173
c) Goats	8	140

3.4.7.4 Whole Farm Economics:

Because of the skewed livestock ownership (including draught oxen) considerable variations will occur in total farm incomes. The order of this variation can be shown by indicating differences of crop income between 2/1 ox and no ox owning farmers. The estimated value of small ruminant income is relatively small, and thus not likely to have marked effect on between-farmer income cariation. The main cause of income variation derives from ox ownership. This is shown in table 3.6 below. Generally approximately 20% of farmers will fall in the lowest income group, 60% in the middle groups, and 10% of farmers with even higher incomes than the highest shown here because larger than modal livestock holdings. Income variation is likely to be least in the enset dominant farming system incomes because of the lack of need for draught power.

Table 3.6 Estimated Range in Total Annual Farm Incomes by Farming System

(EB per annum)

Farming System	Crop Income		Livestock Income		Total Farm Income	
	1/2 Ox Owner	Zero Ox	Cattle	Sheep/Goat	Without Livestock	With Livestock
1.	289	213	293	14/7	213	582
2.	319	283	313	14/7	283	632
3.	558	511	293	14/7	511	851
4.	391	284	293	14/7	284	684
5.	603	542	293	14/7	542	896
6.	330	321	313	14/7	321	643
7.	313	265	313	14/7	265	625
8.	493	417	293	14/7	417	786
9.	426	341	293	14/7	341	719
10.	510	384	293	14/7	384	803

3.5 AGRO-PROCESSING AND MARKETING.

3.5.1 Agro-processing.

Most post-harvest grain processing (threshing and milling) is carried out either manually or by animal trampling, either on the farm or at the homestead. There is no domestic processing of oilseeds. Powered grain mills are confined to the wereda and other small towns, except for 3 SC mills in Gumer wereda. The processing of enset is complex and laborious (see FD-14) and is almost totally the preserve of women. There is a high labour input in decorticating the sheaths and in shredding and pulverising the corm. Nine food consumption products are made, the most important being "kocho", a white doughy substance. In addition fibre is made from the sheath (4 meters of rope per mature plant), and animal feed from the leaves. Coffee processing is confined to the removal of the epidermis, washing, and drying. There are no mechanical hullers in the project area, the nearest being in Areka adjoining Angacha wereda. Livestock products from processing are mainly confined to butter and cheese, and hides and skins.

3.5.2 Agricultural Marketing.

3.5.2.1 Official Marketing:

The official government marketing agencies in the project area are the Agricultural Marketing Corporation (AMC) which is resposible for all grains and food crops, and the Ministry of Tea and Coffee for coffee. AMC establishes national crop prices and regional quotas which are passed down to individual PAs. Purchases are made by SCs from farmers receiving EB5 per Q. from AMC as handling charge. PCs receive higher prices (generally 10%) than individual farmers. Private traders must sell at least 50% of their purchaes to AMC (raised to 100% in some years). AMC purchases in 1986/87 in the project area are shown in Annex 1 - table A-1.4. Overall they ammounted to 6750 m.tons or some 9% of total cereal production.

3.5.2.2 Open Marketing:

The open marketing system comprises a hierarchy of local, primary, secondry, and terminal markets. Local markets usually serve 5 -10 PAs, whilst primary markets are located in all wereda towns and some non-wereda towns. Secondary markets are established at Hosaina and Butajira, whilst the main terminal market is at Addis Ababa. Some markets specialise: Demboya in enset and cattle; Alaba Kulito in sweet potatos and peppers; and Doyogene and Tshashogo for butter.

A comparison of AMC prices and the open market prices are shown in Annex 2 table A-2.1. Generally post-harvest open market prices are about 60 - 140% higher than those of AMC. Seasonal price fluctuations on the open market do occur, with immediate post harvest prices 60 -. 80% of immediately pre-harvest.

3.5.2.3 Livestock Product Marketing:

Live animals for slaughter pass through the private marketing system which comprises private traders who bulk and then treck the animals to Addis Ababa. Prices are determined on the open market. Hides and skins are purchased by licenced traders using government established prices. Dairy products are sold as cheese and butter and rarely as milk. Butter is traded mainly locally to Hosaina, with most externally traded butter going to Butajira rather than Addis Ababa.

3.6 RURAL INDUSTRIES AND WOOD SUPPLIES.

3.6.1 Rural Industries

The CSO report no medium or small scale industries in the project area. However in the wereda towns a number of individual tailor and blacksmith shops can be found. Home industries include cloth weaving, mat and basket weaving, rope making, pottery making, leather products, and furniture making.

3.6.2 Fuel and Building Supplies

The only remaining natural forest is confined to 250 ha along some of the rivers. Wooded land(with 10-40% of the vegetation as trees) covers approximately 8500 ha. Fuelwood and timber are thus in short supply, particularly in AEZs 1,and 4 located in the drier lowland areas. At higher altitudes where LGPs are longer Eucalyptus planting by individual farmers is common. Building timber and thatch are also in short supply, although again at higher altitudes bamboo is grown.

3.7 RURAL INFRASTRUCTURES AND SOCIAL SERVICES.

3.7.1 Roads

The project area is relatively accessible, being served by five all-weather roads, four linking with Hosaina. The road network is shown on Map 2. Although overall 70 % of PAs are within 5 kms of an all-weather road and 80% within 5kms of any road, there are differences between weredas. Gumer, Limu, and Ṣike have only 65,50, and 40 % of their PAs within 5 kms. of an all-weather road. The conditions of the dry weather roads vary, with those on the poorly drained heavy clay soils almost impassable during the wet season because of the lack of drainage structures (particularly in Shone wereda).

3.7.2 Water Supplies

Village water supplies are generally rudimentary. In the Kolla and the drier Woina Dega zones (in Shone and Dalocha weredas) a number of ponds have been constructed, but these are generally dry before the end of the start of the rains. In the higher zones springs and streams are the general source. A protected spring programme is operating in Angacha, and a hand dug pond programme in Shone wereda using food for work.

3.7.3 Storage Facilities

Storage facilities for inputs and produce are held by AMC, MOA, RRC, and some SCs. Traditional farm level storage is in bamboo bins and baskets outside the house. Storage losses are estimated at about 10% per annum., although they are higher in the Kolla and drier Woina Dega Zones, and with the large rather than the small grains.

3.7.4 Market Facilities

Market facilities are available at all wereda and small towns. Elsewhere rural market facilities are usually non-existant, with farmers and traders meeting in a designated open area with wares displayed on the ground.

3.7.5 Health and Education Facilities

Health clinics are located in all wereda towns, with two hospitals at Hosaina (one government and one mission). There is thus one hospital per 300 000 people, and an average of one clinic per 10 000 people.There are three secondary schools serving the project area: Hosaina, Durame, and Angacha. Junior schools and Elementary schools total 18 and 56 respectively.

3.8 ORGANISATIONS AND INSTITUTIONS.

3.8.1 Agricultural Support Services.

3.8.1.1 Extension Service:

The polyvalent Development Agent (DA) provides extension advice at the field level. In addition to agricultural extension duties DAs are often involved in extra-extension activities such as villagisation, tax collection, credit organisation and collection, and AMC quota supervision. On average a DA covers 4-5 SCs with 16-20 PAs. At the wereda level the Coordinator is

generally a diploma holder with 5-10 years experience. He supervises all extension and technical staff at the wereda HQ. Supporting technical staff cover soil conservation, home economics, vaccination of livestock, cooperative development, and agronomy. Details of staffing in the project area are shown Annex 1 - table A-1.2. There are no staff training programmes, and no training facilities exist even at the awraja level. There an overall lack of transport and funds for travel, and logistical support. There is no structured work programme or management/supervision system.

3.8.1.2 Agricultural Research:

The MOA ADD have a research site at Hosaina where variety screening and husbandry trials are conducted. NFIU have a number of fertilizer trials in the project area.

3.8.1.3 Input Supply Services:

These are provided by the Agricultural Inputs Supply Corporation (AISCO) which functions under MOA. At the field level all wereda MOA HQs and five SCs are the main outlets. AISCO undertakes to deliver to all SCs from these main depots. The SCs are then reponsible for issuing to PAs and PCs. SCs pay 15 % deposit to the Commercial Bank of Ethiopia (CBE) before AISCO will deliver, the balance being paid after harvest with 12 % interest. Some 90 % of fertilizer is currently sold on credit in this way and AISCO is thus a major source of credit . Failure to repay the full ammount renders that SC inelligible for further credit. In some weredas this now ammounts to 50 % of SCs. Improved seed is purchased by AISCO from the Ethiopian Seed Corporation(ESC) for distribution through MOA to SCs. In addition MOA has its own multiplication facilities. Pesticides and herbicides are becomming available through private traders, some of whom undertake applications.

3.8.1.4 Credit:

The main credit institution for agriculture is the Agricultural Investment Development Bank (AID Bank). It has no offices in the project area and works through the CBE office in Hosaina. It lends to SCs and PCs at 9.5% with on-lending to farmers by SCs at 11%. In addition there is the considerable

seasonal credit operation operated by AISCO/MOA for fertilizer. In 1987/88 AISCO lent some EB2.54 million for fertilizer and improved seed in the project area.

3.8.1.5 Non-Government Organisations(NGOs):

The Kale Heywot church has initiated a number of agricultural development and support activities in the Kambata and Hadiya awraja based on Durame. These are supported by a number of NGOs. Activities are concentrated on livestock development, in particular of improving local breeds through the availability of Freisen bulls at Durame and Angacha. The facilities are currently able to service 600 cows per annum. In addition forage development , veterinary services, seedling provision for afforestation (2.5 million per annum), horticultural development with seed supply are all pursued and offered.

3.7.2 Farmers Organisations.

There are a total of ~71 Service Cooperatives in the project area servicing 302 Peasant Associations with a total membership of 143 119. Of the members approximately 14 % are females, usually unsupported widows and divorcees. The SC is the primary unit for the supply of credit, inputs, and commodities; as well as being the purchase point for AMC quotas. Producer Cooperatives are not well developed with only 20 PCs, all still at the malba stage, with 546 members cultivating 1 720 ha. This is 3.1 ha per member - a considerably larger area than the average PA member.

Kebelle PAs Committees are resposible for land allocation to individual members and to PCs, as well for carrying out certain judicial and regulatory functions. SCs have purely service functions. PAs, PCs, and SCs are all legal entities, and may sue and be sued. Kebelle PAs are organised into wereda and awraja PAs. These are empowered to change Kebelle PA boundaries, create new or amalgamate existing PAs. Judicial and other appeals can be made from KPAs through wereda and awraja Associations to the nation Association.

3.7.4 Villagisation

Because of the peculiar problems occasioned by the enset cultivation system, villagisation has not proceeded at the same pace as in other parts of Shewa. The main problem relates to the intricate land use relationships between the homestead ("tukal") with its kitchen garden; the "djaf" an area around the homestead often used for night kraaling livestock which are important for the supply of manure; the adjoining enset groves which consist of enset nurseries containing enset at different stages of its six to eight year growth cycle; and lying beyond these the annual grain cropping area. The disruption of these intimate spatial relationships caused by the relocation of the homesteads in the villagisation process would be quite disasterous for the enset system and to date villagisation has been concentrated in the cereal system areas.

3.8 PLANNING ZONES. (see Map 4)

In order to organise the technical recommendations and interventions in a comprehensible way for implementation the PAs were organised into Planning Zones (PZs). The boundaries of the PZs were conformable as possible to the agro-ecological zones and the farming systems. Although the boundaries of some PAs were not exactly conformable they were sufficiently close in most cases for implemntation purposes. Farming systems 2 and 7 were combined because their problems and potential were very similar. The original farming system and AEZ numbering has been retained. Maps in Annex 1 for each wereda indicated the Planning Zones in that wereda.

MAP 4 PLANNING ZONES

CHAPTER 4.

A DIAGNOSIS AND SPECIFICATION OF THE MAJOR LAND USE AND AGRICULTURAL DEVELOPMENT PROBLEMS AND POTENTIAL.

4.1 INTRODUCTION.

4.1.1 Development Objectives.

The national agricultural development objectives have been set out in Chapter 2. These generalised objectives can now be specified for the Hosaina project area as follows:

(i) to secure, intensify, and where possible expand crop production, processing, and marketing; with the priority firstly on food crops, and secondly on industrial (tobacco and chillies) and export (coffee) crops;

(ii) to secure and intensify livestock production and marketing, in particular for dairy production, draught, and increased offtakes of sheep and cattle by sale;

(iii) to improve natural resource conservation in order that intensified and expanded agriculture is self-sustaining in ecological and economic terms;

(iv) to improve access to the basic needs of all the rural population, including nutrition, income, water supplies, health, education, fuel, and marketing facilities;

4.1.2 Constraints and Problems.

In order to develop firstly alternative and secondly preferred strategies and land use systems to achieve these objectives, it is necessary to diagnose and specify in detail the constraints to the current as well as to any proposed intensified or expanded land use; and how these manifest themselves as land use and development problems. Many of the land use problems examined in this chapter comprise a complex of inter-acting constraints often forming causal chains. For example the variability in the timing and amount of rainfall (an environmental constraint), coupled with the shortage of work oxen (a production constraint), lack of improved drought resistant crop varieties (a technical constraint), and the difficulties of delivering fertiliser to remote areas (an accessibility constraint) combine to form the "problem" of low crop productivity. This in turn leads to poor human nutrition and low incomes, which in turn lead to problems of reduced human power and capital resources, which then feed back in downward spiral into the problem of low crop productivity.

The objectives of this chapter are not only to identify the constraints, but also to analyse in a systems way their inter-relationships as "problems" and the resulting causal chains of problems and their feed-back mechanisms. This is important, because resolving one or two of the constraints may not solve the problem. The major problems can be considered under two categories:

(i) core land use problems

(ii) ancillary land use problems

Core land use problems relate directly to the use of the land, and have been defined as follows:

(i) Low crop productivity and high risk

(ii) Specific land and soil management problems

(iii) Scarce livestock feed and low productivity

(iv) Land shortage, increasing population, and land use conflicts

(v) Shortages of wood and water

Ancillary problems refer to the indirect conditions which influence land use decisions and the core problems. They have been defined as follows:

(vi) Poor accessibility and logistical problems

(vii) Institutional and regulatory problems

(viii) Health and nutrition

(ix) Economic problems

4.2 LOW CROP PRODUCTIVITY AND HIGH PRODUCTION RISK.

4.2.1 Natural Resource and Environmental Constraints.

4.2.1.1 Agro-climatic Constraints.

Variable and Low Rainfall: Variable and low rainfall is a major crop production constraint in the Kolla of Hosaina South (PZ 1), and to a lesser extent in the degraded Woina Dega of Hosaina North (PZ 4). There are three phases to the rainy season which are of importance to crop production:

Phase 1. Light and variable (belg) rains from February to April:

Phase 2. A rainfall trough between May and June of variable occurrence, intensity, and length:

Phase 3. Main (krempt) rains from July to October:

The belg rains are important for land preparation and planting of the main crop maize, together with subsidiary crops of sorghum, finger millet, and horse beans all of which have long growing periods. A delay or failure of these rains have a major impact on the production of these crops. A failure of the belg rains in the Kolla zone of Hosaina South (PZ 1) can be expected 4

years in 10, and 2 years in 10 in the northern degraded Woina Dega (PZ 4). These belg failures are always followed by a pronounced rainfall trough, thus extending the period of moisture deficits, and increasing the negative impact on yields of the long growing period crops.

A rainfall trough (here defined as three 10 day periods with rainfall lower than the highest rainfall experienced in any three previous decads) can be expected 7 years in 10 in the south (PZ 1) and 4 years out 10 in the north (PZ 4). When a pronounced trough occurs during maize tasselling a significant yield reduction can occur.

The main (krempt) rains are important not only for the continued sustained growth of the long season crops, but also for the establishment of the next major crop teff and also wheat. An length of growing period (LGP) of less than 100 days of the belg and krempt combined when almost total crop failures will occur can be expected 20 % of years in the south (PZ 1) and 15 % of years in the north (PZ 4). Year on year variations of yield due to soil moisture deficits were estimated using the FAO (1986) methodology for yield assessment for Alaba Kulito and Silti for a 100 cms deep planosols with a water holding capacity of 125mm per meter. The return periods of yields as percentages (100-70, 69-50, <50) of maximum yield are as follows:

Table 4.1 Return Periods of Yield Reductions due Moisture Deficits

	100 - 70% of yield	69 - 50% of yield	< 50% of yield
(a) Alaba Kulito (PZ 1):			
Wheat/teff	6 in 10 years	3 in 10 years	1 in 10 year
Maize/sorghum	5 in 10 years	3 in 10 years	2 in 10 year
(b) Silti (PZ 4):			
Wheat/teff	8 in 10 years	nil	2 in 10 year
Maize/sorghum	6 in 10 years	1 in 10 years	3 in 10 year

An early cessation of the krempt rains (i.e., at the end of September instead of the end of October) will occur about 4 years in 10 in both PZ 1 and PZ 4. The impact of an early cessation on yield will be greater on wheat than teff, which if well established can normally survive an early cessation with little or no yield reduction. In summary the major crops can be ranked in order of risk (most to least) as follows: maize > horse bean > sorghum > wheat > teff.

Outside PZs 1 and 4 coffee is the crop most sensitive to soil moisture stress. The crop occurs mainly in the Woina Dega zones of Hosaina South (PZs 2, 3, and 5). However only in the undulating Woina Dega zone (PZ 3) does the shortness of the LGP periodically affect coffee yields: with a crop failure possibly occurring 1 year in 5, and a 50% reduction in yield 3 years in 10.

Temperature: Low temperatures during the growing period lengthen the crop growing season and if low enough preclude cultivation. Of the main cereals the order of sensitivity are sorghum, maize, wheat, barley. In the upper dega and lower wurch only wheat and barley can be grown, and only barley in the lower wurch. White potato is the only other major crop above 3 200 masl. Incidence of frost becomes frequent enough to become a major crop restraint in the upper dega and lower wurch (PZs 9 and 10). particularly in valley bottoms and hollows where crop cultivation may be precluded.

Hail: Hail incidence is frequent and occurs in all zones, but is usually very localised. Generally incidence increases with increasing altitude. It can have devastating effects even on crops such as enset.

4.2.1.2 Crop Pests and Diseases.

Crop Pests: Aphids are reported (ADD,1986) to be the most important pest, mainly on wheat and barley, but also occurring on the major pulses particularly horsebean and fieldpea. They are said to have virtually eliminated horsebean from the crop mix in the Woina Dega plains of Hosaina North (PZ 4). Stalk borers are the main problem of maize, and the second after birds on sorghum. Both aphids and stalk borers show an increased incidence during the rainfall trough between the belg and krempt rains. After

aphids bollworm is the next most important pest in the higher zones, particularly of fieldpea and noug. Grasshoppers and army worm are local but can be devastating pests mainly of maize and sorghum, and again are associated with the rainfall trough or late belg rains. All outbreaks of insect pests require careful monitoring to establish the most economic and effective time of insecticide application. Birds (Quellea and passage migrants travelling through the Rift Valley) are the most important problem for sorghum and the new varieties of maize in the Kolla plains of Hosaina South (PZ 1). Large digging animals such as warthog, porcupine, and moles are the major pests on enset and white potato.

Crop Diseases: Perhaps the biggest potential disease problem in the Project Area is bacterial wilt (Zanthomonas musacearum) in enset. Its prevalence varies widely, with some attacks being highly localised, even within the same PA. Transmission is mechanical and thus can include man, animals, insects, and tools. In particular three insect vectors (leaf hopper, banana aphid, and mealy bug) have been recognised (IAR, 1986), so technical solutions based soly on better hygiene may not be successful. In addition Canna orchoides has found to be a host to the disease. Farmers report that land cannot be planted to enset for a period of four years after infection, whilst IAR report knives remain infectious for a upto five days. The IAR enset commodity team (per.comm.) report that no resistant varieties have yet been identified, although ADD/AACM report that farmers at Butajira, Goro, and Indibir (outside the project area) have recognised five tolerant varieties from over 70 grown in these areas. Although as productive as non-tolerant varieties they are said to the not as palatable. A tolerant variety was reported from Angacha, but this was not as productive. The disease is most virulent at the climatic margin of enset, and a 100% plant death rate occurred in PZs 4 and 5 after the 1983/84 drought.

Rust however is the most prevalent disease problem, being most serious on wheat, horsebean, and pepper, but also found on teff, barley, and pulses. Incidence is most frequent during cloudy periods after flowering. Smut is also prevalent, particularly on barley. Coffee berry disease (Colletotrichum coffeanum) is prevalent in all the coffee growing areas, whose incidence has increased in recent years. Weeds are a problem, particularly in teff above 2200 masl. , and meskal weed in maize and sorghum is found below 2 200 masl.

4.2.2 Crop Production Factor Constraints.

4.2.2.1 Land:

In most areas there is now a shortage of cropping and grazing land with no major expansion of crop area possible. This is explored further in Section 4.5.2 in relation to PAs population support capacity. Constraints to access to land are outlined in Section 4.5.1.

4.2.2.2 Labour:

Labour does not appear to be a constraint, with the major exceptions occurring in the enset growing zones. In September and October labour requirements for both male and female labour exceed supply. The main demand derives from enset processing and manuring for female labour, and land preparation and interculturing of both the nursery and main enset gardens (mainly male labour).

4.2.2.3 Draught Oxen:

Draught oxen requirements are generally low in the enset systems except for those with a relatively high proportion of arable land under annuals, in particular the lower and upper Dega. In addition the main cereal areas in the Kolla and Woina Dega zones (PZs 1 and 4) and the lower Wurch zones (PZ 10) also have high draught requirements. Using woreda ox ownership patterns (MOA, 1984) and the half monthly oxen requirements for each farming system from the Socio-Economic Report, the surplus/deficit ox pair days were calculated for each class of ox owner (i.e.. 2, 1, or) oxen). Only in Planning Zones 1, 2, 9, and 10 do oxen deficits occur, and only for the no ox owning farmer. (See Annex 4 for a fuller discussion). In the Kolla zone deficits occur from mid-March to the end of April, and again from the beginning of June to mid-July. Deficits in the first period seriously affect the farmers ability to prepare and plant the long season crops (maize,sorghum, and chillies), whilst those in the second periods affect the land preparation and planting of teff and wheat. In the undulating Lower Dega (PZ 8) deficits occur from mid-February to the end of July. Similarly land preparation and planting of maize, teff, wheat, and barley are all adversely affected. Delays in land preparation and planting are exacerbated in the Kolla zone by the variability in the timing and amount of the belg rains.

4.2.2.4 Working Capital:

Working capital includes cash income from surplus crop and livestock product sales, and also from credit. Estimated net cash returns from surplus (unimproved) crop sales for each farming system vary from EB50 - 200, and from livestock products EB50 - 200. Current costs (at recommended application rates) for fertiliser are EB97 per ha. and improved wheat and maize seed costs EB87 and EB16 per ha. respectively. Thus in all Farming Systems the cost of purchasing fertiliser would absorb a considerable proportion of the farmer's cash income. Since 1987 seasonal credit has been made available by AISCO, the AIDB, and ECB, an estimated 50% of farmers in Hosaina North but only 20% in Hosaina South have had access to this credit.

4.2.3 Accessibility to Resources and Technology.

4.2.3.1 Physical Accessibility:

Sike, Limu, and Gumer weredas are the least accessible in terms of having the greatest number of PAs beyond 5 kms of either an all-weather or even a dry weather road.

4.2.3.2 Access to Improved Technology.

Improved Inputs: Fertiliser purchases have increased from 420 m.t. in 1985 to 5,532 m.t. in 1987. This has occurred because of a commensurate increase in seasonal credit through the AIDB, ECB, and AISCO itself. Purchases of improved wheat, maize, and teff seed have also seen increases. Fertiliser adoption rates (assuming 1 quintal per purchasing farmer) are just over 50 % in Hosaina North, and 20 % in Hosaina South. The three woreda MOA offices in Hosaina South all reported an excess of demand for fertiliser over supply. Adoption rates of improved seed however are very much lower, by not more than 2 % of farmers. Estimates of improved seed demand are difficult to assess. Purchases of improved seed by MOA/AISCO have been well below the orders placed by them with ESC, simply because of the unreliability of farmer demand estimation. However farmer demand for wheat and maize does appear to be strong and is not yet met by current supply. There is no information on improved seed renewal by farmers or of

current vigour of seed supplied. Use of hybrids or synthetics such as Awassa 511 and 611 require annual renewal, whilst the composites require triennial renewal to maintain vigour.

Pesticides and sprayers are available at MOA woreda offices, but not at Service Cooperatives or PA offices. Awraja pest control brigades are established but are frequently without transport. Some private traders hold stocks of pesticides and herbicides and are prepared to undertake applications, but non-availability of sprayers is reported to be a problem.

Coffee: Although coffee berry disease (CBD) is a major problem in the project area CBD resistant varieties are not available. Effective fungicides although available have not been adopted because of availability of credit. The main coffee growing areas are in Hosaina South where fertiliser is in shortest supply.

4.2.4 Limited Range of Tested Improved Technology for the Project Area.

4.2.4.1 Improved Crop Varieties:

Only for maize and wheat are improved varieties available: other "improved "varieties (for teff, barley, and sorghum) are local selections, and generally do not out-perform local varieties. There is a lack of short duration and drought resistant varieties particularly for teff, sorghum, and cowpea. Work has only recently commenced on clonal selection of enset in the Wolaita area of Sidamo. However no work has commenced on improved agronomic practices (spacing, fertilisation, or inter-cropping).

4.2.4.2 Fertiliser:

Current fertiliser recommendations are global irrespective of soil or agro-ecological zone or crop: viz 100 kgs. DAP with 50 kgs. urea as a topdressing. Preliminary fertiliser trial results for Hosaina from the National Fertiliser and Inputs Unit indicate that at both AMC and open market prices the economic application rates of fertiliser are only 40 - 60% of recommended rates. In addition there are significant differences in nutrient response between different crops, and between different (red or black) soils. These

results would appear to indicate that a change in fertiliser recommendations may be necessary, although firm recommendations will have to await the analyses of the 1987 results.

4.3 SPECIFIC LAND AND SOIL MANAGEMENT PROBLEMS.

4.3.1 Soil Fertility.

As in most of highland Ethiopia soils in the project area are deficient in phosphorous (P). The significant response to P fertiliser has already been mentioned in section 4.2.4 above. In land short PAs where fallowing is rarely or not practised nitrogen (N) and organic matter (OM) levels are likely to be low. In the Kolla and the drier Woina Dega zones (PZs 1 and 4) where manuring is not extensively practised (because of its use as fuel) N and OM levels are also likely to be low. OM mineralisation rates are also higher in these zones because of higher temperatures. In the remaining Zones manure application is limited to coffee, enset, and Ethiopian cabbage, and to maize grown in the "guaro" garden.

4.3.2 Land Degradation.

There are approximately 33 000 ha of badlands i.e. land which is degraded to a state beyond which reclamation for cropping is not possible. In addition some 48 000 ha. are exposed to a severe risk of land degradation and badland formation. These latter areas are associated with or adjacent to existing degraded areas. Three major types of erosion either have or are occurring in the project area:

(i) extensive badlands erosion caused by massive and extensive slumping, sliding, stripping, and gulleying;

(ii) sheet and rill erosion on crop lands;

(iii) soil compaction on overgrazed pasture land which can lead in turn to badlands, or to sheet and rill erosion;

4.3.2.1 Extensive Badlands:

Extensive badlands are most widespread in Hosaina North, and result from either geological erosion or man-induced accelerated geological erosion. Three major processes are operating: (i) piping, sliding, and stripping of soil and upper pyroclastic layers on low angle slopes; (ii) stripping of soil from high angle slopes; and (iii) massive slumping, slope failure, and gulleying.

Piping, sliding, and stripping are largely confined to the eastern Woina Dega plains where there are extensive areas of vertisols, vertic cambisols, and planosols (PZ 4). Sub-surface piping or tunnelling (i.e. erosion of sub-soil along cracks and fissures) eventually leads to collapse of the overlying material. In areas of planosols this process is accelerated by slumping of the unstable sodic subsoil. In addition to piping and tunnel collapse, the sliding of hard resistant layers over moist, soft, and lubricated layers of pyroclastics also contributes to extensive stripping.

Stripping of soil on high angle slopes occurs on the isolated hills west of Dalocha and appears to be the result of shallow but extensive land slips.

The massive slumping, slope collapse, and gulleying occur at or along the lines of very recent rift faulting which has initiated stream incision and subsequent slope instability in deep, stratified layers of pyroclastics of variable cohesion and hardness.

It is necessary to distinguish between stable and unstable badlands. Stable badlands are those areas which have in the past suffered from massive and extensive erosion but which now appear to be stabilised. These include gulleys and incised streams which appear to be at grade, and previously eroded or stripped land whose slopes now appear to be stable. Evidence for stability can be seen in gulley and stream floors and sides which are now vegetated, and slopes which are covered with grass and shrubs. Unstable areas are clearly recognised by areas of exposed soil and exposed layers of underlying weathered pyroclastics. Whilst stable areas are relatively easy to deal with, the unstable areas currently being subject to massive gulleying, slumping, and extensive stripping present a much more difficult problem.

4.3.2.2 Wash and Rill Erosion:

Wash and rill erosion on crop land is far less spectacular, but may overall be responsible for a greater volume of soil loss than currently active badland erosion. On slopes of less than 13% annual soil loses do Generally not exceed 30 m.t. (2.5 mm per annum), and between 30 - 75 m.t. (2.5 - 5 mm per annum) on cultivated slopes upto 25 %. Much soil conservation work has been implemented in the project area, mainly in the form of bunding. However many instances of bund failure can be observed. Failures are generally due to non-maintenance of bund trenches and the in-washing of sediment which leads to overtopping of the bund, often on lines weakness e.g.. down old footpaths and cattle trails perpendicular to the slope. Although graded bunds might be preferable to the current contour bunds, the absence of natural waterways on many slopes coupled with the difficulties of contracting safe artificial waterways on slopes in excess of 13 % make for no easy solution.

4.3.2.3 Soil Compaction:

Soil compaction and surface sealing, together with very sparse vegetative cover can be observed on many pastures due to overgrazing. This results in high surface run-off rates, the subsequent channelling along footpaths and cattle trails, leading to deep gulleying, most particularly down the crest-lines of spurs. These crest-line gulleys are exceptionally deep, and their walls of soft weathered pyroclastics are generally unstable even though active down-cutting on the gulley floor may have ceased. On the areas of vertisols and vertic cambisols excessive surface run-off is concentrated into cracks and fissures accelerating the subsurface removal of material, and so to tunnelling and piping.

4.3.3 Surface and Subsurface Poor Drainage.

Three types of drainage problem occur in the project area: surface ponding and topsoil waterlogging which occurs for relatively short periods during the heaviest rains in August-September; subsoil water-logging from a deep watertable which can occur for longer periods; and thirdly temporary water-logging from perched watertables. Each poses different problems requiring different remedial actions.

Surface ponding and topsoil waterlogging occurs mainly on the vertisols and vertic cambisols found on the Woina Dega plains of Hosaina North (PZ 4). It is caused by surface sealing of the heavy swelling clays, followed by an excess of water over the very reduced infiltration rates. On level or nearly level sites this water is unable to drain away. Plant roots in the topsoil remain under water in anaerobic conditions.

Subsoil drainage problems occur on receiving sites where subsurface water accumulates as a deep ground water table. When the water table reaches the rooting zone anaerobic conditions prevail, and if these persist for more than two weeks cropping is not possible. Often surface and subsurface drainage problems occur simultaneously on low-lying fluvisols during August-October, and the land remains unused for cropping or grazing.

Another form of poor drainage can occur on the duplex planosols found extensively on the Kolla plains of Hosaina South (PZ 1). Here water can accumulate as a " perched " water table within the light textured topsoil but above the heavy and often sodic subsoil. Crops which dislike "wet feet" (e.g..maize and chillies) can be particularly susceptible to this type of waterlogging.

4.3.4 Tillage Problems.

The wet and dry consistencies of the vertisols provide major constraints to both ox-drawn and mechanised tillage operations. Consistencies when dry can be extremely hard, making ox-ploughing very difficult. Very hard dry consistencies can also occur on vertic cambisols and on planosols in the Woina Dega and Kolla plains (PZ 1 and 4). The wet consistencies of vertisols are extremely sticky and very plastic. This results in clogging of the maresha, mouldboard, and disc ploughs, requiring increased pulling power, and time to continually clean discs or tips. Additionally there is a considerable loss in traction. Land preparation of vertisols by oxen is estimated to take half as long again as other soils.

4.4 LOW LIVESTOCK PRODUCTIVITY.

4.4.1 Introduction.

4.4.1.1 Productivity:

The various production objectives for livestock holdings have been set out in sect. 3.2.3. The low productivity of livestock in the project area is manifest in a number of ways. These can be summarised as :

(i) high calf, lamb, and kid mortality rates

(ii) low reproduction rates (important for a self-reproducing store of wealth and supply of draught power)

(iii) low and widely seasonal fluctuating liveweights

(iv) low draught power particularly at critical land preparation periods, related to (iii) above)

(v) low milk off-take

(vi) limited power as pack or human transport animals

(vii) the poor quality of hides and skins

Whilst the overall genetic potential of local cattle and small ruminants is low, environmental factors also play a major role in this poor productivity - in particular nutritional stress and disease. Because of this low productivity and high mortality rates, off-takes rates are also generally low: approximately 7 - 10% per annum for cattle, and 25 - 35% for small ruminants (about the national average).

4.4.2 Available Livestock Feed Resources and Current Requirements.

4.4.2.1 Available Feed Resources:

The three major feed sources are: individually owned (communally in the case of PCs) crop residues, individually owned pastures adjoining the homestead, and communally controlled natural forage. Stubble (or "aftermath") grazing in the out-fields is initially used by livestock belonging to the cultivator immediately after harvest, but thereafter reverts to the communal pool. Available feed varies between years as well during the year. Supply and palatability fall off rapidly as the dry season progresses. Feed from unused arable land was estimated (Field Doc.22) to vary from 2.5 t/DM/ ha. in the dry Kolla to 3.6 mt/DM/ha in the wetter Dega zones. In dry years forage production could fall to 50% of these figures. Production from wetland pastures are estimated at 4.1 - 6.0 mt DM/ha. , whilst on degraded hillsides production can range from zero to 1.2 mt DM/ ha. Crop residues, including enset leaves and aftermath grazing are important sources of livestock feed, and their contributions are set out in Annex 2. A daily average supply was estimated for each PZ by taking a weighted average of feed sources calculated during the carrying capacity analysis in the Land Evaluation Report, and are included in table 4.2 below.

4.4.2.2 Current Livestock Feed Balance:

Two approaches have been used to estimate feed requirements: as dry matter or as mega joules of metabolizable energy (MJ ME). Opinions differ as to the estimated requirements, between sources and whether survival, maintenance, or full production rations are assumed. The EHRS uses 2.5% of liveweight (in DM) whilst LUPRD and the South Shewa Development Project Preparation Report quoting Kearl use 2.0% (for maintenance). Using the energy balance approach estimates of daily requirements vary for a standard TLU from 32.7 MJ ME, 31.5 MJ ME, and 20.0 MJ ME(8).

Using 2% of liveweight, and 23 ME MJ (maintenance for cow), and 31.5 ME MJ (maintenance plus moderate work for an ox) the feed balance situation for each of the planning zones is shown in table 4.2 below:

Table 4.2 Average Daily Feed Requirements and Availability per TLU by Planning Zone.

PZ	Req.	Supply	Req.1	Req.2	Supply
	(Kgs DM per day)		(MJ ME per day)		
1	5.0	2.98	23.0	31.5	19.4
2/7	5.0	3.30	23.0	31.5	21.4
3	5.0	3.75	23.0	31.5	24.4
4	5.0	4.00	23.0	31.5	26.0
5	5.0	3.42	23.0	31.5	22.2
6	5.0	3.05	23.0	31.5	19.8
8	5.0	5.86	23.0	31.5	38.1
9	5.0	3.75	23.0	31.5	24.4
10	5.0	3.38	23.0	31.5	22.0

All PZs except the Lower Dega of Hosaina North (PZ 8) are deficient. Even at 23 MJ ME which is sufficient only for maintenance for one cow, half the Zones are still deficient. This is particularly serious for those deficit Zones (PZs 1, 4, and 10) which rely on draught power for land preparation. There are however seasonal changes in both requirements and supply, and these are out of phase. Thus available supply is lowest just when requirements are highest, at the end of the dry season and at the beginning of the rains.Heavy ploughing may double the average daily requirements from 31.5 to 60 MJ ME, just when supply may be half the daily average. Feed resources are again constrained in July- September when the valley floors are subject to inundation.

4.4.2.3 Water:

The Kolla and drier Woina Dega zones (PZs 1 and 4) report shortages of water in the dry season, and livestock must be walked long distances. Some ponds have been constructed under the FFW programme but many PAs are still without reliable dry season supplies. Concentrations of livestock at the few watering points along perennial streams and ponds have lead to localised but severe land degradation.

4.4.3 Disease, Herding Systems, and Herd Dynamics.

4.4.3.1 Livestock Diseases and Parasites:

A full list of diseases and parasites by ecological zone is provided in Field Document 20. Most of these are endemic and debilitating rather than epidemic and fatal. This is particularly so of the tick-born diseases and internal parasites. The latter are mainly prevalent on the bottomlands where there is a large build-up of cattle during the dry season. The main effects of poor nutrition combined with disease are the low calving percentages (estimated at about 55%), high calf mortality rates (18%), low milk offtakes (rarely exceeding 300 kgs per lactation), late calving age (approximately 4 years), low mature liveweights (210 kgs for cows and 280 kgs for oxen), and very importantly low draught power. Effects on the small ruminants are similar with lambing/kidding percentages of 85%, mortality rates of upto 30 % , and low liveweights at sale of 20 - 30kgs.

4.4.3.2 Herding System:

Livestock generally graze in mixed sex groups so there is little opportunity for controlled mating and thus seasonal calving. Herding is not permitted outside a farmer's SC boundary, and generally not outside the PA boundary.

4.4.3.3 Herd Dynamics:

The problems of estimating herd dynamics were enumerated on pg 22 and it was estimated that in the medium term livestock numbers are largely static because of periodic very high mortality rates and distress sales due to drought. Thus the drier Kolla and Woina Dega zones (PZs 1 and 4) are likely to be most affected by periodic herd reductions, with the wetter and higher Zones less so. The relatively high risk in holding personal wealth in the form of cattle and the lack of alternative sources of investment result in the holding of as large a number of livestock as possible with low offtake rates. Thus in the short term a voluntary reduction in livestock numbers is extremely unlikely. Some long term possibilities are suggested in section 4.6 below.

4.4.3.4 Livestock Ownership Patterns:

Cattle ownership patterns are highly skewed, with one third of farmers owning two thirds of the cattle. Some 30% of farmers own all the sheep, and 16% of farmers all the goats.

The successful introduction of communal grazing management schemes in those zones with a large proportion of communal grazing (PZs 1 and 4) would thus require the acquiescence and support of this small group of well-endowed farmers, with perhaps some pressure from the larger group (three quarters) of farmers who only own between one and four head of cattle.

4.5 LAND ALLOCATION, SHORTAGE, AND INCREASING POPULATION.

4.5.1 Land Allocation and Regulation.

The non-allocation of land in Sike, Kediya Gamela, and parts of Dalocha weredas to aspiring new PA members is depriving many people of access to land, and is entirely contrary to Proclamation 31 of 1975. In Sike and Kediya Gamela weredas the establishment of Kebelle PA "community " farms (to generate development funds) is taking place at the expense of allocating land to new members. The only method of access to land in these weredas is by emigration (as 5858 families did in Sike woreda in 1986) or by joining a Producer Co-Operative. Since 1986 the number of PCs in Sike has risen from 4 to 12. In Abunsa PA(0333) even the communal grazing area has been handed over to the PC, thus depriving the remaining PA members of access to grazing for their livestock.

No KPA or Woreda PA has established rules or guidelines for the use of the communal resources (grazing,natural woodland, and water). A number of exclusion areas have been established as part of the Bilate Catchment Conservation Plan by the Ministry of Agriculture rather than the PAs, and post-recovery management schemes have yet to be formulated.

4.5.2 Land Shortage and Increasing Population.

Using the methodology described in FD 22 but incorporating the 1987 AMC quota requirements, a detailed population support capacity analysis was been undertaken for each PA in the project area. Four Planning Zones, three in Hosaina North and one in Hosaina South are now at or above the crop land support capacity: the Woina Dega plains (PZ1 and 4), and the upper Dega and lower Wurch zones (PZs 9 and 10). The numbers of PAs within all Zones which are at or above capacity at present, in 1994, and 2009 (assuming a 3% per annum population growth and current yield levels) are shown below in table 4.3:

Table 4.3 Numbers of PAs in all PZs at or above Crop Land Support Capacity for the years 1984, 1994, and 2009 assuming a population increase of 3% per annum, and current yield levels.

	1	2/7	3	4	5	6	8	9	10
1984	4	9	3	28	12	2	7	9	7
1994	13	33	8	33	17	3	17	17	7
2009	28	50	9	36	18	9	33	17	7
Total	32	54	11	36	18	11	36	17	7

Total	1984	81	
	1994	148	out of 222 PAs
	2009	207	

4.6 WOOD AND WATER SHORTAGE.

4.6.1 Fuel and Construction Wood Shortage.

Fuel and construction wood shortages occur over the whole project area, and are estimated at 240 000 cu.meters per annum. In order to make up this deficit an estimated 20 000 ha of planted fuel and construction woodland (or approximately 0.2 ha per family) are required. Tree growth even of exotics will be slower in the drier Kolla and Woina Dega zones (PZ1 and 4). Currently wood deficits are being made up with dung cakes, reducing the amount of manure which could otherwise be applied to crops, and crop residues (currently selling for EB1.0 per 6kgs in Alaba Kulito) thus reducing the amount of livestock feed.

4.6.2 Water Shortage.

Water shortages occur mainly in the drier Kolla and Woina Dega plains (PZs 1 and 4) particularly in the dry season. Elsewhere supplies are generally available but unprotected, and in the dry season often considerable distance from the homestead.

4.7 INSTITUTIONAL AND REGULATORY PROBLEMS.

4.7.1 Government Institutions.

4.7.1.1 MOA Extension Service:

The transfer of technology and information requires a well informed, staffed, organised, and equipped Extension Service in close and frequent contact with the farmers. Current Extension worker to farmer ratios are about 1 to 5 300. However as many DAs are assigned to PCs the actual ratios to the majority PA members are much higher. Considering the lack of accessibility and transport this level of support is very low indeed. Staff are currently constrained by the lack of transport, and demonstration equipment and materials. Considerable time is spent on extra extension activities such as data collection, AMC quota organisation, input distribution, organisation of credit, and villagisation. A major strategy of the TYPP and the Three Year ADP is to expand the coverage of the Training and Visit system of extension. This system has not yet been introduced into the project area. The very small range of technical packages (mentioned in section 4.2.4) for the Extension Service to promote results in a lack of confidence on the part of the farmer in the DA, and low morale of the DAs.

4.7.1.2 MOA Technical Departments:

The awraja MOA offices for Kembata and Hadiya and for Chebo and Gurage do not have staff from RID or the Irrigation Development Department (IDD). Generally 1 SWCD technician is stationed at each woreda office. Crop Protection Teams are

stationed at each awraja office, but are severely constrained by lack of transport. Their effectiveness is reduced by the lack of a quick and reliable crop pest monitoring system.

4.7.1.3 Input Supply and Credit Organisations:

Fertiliser and seed are distributed through AISCO to the SCs. Seed is purchased from the Ethiopian Seed Corporation (ESC) who multiply the bulk of this on their Arsi farms, and which must then be transported to the project area. ESC obtain their foundation seed from IAR. IAR and MOA have only recently established a varietal screening facility in the Hosaina area, and thus the varieties currently being distributed are "best bet" rather tested and proved. Problems have been encountered in making reliable estimates of seed demand by farmers,resulting in MOA/AISCO often purchasing less than 10% of seed ordered by them from ESC. Credit is currently being provided by AISCO through the AID bank for fertiliser.

Because neither AISCO, AIDB, nor ECB have their own field staff MOA staff have to take on the responsibility of credit assessment, supervision, and subsequent recovery operations. A number of private traders stock agrochemicals, and are reported to occasionally supply application services. A reported constraint is the short supply of sprayers.

4.7.1.4 Marketing:

The main marketing institution is the Agricultural Marketing Corporation (AMC). AMC sets regional and awraja crop quotas which are then passed down to individual PAs through the awraja and woreda PA committees. In 1985/86 the quotas were only half filled, and were then reduced in 1986/87 when they were almost filled. All 1987/88 quotas have been set 20 to 40 % above those of the previous year. Per farmer quotas on 1987/88 were between 0.2 Q (in non-surplus producing weredas) and 2 Q. in the surplus producing weredas. Two woreda MOA offices reported that they arbitarily set quotas well above those set by the awraja offices to "ensure that the peasants supplied the amount set by the awraja office." The quota estimation procedures thus appear to be haphazard. Because AMC do not have field agents again MOA field staff are generally responsible for organising collection by SCs from the PAs and PCs. It is apparent from the population support capacity analysis a number of land short PAs must have

considerable difficulty in reaching the AMC quotas, and as population and land pressure increases this situation can only get worse.

AMC establish national crop prices for all major food crops and all cereals, which have not been changed for five years, despite a 34 % increase in the cost of living index. This has resulted in a commensurate worsening of the terms of trade for the farmer with respect to non-food purchases.

4.7.2 Farmers Organisations.

4.7.2.1 Service Cooperatives :

The SC is primarily a servicing organisation dealing with crop purchases, credit,. and input distribution. Any proposals for a large increase in any of these activities will place a severe strain on the management and accounting capabilities of these organisations. The South Shewa RDP Preparation Report mentions numerous cases of mismanagement and misappropriation of farmers loan repayments in the SCs. Training of SC staff in these skills is currently minimal.

4.7.2.2 Peasant Associations:

PAs are organised in a hierarchial system with the kebelle PAs at the base, and the National PA at the apex. The woreda PA has the powers to change kebelle PA boundaries, although there are no formal procedures established to do this. Only one woreda Association committee reported having exercised its powers of land redistribution. This appears to be a question more of local leadership rather than a purely legal problem.
The kebelle PA has the power to regulate with respect to the conservation of natural resources within its area, although a number of woreda PA committees felt it was the responsibility of the awraja PA. No cases were found of PAs regulating land use on their communal areas , except for some area closures in the Bilate Catchment area which in fact had been authorised by MOA (CFSCD) using their own powers under Proclamation 179 of 1980). The lack of defined procedures for the allocation of land to new members has been described in Section 4.5.1.

4.8 DEVELOPMENT POTENTIAL.

4.8.1 Intensified and Expanded Agricultural Development.

Agricultural development, is generally associated with securing and increasing production, and can be achieved by sustaining, intensifying, or expanding either existing or new methods of production or both. Sustaining production means maintaining existing levels of production without ecological damage. Intensifying production, sometimes referred to as "vertical expansion" involves an increase in production (of crops, livestock, and fuelwood) using existing natural resources, land area, livestock numbers, but with the introduction of improved technology, new types of inputs, better management , and some limited capital development (e.g.. smallscale irrigation, broadbeds and furrows, conservation grass strips and bunds).It assumes no increase in the gross area utilised, and no change in major land utilisation type (e.g.. from grazing to cropping). Expanding production, sometimes referred to as " horizontal expansion", involves an increase in the the area used for a particular major land utilisation type. It often involves major land development works (land clearing, large scale irrigation works). It could be associated with an increase in the number of farmers, perhaps through resettlement. Expanded livestock production will infer an expansion of numbers (through health and better nutrition) and / or increased offtake (through improved marketing).

4.8.2 Sustained Crop Production.

Current levels of crop and livestock production are in serious jeopardy in areas where crop land is unprotected and grazing areas degraded from overgrazing. Some 48 000 ha of crop and grazing land is exposed to massive gulleying and slope failure from encroaching badland. Soil conservation measures have been implemented over considerable parts of Hosaina South, particularly in the Bilate River Catchment area. However there are considerable areas in Hosaina North which have arable areas without any measures. Those arable areas already conserved require a regular programme of maintenance, and many physical measures have been constructed in the absence other improved crop husbandry methods. There is in the project area a considerable history and experience of soil conservation, and manuring and or

fertilising. Despite an increasing population and land pressure, and the shortening or elimination of fallow periods, there is considerable potential for sustaining crop production with the adoption of conservation-based crop husbandry techniques.

4.8.3 Sustained Livestock Production.

Grazing lands are communally used with no rules regulating the numbers of individually owned livestock numbers or of grazing management. As yet there is said (by kebelle and woreda PA members and committees) to be little potential for restricting individually owned livestock numbers. There is however considerable use of individually owned pastures near the homesteads. These offer considerable potential for improvement through planted grasses and legumes, in a way that communally owned pastures would not. On the communal lands measures such as temporary hillside closures coupled with forage planting, both inside the enclosed areas (for cut and carry) and outside for managed grazing have dramatically demonstrated in other areas how the decline in livestock feed can be arrested. The practice of some PAs in charging for cut and carry forage will have the beneficial effect of "taxing" the larger livestock owner. In the Bilate Catchment devastated areas have been able to produce a cover of grasses and tree legumes after two to three years of closure, and thus provide a vivid demonstration and experience as to what is possible. Thus there is the potential for the careful and phased introduction of grazing management and improvement schemes on the areas of badlands and communal grazing areas.

In the longer term increased security (i.e risk reduction) in holding livestock because of improved livestock nutrition and health, leading to lower mortality and faster growth rates, coupled with higher livestock prices will lead to higher offtake rates. These together with alternative investment opportunities such as rural savings banks, small to medium enterprises (e.g. in agro-processing and rural transport) offer ways of reducing the total livestock population.

4.8.4 Intensified Crop Production.

4.8.4.1 Improved Crop Husbandry:

Excepting the drier Kolla and Woina Dega zones, the project area enjoys adequate and relatively reliable rainfall and length of growing period, although the lower Wurch is constrained by low temperatures. Soils although with tillage and drainage problems and a phosphorous deficiency are deep, relatively fertile, and have good moisture holding characteristics. Current use of improved crop technology is low in the project area. Use of improved seed and fertiliser on any scale occurred only for the first time in 1987. Although now widespread in Hosaina North availability is still restricted in Hosaiana South where there is a large unmet demand. The current indications from FAO fertiliser trials in the project area are that for wheat and maize yield increases of between 30 to 60% can be obtained from the recommended application rates. Demand for rust resistant wheat (Enkoy) and the more productive maize varieties has been good. In the two drier zones (PZ1 and 4) there is the potential for shorter duration varieties of maize (Katumani) and perhaps the dwarf sorghums currently being smuggled into Bale from Kenya.

Potential to intensify crop production in the lower Wurch and in the Kolla zones is much more limited. In the kolla there is the potential to increase production through the use of short duration crop varieties together with the judicious use of dry seeding, mixed or relay cropping, and through increasing soil moisture through bunding and terracing. There is little potential to intensify barley production in the lower wurch, except through the use of fertiliser, and this will need to be combined with physical soil conservation measures to prevent excessive fertiliser leaching. However in the Menagesha area at similar altitudes oats (a more resistant crop to frost and waterlogging) have been successfully introduced and adopted as a food crop by farmers, and would thus offer potential for these zones in frost prone and water-logged sites. Better storage characteristics and methods for potatoes and shallots would allow the marketing season for these crops to be extended. There is very good potential to improve production of existing coffee through judicious pruning ,manuring , fertilisation, and the use of fungicides to control CBD. Replanting with improved and CBD resistant varieties offers the best medium term potential for increasing production.

In the Kolla zone of PZ 1 a number of potential small scale irrigation sites have been identified for engineering investigation. There is limited potential for small scale (less than 20 ha.) irrigation schemes for supplementary irrigation. However a careful selection of crops (with better storage characteristics and a wider spread of harvest dates) will be required to avoid local gluts.

ILCA (1987) have demonstrated yield increases for faba bean, wheat, and sorghum of between 40 and 120% on broad beds constructed on vertisols with the ox-drawn broadbed and furrow maker, with similar increases in crop residues. A combination of better work oxen nutrition and health, together with better drainage from the broadbed and furrow would give farmers more flexibility and permit more timely land preparation and planting, and they would thus be better able to cope with the variable belg rains and the very heavy rains of. July-August. This is particularly so for the drier Kolla and Woina Dega zones (PZ 1 and 4), which have extensive areas of soils suitable for this type of treatment.

4.8.4.2 Production Factor Availability:

In the areas where draught power is important (PZs 1 and 8) and there is clearly a land preparation constraint with some 7100 zero ox farmers experiencing severe problems. Ox ownership is clearly linked to higher crop productivity and thus incomes (see Annex 4). The ox purchase credit scheme allows the no ox-owning farmer to purchase at least one ox, and thus permits a more equitable distribution of capital, as well as injecting more cash into the local economy.

The current widespread availability of seasonal credit for fertiliser in Hosaina North can be extended to Hosaina South. However there is need to combine this with managerial and accounting training at the SC level if the current wave of mismanagement and misappropriation of farmers repayments is to be prevented.

4.8.5 Intensified Livestock Production.

There is good potential for increased livestock feed resources through the increased quantity of crop residues (from intensified crop production), treatment of crop residues to increase their nutritional value, and from planted forage

selected from a number of species which are already tested and available for grazing/browsing and cut and carry on reclaimed badlands, other communal grazing areas, and from individually owned grazing plots . The SWCD and the Fourth Livestock project are currently multiplying forage foundation seed in the project area. Those PAs which are critically short of feed and grazing (see tables Appendix 14 table A8.14 in Field Doc.22), and thus where the impact of introduced forage will be the greatest, will have the best potential for forage development. The practice in many of the farming systems of individually owned grazing plots would increase the likelihood of adoption. Additional logistical support will be required to the awraja Veterinary Department if animal health standards are to be improved.

With the current low level of cattle productivity, and reproduction and mortality rates, coupled with the continued dependence on draught power there is little potential in the medium term for a dramatic increase in offtakes rates. However close monitoring of livestock numbers would still be required, coupled with better livestock marketing should numbers show a marked increase.

4.8.6 Expanded Crop Production.

There is no potential for large scale expansion of rainfed annual cropping in the project area. However in PZs 1 and 4 and part of 5 in the Kolla and lower Woina Dega zones where extensive areas of vertisols and vertic cambisols occur, there is some limited potential to bring into cropping areas which are currently too wet through the construction of broadbeds and furrows. There is considerable potential given the project areas good communications and access to Addis Ababa to increase the area under cash crops, in particular peppers, sweet potato , sugar cane, tobacco, and possibly ginger and sisal. Expansion of these crops would be dependent on establishing marketing links with processing plants either located in the project area or elsewhere. The area under coffee could be expanded if improved and CBD resistant varieties were made available, and premium prices obtained if washing facilities were established.

4.8.7 Expanded Enset Production.

Because of its very high food calorie production per ha (11.2 million Kcals) and very high all-year round forage production (6 - 7 mt DM per ha) any expansion in the area planted to enset could have major impacts on population support and livestock carrying capacities. The potential to expand enset area is therefor examined in some detail. The main potential areas are the enset-cereal farming systems found in PZs 2, 3, 7, 8, and 9. PZ6 already has 70% of its cropped area under enset, whilst PZs 1, 4, 5, and 10 are agro-ecologically unsuitable. Social constraints in the potential areas would appear not to be a problem. Nair (per.comm.) reports that cereal production in these areas is only a post-land reform phenomena, and that prior to redistribution of land held by landlords enset was the dominant crop with little cereal cultivation (and thus a major part of the diet).

Because land is now so short any expansion of enset area will have to be at the expense of land under cereals. Under current agronomic practices it would require an increase in the supply of manure requiring in turn an increase in the numbers of cattle. It would also require a commensurate increase in female labour for manuring and kocho processing, and male labour for land preparation, transplanting, and interculturing.

In PZ 6 (the typical enset dominant area) an estimated 12 mt of wet manure are collected from 4 TLUs per annum. Assuming 80% is applied to 0.36 ha of enset, the application rate is 27 mt per ha. Assuming an increase in area of 0.1 ha of enset was the objective for the other enset areas, this would require an increase of 1 TLU to supply the required manure, necessitating an increase of 25% in livestock numbers. The increase in forage production from 0.1 ha of enset would 0.7 mt. DM, sufficient to maintain only 0.4 of TLU, leaving a shortfall of 1.1 mt.

Forage supply in all potential areas (except PZ 8) is only 70 - 80% of requirements. The livestock carrying capacity analysis (FD 22) indicates that even at the intermediate level of crop inputs and grazing management, livestock feed deficits of the order of 20 - 50% would remain. Current indications of herd dynamics indicates a herd growth rate of 1 - 3% per annum suggesting a minimum of 7 to a maximum of 20 years to produce the required 25% increase in cattle numbers. Male and female labour shortages currently occur at critical enset production activities (manuring, interculturing, and processing).

There are a number of potential interventions:

(i) the use of chemical fertiliser as a substitute for manure,

(ii) a significant reduction in the application rates of manure at the expense of yield reductions (currently unknown),

(iii) the selection of less manure demanding clonal varieties,

(iv) the use of improved mashing technology (already available) to reduce labour demand,

(v) a significant increase in forage supply, possibility from fodder banks in the "djaf" area of the homestead (current area is approximately only 0.07 ha),

(vi) the use of crossbred animals producing double the manure and reproducing at faster rates but requiring double the feed.

However unless and until further research is conducted into potential interventions (i) to (iii) and changes made to the manure application rates and/or there is a significant increase in forage supply, then there is little potential under current conditions to significantly expand the area under enset. The current farming systems would appear at present to be in optimum equilibrium with respect to manure supply, labour supply, and the area currently cultivated to enset.

4.8.8 Expanded Livestock Production.

There is little potential for increasing cattle numbers without decreasing nutritional status. Nor is there any potential for increasing the area of grazing. There is limited potential to increase the current very low rates of small-ruminant ownership, particularly if the production of browse increases in the closed grazing areas. Offtake numbers and rates could be increased with increased road accessibility, and with better marketing and health facilities.

4.8.9 Expanded Wood Production.

There is considerable potential to expand wood production for construction and fuel through the planting of Eucalyptus, either as woodlots or as wind breaks on field edges on an individual, as well as a communal basis. Eucalyptus trees in the Woina Dega and higher zones exhibit good growth characteristics. Species for the drier Kolla zone need to be assessed, although recent plantings of E.camuldalensis and E.saligna are exhibiting good and rapid growth characteristics.

4.8.10 Improved Human Health and Nutrition.

In most years food supplies are sufficient but PZs 1, 4, and 10 are particularly vulnerable. PZ10 is vulnerable because of frost and hail hazards and the limited range of crops caused by the low temperatures. Whilst PZs 1 and 4 are vulnerable because of the low and variable rainfall. The potential to improve food supplies is limited in these zones because of the relatively low crop production potential. In all zones potable and secure water supplies are a problem in the dry season. There is considerable potential for shallow hand-dug protected wells and for enclosed scoop dams. Potential for deep aquifers in the project area is not known.

In addition to the potential to improve health directly with increased and clean water supplies, the close proximity to fuel wood and water supplies will reduce time and energy spent on collecting these items, particularly for women. Similarly for livestock, closer proximity to water will result in less energy expended in walking long distances leading to better nutrition and health. These aspects are important in PZs 1, 4, and 10 where energy saved on these activities has an important contribution to human health and energy, and thus to crop productivity.

4.8.11 Improved Access.

In Sike, Limu, and Gumer weredas there is considerable potential to increase physical access with all the ramifications outlined in section 4.4 . Terrain conditions are not a major constraint to the construction of roads.

4.8.12 Improved Land Use Regulation and Policy.

Currently land use regulation is confined to the allocation and redistribution of crop land. The non-allocation of land in Sike and Kediya Gamela weredas requires immediate investigation and action. No woreda has established a workable and regular system of adjudication and redistribution of land between PAs in an effort to obtain a more equitable allocation between PAs. There is the potential to introduce these procedures to the four woreda PAs, using the results of the population support capacity analysis to guide the adjudicators. This would assist in relieving the pressure on the land short PAs. Kebelle and woreda PAs have the powers to regulate land use in order to conserve the natural resources, and there is the potential to use these powers in establishing grazing management schemes, as well for mobilising support and assistance for the construction of soil conservation measures and their subsequent maintenance.

4.8.13 Community-based Activities.

There is now considerable experience of food-for-work in the project area, and much has been achieved through its use. There is thus the potential to continue with community assisted projects such as the construction of access tracks, pack animal trails, scoop dams, and hand dug wells.

CHAPTER 5.

THE INDICATIVE LAND USE PLAN

DEVELOPMENT STRATEGIES AND TECHNOLOGIES

5.1 GENERAL DEVELOPMENT STRATEGIES.

5.1.1 Alternative Strategies and Land Use Systems.

The national development strategies have already been determined by government in the TYPP and the Three Year Agricultural Development plan. The land use systems of the project area have developed over centuries and have attained a fine adaptation to the local environment, the crop types and varieties, and the available technology. Thus no fundamental changes to the national development strategies, and no major alternative land use systems are proposed. Proposed changes to the current land use systems relate rather to co-ordinated interventions of appropriate and proven technology using a phased approach to relieve key inter-related production constraints. Alternative general strategies which can however be considered relate to the following:

(i) Implementation strategy and priorities

(ii) Which target farmers or farmers groups

(iii) Which appropriate technology level

(iv) Institutional issues

5.1.1.1 Implementation Strategy and Priorities:

The area covered by the Hosaina Land Use Plan lies within that of the South Shewa Rural Development Project (SSRDP) for which agreement has been reached between the government and the European Development Fund. The development programme for this project has been worked out at the awraja level for a five year period. The Hosaina Land Use Plan clearly should be implemented within the framework of this project. The Land Use Plan area is also covered by the Fourth Livestock Project (with World Bank funding), the Dairy Rehabilitation and Development Project (with Africa Development Bank funding), and the activities of the Kale Heywot Church based at Durame in Hosaina South (being funded by a number of NGOs including World Vision, Concern, CIDA, and CRO). Each of these projects have overlapping spheres of development, and all are concerned with components included in the Hosaina Land Use Plan. In particular are the soil conservation and community forestry , the planted forage components, and the dairy development components. These various implementing agencies and their activities will require co-ordination through the South Shewa RDP management team.

5.1.1.2 Target Farmers/Farmer Groups:

There are two major groups of farmers in the project area: those farmers belonging to Producer Cooperatives and those to PAs. Currently PCs although small in numbers and membership receive preferential extension support, allocation and prices for fertiliser and inputs. Whilst these inputs were in short supply it was cost effective to direct them to those farmers benefiting from close extension supervision and who embrace collective discipline with respect to crop husbandry methods. However as extension support widens and funds for fertiliser increase under SSRDP, so should the availability of and access to improved inputs and technology. Thus the preferred strategy for allocation and transference of improved inputs and technology is to give preferential allocation and access to PCs in the short term, but extending to all PA members in the medium term.

5.1.1.7 Appropriate Technology Level:

The TYPP advocates a strategy of labour-intensive techniques for agriculture, rural industries, and rural construction. Only mechanical small units have been advocated in the South Shewa RDP with funds provided for flour mills and irrigation pumps. No changes to this strategy are proposed.

5.1.2 Preferred General Strategies - A Summary.

The national strategies set out in the TYPP and the Three Year ADP form the basis of the overall development strategy. Additionally the following supplementary general strategies are used to formulate the Hosaina Land Use Plan and the development priorities:

(i) no major changes in the short and medium term to the cropping, livestock, and land allocation systems,

(ii) implementation of the Hosaina Land Use Plan within the framework and programme of the South Shewa Rural Development Project, with components implemented by the Fourth Livestock Project, the Dairy Rehabilitation Project, and the Kale Heywot Church under the co-ordination of the SSRDP,

(iii) phased and co-ordinated approach to implementation would be adopted with well proven and simple technology which would have the maximum impact being introduced initially, gradually introducing more complex technology as experience builds up,

(iv) the continued targeting of PCs whilst resources and improved inputs are in short supply, but with the rapid expansion of coverage to PAs as these improve,

(v) the use of labour intensive and draught power methods and technology where ever possible; the initial use small mechanical units (mainly for processing) with the introduction of larger units only after the establishments of awraja level mechanical capability,

5.2 SPECIFIC DEVELOPMENT STRATEGIES AND TECHNOLOGIES.

5.2.1 A Summary of Strategies, Priorities, and Technologies.

Within the framework of the preferred general development strategies outlined above it is now possible to set the specific strategies, priorities, and technologies related to individual components of the Plan. These are summarised below:

(i) increasing the availability of and access to improved crop inputs through increased and timely fertiliser supplies, seasonal credit, and local production of improved seed by selected FCs and SCs;

(ii) the intensification and risk reduction of annual cropping with a combination of short term varieties, dry seeding, intercroppping, and water harvesting and conservation techniques;

(iii) the intensification of annual cropping in the cold upper Dega and lower Wurch zones with sequential and relay cropping of potatoes and field pea and horsebean, and possibly wheat and barley;

(iv) expansion of the area under selected cash crops (peppers, tobacco, sugar cane, ginger, sisal, and oil seeds) by combining and linking improved marketing with processing facilities;

(v) an urgent programme of enset research to identify wilt tolerant, productive, and palatable varieties, and to identify an appropriate fertiliser/ manure regime to reduce manure requirements;

(vi) the design and implementation of a number of smallscale irrigation schemes in the Kolla zone of PZ 1 and the Woina Dega zone of PZ 5 to expand the area under annual crops and reduce risk;

(vii) increasing yields of current coffee planting and expanding area under trees through provision of pruning and improved husbandry advice, fertilisation, fungicide application, improved and CBD resistant varieties, and establishment of washing facilities at the SC level;

(viii) stabilisation of active land degradation, stripping, gulleying, and mass movement with physical and vegetative measures; and the productive rehabilitation through closure, grass and tree planting of existing stabilised badlands;

(ix) where communal grazing lands are restricted to cut and carry charges would be levied by the PA for such forage thereby taxing the large livestock owner;

(x) promoting the adoption of conservation-based crop husbandry methods by combining the implementation of physical conservation measures with improved crop husbandry and varieties, and the development of undersown legumes and row planted tree legumes, and the productive use of grass strips and bunds (with plants producing forage, fuel, and fruit);

(xi) implementing land improvements, in particular surface drainage on soils subject to ponding and topsoil waterlogging;

(xii) increasing reliance on manure application and undersown legumes, and decreasing reliance of chemical fertiliser for soil fertility maintenance

(xiii) closer integration of livestock with crop production through increased use of untreated and treated crop residues, undersown and row planted legumes, increased use of manure on crops from dung saved by increased supplies of fuelwood, better nutrition with better and readily available draught power for land preparation;

(xiv) the increase of natural forage production through the institution of grazing management schemes;

(xv) the introduction of planted forage on individually owned grazing areas and controlled communal grazing and cut and carry areas;

(xvi) improved physical access through the construction of dry weather roads with community labour and minimal technical assistance;

(xvii) more equitable access to land for land short PAs by careful examination and adjustment of boundaries and possible amalgamation and redistribution of land between farmers

(xviii) a more equitable access to land by aspiring new PA members in those PAs currently not conforming to the spirit and letter of Proclamation 31 of 1975 through intervention by the Regional Peasant Association;

(xix) more equitable access to draught power for no ox-owning farmers through targeted credit to no ox owning farmers in the main cereal producing zones where draught ox shortages occur;

(xx) improved access to water supplies through the construction of low cost and simple structures

(xxi) improved fuel and construction wood supply for home consumption and for sale through the initial provision of seedlings and introduction to farmer-produced seedlings, for planting by individuals as field boundaries and homestead wood lots, or as communal woodlots on closed areas;

5.2.2 Detailed Proposals for Strategies, Priorities, and Technologies

5.2.2.1 Intensified Crop Production:

Improved Inputs: Availability of improved seed and fertiliser is currently largely confined to PCs and to PA farmers in Hosaina North, and would be extended to all farmers. However there are three provisos. Current blanket fertiliser recommendations may be too high, and may need to be crop and soil specific and reduced to a more economic optimum. In the long term even these reduced fertiliser rates should be halved, and the necessary nitrogen obtained from undersown perennial legumes.

Secondly whilst supplies remain short priority allocation should be given to those PAs which have already exceeded their crop land population support capacity.

The strategy of giving priority allocation to land deficit PAs is justified on economic and social grounds. In land short PAs fallow periods are virtually non-existent and soil fertility depletion increasing. NFIU have demonstrated greater incremental yields per unit of fertiliser on soils of lower fertility. Farm sizes are smaller allowing farmers a higher labour input per unit area (for better land preparation, fertiliser application, and weeding) further enhancing fertiliser efficiency. Thus total incremental crop production per unit of (scarce) fertiliser is likely to be higher than in PAs which are not land deficient. In a number of land short PAs farm sizes are close to the minimum required to produce subsistence and nutritional needs under unimproved technology. Targeted fertiliser supplies to these PAs thus has a strong nutritional and health justification.

Thirdly in order to prevent mismanagement and misappropriation as these activities increase the level of managerial and accounting skills at the SC level would be improved through training. In addition the level of supervision from the wereda and awraja SC level as well as MOA Co-Operative Development Department would be increased, and audit and accounting training provided.

In order to attain a local self-suffiency production of improved seed should be undertaken by PCs on contract with quality and viability standards maintained by MOA awraja seed staff . The range of available improved crop varieties (or at least local selections of improved quality or faster maturing qualities) would be widened to include barley, sorghum, horsebean, field pea, haricot bean, linseed, safflower, and sunflower.

Other Crop Intensification Techniques: Current crop production can be intensified through intercropping, sequential and relay cropping. In PZs 1 and 4 (where sort and variable potential growing seasons are the constraints) intercropping of shorter with medium or long duration and/or shallow rooting with deeper rooting crops such as sorghum, sunflower, and chillies with cowpea or soya bean would be combined with dry seeding, and water harvesting (tied ridging) and conservation (contour bunds) techniques. In the upper Dega and lower Wurch of PZs 9 and 10 (where there are low temperatures but a long potential growing

season) relay or sequential cropping of fieldpea and horsebean with potatoes,wheat, and barley are already practised to a limited extent and would be extended.

5.2.2.2 Expanded Cash Crop Production:

The expansion of cash crops such as peppers, tobacco, sugar cane, oil seeds, ginger, sweet potatoes, and sisal would be promoted by improved marketing, and linking market to processing either within or outside the project area. Improved marketing would be promoted through the provision of credit to traders for storage facilities, transport, and working capital and marketing advice (information on the purchase prices of crops required by outside processors of eg.peppers, ginger, tobacco, and oil seeds). Links would be established with outside processors (e.g.. Ethiopian Spice Extraction Factory, Nazeret Oil Mill) to determine supply requirements and purchase prices. Local processing facilities would be promoted through the South Shewa RDP with the provision of credit for purchase of machinery, construction buildings, transport, and working capital, together with technical advice and supervision to aspiring small scale processors of e.g.. ground peppers and tomatoes, oil seeds, raw sugar and industrial alcohol, and sisal rope.

5.2.2.3 Increased and Expanded Coffee Production:

Existing coffee tree output would be increased through a major coffee improvement programme with demonstrations and advice on correct pruning regimes, fertilisation and manuring. Fungicides against CBD and where and when necessary insecticides would be provided on seasonal credit, and applicators on two year credit. Selected PCs and SCs (who have established nurseries for forage and fuel wood trees) would produce and sell seedling of improved and CBD resistant varieties. SCs would be assisted with credit to establish washing facilities for use by members in order to obtain premium grades of parchment for sale at premium prices.

5.2.2.4 Enset Improvement Programme:

Production of enset would be made more secure against bacterial wilt through an immediate programme of varietal selection of already known tolerant varieties, and their clonal propagation by individual farmers who own such varieties for sale through MOA to other farmers and SCs. MOA awraja offices would provide the co-ordination and information service. They would establish links with the IAR enset research programme currently being supported by the Southern PADEP and located at Areka in Sidamo, in order to speed up on-farm trials of agronomic research results emanating from Sidamo on farms within the project area. In the meantime control of the disease would be promoted by the following methods:

(i) strict hygiene with respect to tools used on infected plants

(ii) burning and burial of infected plants

(iii) eradication of Canna orchoides from enset areas

(iv) immediate removal of leaves exhibiting the first signs of infection

In addition research would be undertaken to determine appropriate chemical fertiliser/ manure regimes and plant spacing to reduce manure requirements.

5.2.2.5 Land Improvements:

Improved soil drainage would be effected on vertisols, vertic and gleyed cambisols, and selected fluvisols through the use of the ox-drawn broadbed and furrow (BBF) maker. It is considered that BBF construction on the duplex planosols would not have positive benefits as generally the perched water table is too deep. Where sodic subsoils are near the surface it is possible that the BBF maker would lead to subsoil exposure, leading in turn to slumping and gulley formation. The Physical Land Use Plan indicates those areas which are considered suitable. Initial testing and demonstration would be undertaken on PC farms. Careful consideration would be given to the

availability of oxen within a PA to ensure that farmers with no oxen are not further squeezed during the critical land preparation and planting periods.

5.2.2.6 Small-scale Irrigation Development:

A number of potential sites in the Kolla (PZ 1) and the Woina Dega zone (PZ 5) for small scale irrigation have been identified and are indicated on the Physical Land Use Plan. They will require an engineering investigation into water supply and quality, and water control and reticulation requirements. However a preliminary examination of catchments and water control sites suggests that diversion wear structures leading to off-river night storage in ox-scoop dams would be a better alternative to on-river impounding storage dams. As water is likely to be the limiting factor (suitable land appears to be more than adequate) the emphasis would be on supplementary irrigation of crops sown towards the end of the rains, and those sown and established before the start of the next rains. Crops should be carefully selected for their market potential and their processing ability and/or storability. The marketing and processing proposals for expanding cash crop production outlined above are particularly applicable to these irrigation schemes.

5.2.2.7 Conservation-based Crop and Animal Husbandry:

Physical soil conservation works would be integrated with improved crop and animal husbandry. Physical measures as well as being technically efficient would be conformable with all components of the crop and livestock systems. The emphasis would be on those measures which are the most simple to implement, which have the greatest impact on soil and rangeland conservation in relation to the inputs and cost (labour, materials, grazing foregone, etc), and which cause the least disruption to farm operations and management. This would mean taking a phased approach to certain measures: thus efficient bund construction and the natural formation of terraces may be preferable to the immediate construction of terraces with their very high costs in labour and disruption to farming operations. On slopes upto 15% with soils of clay loam to clay textures grass strips would be used. Productive measures such as planting of forage and fruit trees on physical works such as strips, bunds, and terraces would be demonstrated to help counter the apparent unproductive elements of the physical works.

5.2.2.8 Stabilisation and Reclamation of Badlands:

Active areas of badland formation would be stabilised using physical measures, in particular for gully stabilisation using check dams and cutoff drains. Stabilisation of areas subject to massive slope failure would be effected by closing areas above to develop a good vegetative cover, diversion where possible of surface water away from the affected area, and by closing newly exposed areas and planting to trees. Areas which have been totally stripped and are now apparently stable would not have physical works, but would be closed for sufficient time to allow restoration of a grass and herbaceous cover. Current estimates from the rehabilitation work being carried out on the Bilate Stream edges suggest 2 to 3 years. These areas would also be planted where substrate conditions permitted (e.g., soft weathered pyroclastic materials) with multipurpose trees (including bamboo). Post-restoration management would depend on the degree of recovery. Areas which have a fully recovered ground cover may be suitable for controlled seasonal grazing and browsing, whilst areas with considerable patches of bare ground would be opened only for cut and carry. Each site would have to be determined on an individual basis. As these areas are communally owned and communally restored PAs would levy charges for cut and carry forage and fuelwood from these areas. The large livestock owner would thus have to pay more making the levy into a form of equitable tax.

5.2.2.9 Communal Forestry:

On extremely steep scarps as are found in the far west of Hosaina North (PZ 9) and on other steep areas where massive slope failure has occurred - particularly in the lower Dega zones of Hosaina North (PZs 6 and 8) which although not active are devoid of vegetation - then permanent exclusion of livestock and even of cut and carry may be required. It is recommended that these areas be designated for communal forestry for timber production both for communal consumption and for outside sales on a commercial basis. It might be necessary to plant seedlings into micro-basins (1 meter diameter) where slopes are excessively steep, otherwise pits (25cms X 40 cms) would be used. Eucalyptus is likely to be the dominant species planted, but lowland and highland bamboo ("shambako" and "koukaha") are both suitable and are currently used by farmers in the area.

5.2.2.10 Grazing Management:

Communal grazing would be subject to grazing management schemes. The strategy should be to restrict access to grazing areas rather trying to restrict numbers. Grazing management would have to be co-ordinated with efforts to improve crop production (and thus supplies of crop residues) and where necessary production of planted forage. Access periods to specific grazing areas will have to be determined at the PA level, and in relation to the relative proportions of grazing areas and forage production, as well as livestock numbers. Grazing management types have been reduced to four:

(i) unused arable (including fallow) land with no major erosion hazard: no grazing restriction:

(ii) unused arable (including fallow) and other non arable land with a moderate erosion hazard: restricted wet season grazing:

(iii) degraded non-arable land with a severe erosion hazard: temporary closure for 1-2 years followed by 2 years controlled wet season grazing followed by 1 year cut and carry after seeding has taken place:

(iv) bottomland: dry season grazing, with some wet season cut and carry after seeding has taken place:

Should an area be closed it is important that alternative feed sources are available. This may be achieved by the temporary and permanent amalgamation of two or more PAs for grazing purposes; by improving production of crop residues (through crop intensification); planted forage; or combinations of these. This will require careful planning at the SC/PA level to balance lost feed sources with alternative sources (permanent or temporary). Cut and carry in the third year would only take place after seeding to ensure sustained production.A careful balance of browsers and grazers would be required to ensure that bush species do not crowd out grass species. Where possible as wide a range of multipurpose tree species would be planted for fuel wood, round pole, and forage. Suitable species would include Acacia saligna, Acacia albida, Azadrachta indica, Casuarina cunninghamiana, and lowland and highland bamboo. Casuarina is tolerant of sodic conditions found on the planosols of the Kolla and Woina Dega plains (PZs 1 and 4).

Grazing of bottomland would be restricted to the dry season, and if possible livestock moved from one area to another to reduce the build-up of tick and other parasites. Where possible areas of restricted and controlled wet season grazing areas would not be accessed until new pasture growth has been initiated. Grazing of wet season areas would not commence until after commencement of the rains and the initiation of the new grass cover. Every third year these areas should be closed during grass seed time to allow regeneration of the pasture.

5.2.2.11 Improved Forage Production:

The immediate major strategy for increased forage production would be through increased production of crop residues. However planted forage and treated crop residues would assume increasing importance in the medium term. Priority for planted forage development would go to those PAs at or above their livestock carrying capacity, with development taking place initially on individual farmer's grazing areas and with PCs rather than on communal areas, and with tree legumes (i.e. multipurpose) rather than grasses/legumes. Planting as live fences or as contour strips along conservation strips, bunds, and terraces is preferable to woodlots or fodder banks. Where sown legumes are used preference would be given initially to perennial local legumes undersown in the crop areas.

5.2.2.12 Improved Wood Supply:

Three approaches would be pursued: small woodlots or planted field boundaries planted by individual farmers; communal woodlots and field boundaries by PCs; and PA communal woodlots, or interplantings in controlled or excluded grazing areas as described above. Seedlings would be raised by selected PCs from foundation stock provided by MOA.

5.2.2.13 Closer Cropping/Livestock Integration:

Closer integration of cropping with livestock would be effected by the concurrent implementation of crop intensification measures (providing more livestock feed); the treatment of crop residues to increase nutritional value; improved nutrition leading to better animal traction; use of undersown legumes and

row planted tree legumes in crop land to improve soil fertility and provide increased livestock feed; use of the ox-drawn broadbed and furrow maker for improved soil drainage; and the expansion of fuelwood production thus releasing manure for soil fertilisation.

5.2.2.14 Access to Draught Oxen:

Improved access to draught oxen for the no ox-owning farmers would be facilitated through the AIDB Ox Purchase credit scheme. Credit should be directed to no ox-owning farmers, to PZs 1,2,9 and 10 where critical shortages occur, and initially to those PAs where there is no major shortage of land.

5.2.2.15 Redistribution of Land Between PAs:

In order to achieve a more equitable distribution of land between PAs practices and procedures for alterations to PA boundaries and amalgamation of PAs would be developed.

5.2.2.16 Improved Physical Access:

The short term strategy would be to construct dry weather access tracks and all-weather pack animal trails, with the emphasis on the provision of efficient stream crossings and road surface drainage, rather than on an all-weather running surface. These could be constructed on a community basis with a minimum of technical assistance and supervision. All SC headquarters would be linked by at least a dry-weather access track to the wereda headquarters. Similarly PA villages would have as a minimum an all-weather pack animal trail link to its SC headquarters, and to the nearest rural market. Access track alignments would where possible be along the ridge crests to reduce the necessity for stream crossings and provide better natural drainage. A limited length of all-weather road would be required to provide a minimum framework. The medium term strategy should be to provide all SCs with all-weather road access.

5.2.2.17 Improved Water Supplies:

The short term strategy would focus on the provision of simple low cost structures requiring a minimum of technical assistance and supervision. Appropriate structures would include shallow hand dug lined wells, protected spring boxes, scoop dams, diversion wires leading to scoop dams, and hydraulic ram pumps to tanks. Scoop dams for human supplies would be secured by thorn fences to exclude livestock, and provided with stone jetties to reduce trampling and muddying of water. The medium term strategy would be for the provision of higher cost, permanent low maintenance structures with safer supplies such as boreholes and concrete storage tanks with chemical bacterial control mechanisms.

5:2.2.18 Training and Management:

Training of government support staff is a prerequisite for the efficient transfer to the farmer of the improved technology proposals outlined above. This will require the introduction of a detailed and appropriate programme of training, together with a subsequent programme of performance monitoring (not only of numbers of demonstrations conducted - but of numbers of farmers adopting particular components together with some measure of their impact on production). The SSRDP Preparation Report outlines such a programme.

The recent increased work load on Service Co-Operative staff has exposed cases of mismanagement and misappropriation of farmers loan repayments. If this work load is to increase then this will required considerable training in accountancy, stock control, and management for not only SC staff, but also wereda and awraja MOA (Co-Operative Development) staff.A detailed programme of SC supervision, stock control and audit is required. These training and management programmes for SC and MOA Co-Operative staff would be modelled on the Training and Visit management system proposed for the Extension Service.

CHAPTER 6.

THE INDICATIVE LAND USE PLAN

COMPONENTS AND ACTIVITIES BY PLANNING ZONE

6.1 PLANNING ZONE 1: THE KOLLA PLAINS OF HOSAINA SOUTH.

6.1.1 Key Problems and Potential.

6.1.1.1 Problems:

This is the driest of all the Zones with the shortest growing period. Rainfall variability in amount and timing is considerable. For all cereal crops a yield reduction of 30 - 40% of full yield can be expected 3 years in 10. These grain yield reductions are mirrored by similar reductions in an already low natural forage supply. Large scale emergency sales of livestock occur at these times of crop failure. The range of food crops is extremely narrow with maize and teff accounting for 80% of the crop area, with no enset and little sweet potato. Birds severely constrain successful sorghum and millet cultivation and also damage improved varieties of maize. Aphids have virtually eliminated horsebean from the crop mix in recent years. There is a severe fuelwood deficit, currently made up by burning 20 000 mt. of dung cakes. Water shortages occur during the dry season entailing walking long walking distances for humans and livestock.

6.1.1.2 Potential:

Because of its low altitude higher temperatures during the growing season result in shorter growing periods for most crops. The heavy textured subsoils of extensive areas planosols have high moisture holding capacities. Low angle slopes have a low sheet erosion risk, and except for some localised badlands near the Bilate river and its tributaries, the total area of badlands is small. The use of water harvesting and conservation techniques could help to reduce risks to crop production from the

low and variable rainfall. Good road communications within the area and to Addis Ababa, and a well established local marketing system for chillies and sweet potatoes offer the potential to increase production of these important cash crops. There is the potential to widen the food crop mix with an expansion of the current small areas of cowpea, vetch, and chickpea. Bird control measures and availability of bird resistant varieties could allow an expansion of the drought resistant sorghum and finger millet, thus ensuring a more secure food supply. The population support capacity analysis indicates that only 4 out 32 PAs are currently at or above the crop land support capacity, and this figure will only reach 13 PAs by 1994. This indicates crop land area is not a constraint. (Although note the caveat in F.D..22 pg.122 about the weak agro-climatic data base upon which the analysis was conducted.)

6.1.2 Increased Crop Production.

6.1.2.1 Suitable Crops and Varieties:

The most suitable cereal crops for this zone have been identified as teff and the millets (finger and pearl), followed by oats and barley, with maize and sorghum coming third. A high incidence of rusts at this altitude may prevent the cultivation of oats and barley, and birds severely restrict the cultivation of the millets and sorghum, leaving maize and teff as the main cereal crops actually grown. Of the pulses, vetch, lentils followed by chickpea are the most suitable because of their short growing periods. Niger seed and sunflower are the most suitable of the oil seed crops. Enset and coffee are not suitable except locally on seepage sites or with supplementary irrigation. The recommended improved crop varieties are:

Maize: Katumani (A551 and A552 only in wetter western Area
Wheat: Romani BC, Mamba, Kenya Kanga (on lighter soils)
Enkoy on (heavier soils)

Only local selections are available for the remaining suitable crops.

6.1.2.2 Improved Inputs for Food Crops:

Total improved food crop seed requirements of maize (Katumani) and wheat (Romani BC) are:

Maize 228 mt. (79 mt. per annum)
Wheat 22 mt. (7 mt. per annum)

Assuming only maize, wheat, and teff are fertilised at current recommended rates and a high 70% adoption rate is achieved then 1 300 mt of DAP and 750 mt of urea would be required per annum. Supplies of DAP in 1987 amounted to approximately 640 mt with little or no urea. PAs which have already exceeded their crop land support capacity and would thus receive priority input supply are:

0306 Muda Gendela (Kedida Gamela wereda)
0312 Misrak Gortache (" " ")
0318 Yelayignaw Arisho (" " ")

6.1.2.3 Other Food Crop Improvement measures:

Control of the bird problem would be the only sure way of expanding and increasing production of sorghum and millet. Until efficient control measures are formulated the cultivation of bird damage prone crops in a few concentrated areas rather than many tiny dispersed plots would facilitate the traditional bird scaring methods and reduce the total bird challenge. Cowpea is grown in the zone and is suitable for interplanting or relay cropping with deeper rooting and longer season maize to take advantage of residual moisture. Lentil and chickpea which are suitable but rarely grown would be demonstrated and seed made available for purchase through AISCO and the SCs. These crops are also suitable for inter-planting or relay cropping into maize. Soybean has been successfully introduced in the adjoining Alaba Kulito wereda across the Bilate river and would also be suitable for this zone (inter-planted or relay cropped).

6.1.2.4 Expanded Cash Crop Production:

Five cash crops are suitable for limited expansion under rainfed conditions: nigerseed, sunflower, garlic, ginger, and chillies. Expansion of the oil crops will require promotion, and linking production to marketing and processing. Marketing could

also be conducted by the processing operators if smallscale oil presses are adopted and are sited locally. AIDB is currently importing suitable oil presses for sale on credit. Three mills would be ideally located at Adilo, Gerama, and Halkecha markets. An estimated 2 500 mt per annum would be produced (assuming 30% of farmers cultivated 0.1 ha.) ensuring full working capacity for each mill of 700 mt of seed per annum. Marketing systems for chillies and garlic already exist. The proposal would be to link existing chillie traders with the spice processing factory in Addis Ababa which would estimate supply requirements and guarantee prices. There would be credit provision for construction of storage facilities at the three local markets.

6.1.3 Land Development and Reclamation.

6.1.3.1 Smallscale Irrigation:

Four potential irrigation sites have been identified and are indicated on the Physical Land Use Plan. Two of these lie to the west of Alaba Kulito, one to the west of Gerama, and the fourth to the east of Adilo. All are on or close to dry weather roads. Detailed site investigations will be required, but preliminary recommendations are for masonry or rock filled gabion diversion weir structures with off-river night storage in ox-scoop dams. Supplementary irrigation of end of wet season or end of dry season planted crops is recommended. Suitable crops would be the cash crops recommended for expansion (see above), together with onions/shallots and sweet potatoes in view of the very limited market for fresh vegetables. Alaba Kulito already has a well established market with Addis Ababa for sweet potatoes. Using supplementary irrigation as proposed would enable producers to market their produce out of the main market period when prices are higher.

6.1.3.2 Soil-water Management:

Soil water management techniques such as ridging have been successfully demonstrated at IAR's Research Station at Awassa (Adjei Twum, 1986). Tied ridging on vertisols at Awassa induced waterlogging but this may not be a problem on the deep light textured Cambisols in the southern part of the Zone, nor on the Planosols with deep light textured topsoils in the northern part. Trials on the latter soil type are required to confirm this. These and other techniques such as immediate post-harvest

ploughing, mulching with crop residues, and dry seeding would be assessed in the Zone and if successful included in farmer demonstrations. The Soil and Water Conservation technician at Alaba Kulito has demonstrated that "fanya juu" contour bunds have a positive effect in increasing soil moisture thus increasing crop yields of maize, sorghum, and chillies, and these would be incorporated into the physical soil conservation programme (see below).

6.1.3.3 Physical Soil Conservation on Crop Land:

Physical soil conservation requirements on crop land are low because of the widespread gentle slopes. However on the foothills of Mt. Dato (in Arisho and Muda And SCs) and in the southern part of the Zone (in Tikarea and Koriya SCs) light textured Cambisols on slopes of 6 - 13% would require contour bunds (graded bunds would not be required because of the low rainfall). A gross area of 5 700 ha would require treatment

and is indicated on the Physical Land Use Map. Suitable species of grass and tree legumes for bund stabilisation are indicated in Annex 3.

6.1.3.4 Stabilisation of Active Gulley and Slip Erosion:

Active areas of slip and gulley erosion requiring stabilisation are indicated on the Physical Land Use Plan. Areas of active slip erosion (or stripping) amount to 2 800 ha occurring mainly in the northern part of the Zone north-west of Alaba Kulito (in Muda Sost and Muda And SCs) and south-west of Kulito (in Arisho SC). Details of control measures are outlined in Annex 3, but in summary amount to the levelling of the active mini-scarp, and the closure above and below to enable a complete grass/herb cover to be established. These measures would be supported with multipurpose tree planting once it appeared certain that the area was stabilised. Active gulleys for stabilisation would have check dams constructed so as to produce a graded gulley floor. Where possible water would be diverted from entering the gulley head into adjoining stabilised gulleys and waterways. A 50 meter strip either side of the gulley would be permanently closed to livestock and planted with E.camuldalensis and E.saligna, and Casuarinna trees.

6.1.3.5 Reclamation of Stable Badlands:

The majority of stable or totally stripped areas are alongside the Bilate river, and have been or will shortly all be closed and receive treatment under the MOA and the Kale Heywot CDP programmes.

6.1.4 Livestock and Forage Development.

6.1.4.1 Undersown and Row Planted Legumes:

Because of low and variable rainfall and the short LGP, undersowing of legumes is not recommended at this stage. Row planting (ie. alley cropping) 10 meters apart with leguminous trees such as Sesbania sesban and Leucaena spp has been successfully demonstrated in Konke SC-in Hosaina North. Both species can be used as forage or fuelwood, and at this spacing would act as windbreaks so reducing evapotranspiration, as well as supplying nitrogen to the soil (if not used for forage). Priority would be given to the crop land short PAs and the PAs with critical forage shortages. Oversowing of communal grazing areas evapotranspiration, as well as supplying nitrogen to the soil (if not used for forage). Priority would be given to the crop land short PAs and the PAs with critical forage shortages. Oversowing of communal grazing areas, although technically feasible, but given the current highly skewed livestock ownership pattern in favour of a small group of large herd owners communal enthusiasm for this development is likely to be low. A solution to this would be to charge for any cut and carry from communally restored rangeland with the charges going to the community's development fund.

6.1.4.2 Grazing Management:

Areas recommended for restricted dry season grazing, and for controlled grazing and/or cut and carry after temporary closure are indicated on the Physical Land Use Plan. Areas of restricted dry season grazing amount to approximately 2 300 ha with forage yields in a normal year of about 6 mt DM per ha. Stabilised badlands which have now been subject to closure for 1 - 5 years amount to approximately 1 500 ha. Some of these areas will soon be sufficiently recovered to allow either restricted wet season grazing and/or cut and carry. Decisions on post-recovery management schemes will need to be site-specific

and related to degree of recovery and livestock numbers. Where only cut and carry is permitted PAs would levy a charge for forage cut.

6.1.4.3 Improved Dairy Breeds:

Experience with the ongoing Kale Heywot CDP's cross Zebu - Jersey or Holstein breeding programme suggests that a combination of poor feed supply and higher temperatures compared with those in the Woina Dega and Dega zones would be major constraints in this zone. Traditional breeding policy is for draught oxen rather than milking cows. No proposals are therefore made.

6.1.5 Access to Resources.

6.1.5.1 Physical Access:

The Zone has 15 of its 32 PAs at more than 5 kms distance from the main Kulito-Shone all-weather road, although three dry-weather (RR10) roads reach all but 2 of these. However these RR10 roads are poorly if ever maintained, and access during the wet season is difficult or impossible. The South Shewa RRP has not provided for any RR 10 road maintenance. Road maintenance would therefore continued to be carried out through food for work programmes as at present. No new RR10 roads are proposed for the immediate period.

6.1.5.2 Land Resources:

Three PAs have exceeded their crop land support capacity:

0306	Muda Gendela
0312	Misrak Gortancho
0140	Lekole Burkito

The position of the two northern PAs can easily be rectified by small boundary changes. However that of Lekole Burkito is more difficult as adjoining PAs have at the low input level little or no spare land. However all the remaining PAs in the SC do have sufficient surplus at the intermediate level of inputs. Thus by

targeting fertiliser and improved seed into Shone SC, and by careful adjustment of the boundaries this PA would have a more equitable share of land.

6.1.4.3 Draught Oxen:

Ox ownership is highly skewed with 25% of farmers owning 63% of oxen, and with 38% of farmers having no oxen at all. This probably reflects the large distress sales of oxen which occurred during the two year drought in 1983 -1985. Farmers with no oxen experience shortages during the end of April and May. With a total requirement of 54 ox pair days at EB 3 per day, this represents a rental cost of EB 162, or 108 days of labour, and/or grain. Approximately 5 400 farmers have no oxen and would be targeted for ox-purchase credit.

6.1.6 Wood and Water.

6.1.6.1 Construction and Fuel Wood:

The Zone has an annual wood deficit of approximately 20 500 cu.meters of wood for fuel and construction, which is currently being made up with some 20 000 mt of dung cakes and cereal stover. This will require 2 000 ha of E.camuldalensis or E.saligna planting, or approximately 60 ha per PA, or 300 trees per family. Plantings would be on both an individual basis as field boundaries and farmstead woodlots, and as community woodlots, and planting within closed areas.

6.1.6.2 Water:

Away from the Bilate river which is perennial, there is an acute shortage of water for humans and livestock, most particularly in the dry season. Although some ponds have been constructed by hand with food for work, these are insufficient and people and livestock must walk long distances. The relatively flat topography and the heavy subsoils favour the construction of ox-scoop dams. Ox-drawn scoops would therefore be made available on a SC basis for pond construction. Careful site selection is required if these ponds are not to dry up before the rains. (In the adjoining Alaba Kulito wereda a number of poorly sited ponds with insufficient catchment area were observed.)

6.2 PLANNING ZONE 2/7: SOUTHERN ROLLING WOINA DEGA AND LOWER DEGA.

6.2.1 Key Problems and Potential.

6.2.1.1 Problems:

The population density and numbers of this Zone are the highest in the project area. Enset contributes a high proportion of the peoples' calorific requirements (70%), and so crop land requirements per family are relatively small (less than half the cereal systems). However enset shoot rot disease has reached the area, and if it becomes widespread the impact on the population support capacity would be devastating. Rusts in wheat and barley at lower altitudes are also a major problem. Currently 8 out of 54 PAs are at or above their crop land support capacity at the present low level of technology, but by 1994 more than half the PAs will have exceeded their capacity. Shortage of fertiliser, even with the big increase in supplies in 1987 remains a problem with less than 20 % of farmers having access.

Livestock densities and numbers are also the highest in the project area, and nearly 80% of PAs are critically short of forage. Livestock are kept mainly for milk rather than draught power, but current milk yields although seasonally relatively uniform are low at 220 - 290 litres per lactation. Recently introduced zebu/jersey and zebu/holstein crosses have yielded five times this amount. However any large scale successful expansion of this scheme will require an increase in the forage supply as well as a better organised system of milk and/or dairy products marketing. Although many crop areas are physically conserved some areas remain without, whilst there are many examples of bund failure due to poor or zero maintenance. There is a high incidence and wide prevalence of coffee berry disease (CBD) in the coffee growing areas of the Zone. However there is no coffee development programme, nor are fungicides or CBD resistant varieties available. There are no coffee washing facilities available, and cheery and parchment quality is poor and only the lowest prices are obtained.

6.2.1.2 Potential:

This Zone is climatically suitable for a wide range of food and is cash crops. Farmers have experience of, and there is a high unmet demand for fertiliser and improved maize and wheat seed. Animal husbandry is generally intensive and stall feeding widely practised in both wet and dry seasons. Farmers have their own individual grazing areas in addition to the communal areas. Thus the potential for the adoption of planted forage production by individual farmers is good. There is also good potential for the increased and expanded production of cash crops such as tobacco, chillies, and sugar cane with better marketing channels and local processing facilities. Road access is generally good with only 3 PAs not within 5 kms. of an all-weather or dry weather road.

6.2.2 Increased Crop Production.

6.2.2.1 Suitable Crops and Varieties:

The most suitable cereal crops for this Zone are maize, sorghum, wheat, barley, oats, finger millet, and teff. Oats is not a preferred crop and everywhere out-yielded by barley. All the pulses except cowpea are suitable and cultivated. Coffee is suitable upto about 2 200 masl, above which frost is limiting. Of the oil seeds only niger seed and flax is suitable. The recommended and available improved varieties are :

Maize	A551 and A552
Wheat	Romany BC,Mamba,and Kenya Kanga(on light soils)
	Enkoy (on the heavier soils)

Only local selections are available for the remaining suitable food crops.

6.2.2.2 Improved Inputs for Food Crops:

Total improved food crop seed requirements of maize and wheat are:

Maize	140 mt. (47 mt. annually)
Wheat	140 mt. (47 mt. annually)

Assuming only teff,wheat, and maize are fertilised at current recommended rates, and that an adoption rate of 70% can be achieved then 1 100 mt. of DAP and 550 mt. of urea would be required. PAs which are at or above their crop land support capacity and would receive priority input supply are:

0210	Data Derhabora	(Angacha wereda)
0226	Bondena	(" ")
0301	Hamancho	(Kedida Gamela wereda)
0313	Geyota Wardo	(" " ")
0316	Ambericho	(" " ")
0327	Teza Abara	(" " ")
0333	Abonsa	(" " ")
0335	Zato Shodera	(" " ")

6.2.2.3 Other Improvements Measures:

An urgent programme would be instituted in the Zone in conjunction with the regional programme outlined in section 5.2.2.4 to identify suitable shoot rot disease tolerant varieties of enset. One variety has been identified in Angacha wereda and several others in Gumer and Enemor weredas in Chebo and Gurage. The South Shewa RRP sub-regional management unit would assist MOA staff in Angacha and Kedida weredas in identifying and screening suitable varieties, and organising their propagation and distribution. Stocks of malathiom for timely use against stalk borer on maize and sorghum, and rogor and sprayers for timely use against aphids would be held at SC headquarters. Storage chemicals would be made available at SCs particularly for maize and sorghum.

6.2.2.4 Increased Cash Crop Production:

A major coffee development programme would be initiated in this and the adjoining PZs 3 and 5. Extension demonstration and the training of farmers on the correct pruning techniques would be instituted. Fungicides and sprayers would be made available at all SCs, and seedlings of CBD resistant varieties raised initially at MOA nurseries but subsequently at selected PC nurseries. SCs would be assisted with the construction of washing facilities. Tobacco and sugar cane are minor crops in area, but important contributors to farm cash income. Tobacco cultivation would expand through a special tobacco development programme with the assistance of the Horticultural Corporation of the Min. of State Farms. Improved varieties would be made available, demonstrations instituted, and a grading and marketing system organised through the SCs. Current annual production of

rainfed sugar cane is approximately 1 000 mt, mainly located in the south-west, although plots are scattered. Small-scale raw brown sugar (gur) processing with ox powered mobile crushers (3 mt per day capacity) and open fire evaporators would be developed with the assistance of the AID Bank's medium term credit scheme. Improved varieties of cane with higher sucrose contents would be obtained from the Min. of State Farms. The marketing and processing programme for oil crops (niger seed and flax), chillies, garlic, and ginger proposed for Zone 1 would be extended to this Zone, with storage facilities initially located at Hawa, Demboya, Durame, and Angacha towns.

6.2.3 Soil Conservation and Stabilisation and Reclamation of Badlands.

6.2.3.1 Physical Soil Conservation Measures on Cropland:

Nearly 70 % of the Zone has a moderate to severe risk of sheet erosion because of steep slopes and relatively high rainfall. An unknown but considerable proportion of this area has already been conserved. The Physical Land Use Plan indicates areas recommended for strips (170 ha), bunds (28 000 ha), and terraces (4 700 ha). In most areas bunds and terraces would be constructed on the contour because of the lack of natural drainage lines or waterways. Many instances of bund failure can be observed, and so regular bund maintenance schemes would be introduced. Detailed specifications are given in Annex 3.

6.2.3.2 Stabilisation of Active Gulleys and Badland Formation:

The main area of active erosion is occurring in Hobicho Melisa SC in Angacha wereda on the steep slopes overlooking the Guder river and its tributaries the Yeckesa and Bubuyesa streams. In the lower reaches erosion is by slumping and slipping of sodic Planosols over soft weathered tuffs on low angle slopes. In the upper reaches where slopes are steeper and soils are Nitosols gulley erosion is the main process. The control measures for the lower reaches are those proposed for the adjoining Zone 1. Gulleys would be stabilised with check dams, and where possible water diverted into existing drainage lines.

6.2.4 Forage and Livestock Development.

6.2.4.1 Undersown and Row Planted Legumes:

With its higher rainfall and lower temperatures this Zone is particularly suitable for undersowing of perennial and annual legumes. A full list of suitable species is listed in Annex 3. Planting of strips, bunds, and terraces with tree legumes and grasses would readily adopted in this Zone as cut and carry from existing structures is already widely practised. Seed and seedlings would be made available through SCs from MOA and selected PC nurseries. A list of suitable species is given in Annex 3.

6.2.4.2 Grazing Management:

There is virtually no dry season grazing (wetland) in this Zone, and only 8 PAs have areas recommended for temporary closure (200 ha). However there is a relatively large area (3 500 ha) of very steep land with shallow soils currently being grazed, but with clear signs of pasture and land degradation leading to massive slope failure. These areas would be permanently closed to livestock, planted with tree legumes at low densities (not exceeding 1 600 per ha) and managed on a cut and carry basis. Some PAs indicated that this would be acceptable, and that they would levy a charge for forage removed. The main areas involved are the steep slopes of Mt. Dato and Ambericho, some parts of which have already been closed but planted to forestry. Local decisions will need to be made on whether to close areas for cut and carry forage or just for forestry: both are suitable land uses. However total closure for forestry reduces livestock feed supply, increases pressure on the remaining supplies, and would constrain the proposed dairy development.

6.2.4.3 Improved Dairy Development:

The Kale Heywot CDP has successfully covered 1 900 local cows at their two breeding centres in Angacha and Durame with a conception rate of 80% since 1979. It now has the capacity of 400-500 cows per annum from the two centres. With an estimated fivefold increase in milk yield daily feed requirements increase from 5 kgs DM to 10 kgs plus 4 kgs of concentrate. Any expansion of this programme will depend on the increase in forage supply (see above), and also an organised dairy production and marketing

system. Because of the distance to the nearest main milk markets (Addis Ababa and Shashemene) farmers would concentrate on butter and ayub (cheese) production. Improved traditional dairy technology developed by ILCA such as cream separators, internal agitators fitted to the clay pot churn, and the better method of ayub production would all be demonstrated.

However, as numbers of lactating cross-bred cows build up there would be the potential to establish small butter and cheese production units with a daily capacity of 120 litres of milk. Current constraints to butter marketing have been examined and proposals made in the Livestock Sub-sector Review (AACM, 1986) and incorporated in the Dairy Rehabilitation and Development Project (DRDP). At the field level the main constraints relate to delays in transporting the butter between the primary marketing points and the provincial brokers and the Addis Ababa traders, leading to a deterioration of the product. Other constraints are inadequate storage facilities and containers, and the mixing of butters of varying qualities. In this Zone collection and refrigerated storage facilities would be established at Durame and Angacha by the local SC, who would purchase from farmers and eventually the small scale production units, for sale to licensed traders. Crossbred lactating cows require approximately 800 kgs of supplement per lactation. Noug and other oilseed cake from the oil mills proposed for this and PZs 1, 3, and 5 would be a primary source. Trials at the Kale Heywot CDP with beet forage have been successful and seed would be made available through SCs.

6.2.4 Access to Resources.

6.2.4.1 Physical Access:

Despite the rolling and hilly terrain no PA is further than 5 kms from at least a dry weather (RR10) road. The Pseudo - Hosaina all-weather main road passes through the western part of the Zone, and the Soddu - Shashemene all-weather main road just to the south-east. In addition two RR10 roads traverse the area. No new roads are proposed in the immediate term. Road maintenance for RR10 roads would have to continue on a food for work basis in the absence of any funded maintenance programme.

6.2.4.2 Land Resources:

Currently only 3 PAs out of 54 have exceeded their crop land support capacity, although a further 6 are at capacity.However those at or above capacity increase to 34 by 1994, and to 51 by 2009. The PAs currently in excess are:

0316 Ambericho (Kedida Gamela wereda)
0333 Abonsa (" " ")
0335 Zato Shodera (" " ")

Careful adjustment of the boundaries could be made between Abonsa and Jore (0332), and between Zato Shodera and Aze Doboo (0336) in the same SC (Sharifa Durame) and Fulasa Deakeata (0326) in the adjoining Wasta Teza SC. There is a clear need to effect land allocation to currently landless families in all PAs.

6.2.4.3 Draught Oxen:

Shortage of draught oxen is not a problem in this Zone.

6.2.5 Wood and Water.

6.2.5.1 Construction and Fuel Wood:

It is estimated that the average farmer in this Zone owns between 200 - 400 trees producing 2 cu. m. of wood annually. However there is still a shortfall of some 14 000 cu m. This would be made up from the production from 3 500 ha of closed hillsides producing 40 000 cu m. annually, with any timber surplus to local requirements being sold by the PA.

6.2.5.2 Water Supplies:

Supply of water is less of a problem in this Zone than in the Kolla. However many supplies are unprotected and open to contamination and dirt. Protected spring boxes offer the easiest solution to preventing contamination, and only require a minimum of technical input. The on-going spring development programme in Angacha wereda would be extended to Kedida Gamela wereda using food for work.

6.2.3 PLANNING ZONE 3: THE SOUTHERN UNDULATING WOINA DEGA.

6.3.1 Key Problems and Potential.

6.3.1.1 Problems:

This Zone has the third highest population density in the project area after the adjoining PZs 2/7 and 5 with 352 persons per km^2. The livestock density is the highest in the project area at 226 TLUs per km^2. Although enset provides a smaller proportion of the calorific requirement (54%) than PZ 2/7 it is still an important contributor. Thus the appearance of bacterial wilt in the area could have potentially serious effects on the crop land support capacity if it became widespread. Current only 3 of the 11 PAs are at or above their crop land support capacity, although this number increases to 8 by 1994 indicating the current position is precarious. In terms of livestock feed availability only 2 PAs have sufficient to support their current livestock numbers. Livestock are retained for milk and manure rather than for draught, but current milk yields average only 166 litres per lactation. There is a high incidence of coffee berry disease, coffee tree husbandry is very poor, and trees are often old and of unimproved varieties. There is no coffee development programme in the Zone. No coffee washing facilities are available.

6.3.1.2 Potential:

The Zone is climatically suitable for a wide range of food and cash crops. Farmers have experience of, and there is a large unmet demand for fertiliser and improved maize seed. The food crop mix includes sweet potato, taro, and even cassava in addition to enset and cereals. Cash cropping of coffee, sugar cane, gesho, and fruits is well established. Road access is good with no PA more than 5 kms from a dry weather (RR10) road.

6.3.2 Increased Crop Production.

6.3.2.1 Suitable Crops and Varieties:

The most suitable cereal crops for this Zone are sorghum, maize, wheat, barley, oats, and teff. Although all of these (except oats) are grown, maize and teff predominate. It is possible wheat and barley suffer from rust problems in this moist zone, and sorghum from bird attack. All the pulses are agro-climatically suitable, although the Zone is characterised by a paucity of pulses in the crop mix (protein probably being obtained from milk and milk products). Cowpea is recorded although it would not be suitable in the higher parts of the Zone due to low temperatures. Of the suitable perennials only tea is not grown. Of the oil seeds niger seed and flax are the most suitable followed by sunflower. All the horticultural and cash crops are suitable except for cotton, groundnut, and pineapple, although only sweet potato assumes any importance in the actual crop mix. For maize A551 and A552 and for wheat Romani BC are the accepted improved varieties. Only local selections are available for the remaining food crops.

6.3.2.2 Improved Inputs for Food Crops:

Total improved food crop seed requirements for maize and wheat are:

Maize	75 mt	(25 mt annually)
Wheat	36 mt	(12 mt annually)

Assuming only maize, teff, and wheat are fertilised at current recommended rates, and that an adoption rate of 70% can be achieved then 350 mt of DAP and 175 mt of urea would be required. Those PAs which are at or above their population support capacity would receive priority input supply. They are:

0104	Koto	(Sike wereda)
0110	Ajeba Borara	(" ")
0337	Bezena Beanara	(Kedida Gamela wereda)

6.3.2.3 Other Improvement Measures:

This Zone would join with PZ 2/7 in the programme to select shoot rot tolerant varieties of enset. Stocks of malathiom would held at SC stores for application on maize against stalkborer, and rogor against aphids. Storage chemical (lindane) would be made available at SCs particularly for maize storage.

6.3.2.4 Increased Cash Production:

The coffee rehabilitation and development and the tobacco development programme proposed for PZ2/7 would also apply to this Zone. Current production of sugar cane amounts to approximately 1 000 mt per annum, and cultivation is concentrated over a smaller areas than PZ 2/7 . Small scale sugar processing units would be located at Sike. The marketing and processing development programme for oil crops (flax, sunflower, and niger seed), and spices (chillies, ginger, and garlic) proposed for PZ1 and 2/7 would also apply to this Zone, with facilities initially located at Sike.

6.3.2.5 Small-scale Irrigation:

Two potential sites have been identified: the first 2 km south-west of Sike (100 ha) and the second 4 kms south of Wade (140 ha). Both would abstract water from the Ambericho stream (which is perennial) from the same weir offtake located 6 kms north of Sike. As with the proposed schemes in PZ 1 these would concentrate on supplementary irrigation of cash crops (chillies, shallots, and tomatoes) out of season.

6.3.3 Soil Cobnservation and Badlands.

6.3.3.1 Physical Soil Conservation Measures on Crop Land:

Approximately 75 % (8 800 ha) of the potential arable land has a significant sheet erosion hazard. These areas are indicated on the Physical Land Use Plan. Most areas would be bunded, with bunds constructed on the contour because of the lack of natural drainage lines or waterways. Detailed specifications are given in Annex 3.

6.3.3.2 Stabilisation of Active Gulleys and Massive Erosion:

The area of badland is negligible in this Zone, and the area affected by moderate or severe gulley erosion is about 1 700 ha. Active gulleys are few and are indicated on the Physical Land Use Plan. These would be stabilised using check dams, and where possible water entering the gulley diverted into natural waterways.

6.3.4 Forage and Livestock Development.

6.3.4.1 Undersown and Row Planted Legumes:

As with PZ 2/7 this Zone is well suited for undersowing perennial and annual legumes. Planting of strips and bunds with tree legumes and improved grasses would be undertaken. It is anticipated that these measures would be readily adopted as existing bunds are already used for cut and carry of indigenous grasses. Seed and seedlings would be made available through MOA, Kale Heywot CDP, and newly established PC nurseries to SCs. A list of suitable tree legume and grass species is given in Annex 3.

6.3.4.2 Grazing Management:

There are some 180 ha of bottomland grazing with a DM production of about 4 mt per ha. Because of the extreme shortage of forage it is recommended that these areas be closed to livestock, and restricted to cut and carry. Cut and carry would commence only after seeding had taken place. The steep slopes to the west of Durame (in Elfata PA) would be closed to livestock, and planted to communal forestry, with some limited cut and carry of forage.

6.3.4.3 Dairy Development:

The Kale Heywot CDP's breeding centres at Durame and Angacha would continue to offer facilities to farmers in this zone. As with PZ 2/7 farmers in this zone would concentrate on butter and cheese production using the improved traditional churn, and ayub production. As numbers build-up there would be potential to establish butter/cheese production units (daily capacity 120 litres) at Sike and Wade. Noug cake would be

available from the oil mills proposed above. Improved veterinary services would be established at the MoA wereda office at Sike and Durame. Under the DRDP refrigerated storage facilities would be established by the wereda SC at Sike.

6.3.4.3 Cross-bred Work Oxen:

Cross-bred oxen would become available from the breeding programme. An ox-training and demonstration facility would be established at Sike wereda MoA office to demonstrate the single ox plough.

6.3.5 Access to Resources.

6.3.5 1 Physical Access:

No PA is more than 5 Kms from the Durame - Sike - Gemesha (RR10) road, which is currently maintained in reasonable condition. The Sike - Shone (RR10) road however requires improvements (see proposals under PZ5). Road maintenance would continue on a food for work community basis.

6.3.5.2 Land Resources:

Currently only 3 out of 11 PAs are at or above their crop land support capacity. The two PAs currently in excess are 0110 Ajeba Borara and 0337 Bezena Beanara. Adjoining PAs are at capacity and so boundary changes offer no solution. These PAs would therefore receive priority for fertiliser and improved maize and wheat seed.

6.3.5.3 Draught Oxen:

There is no shortage of draught oxen in this Zone.

6.3.6 Wood and Water.

6.3.6.1 Construction and Fuel Wood:

Current annual wood deficit is approximately 5 000 cu.m. requiring 440 ha of planting, or approximately 130 trees per family.

6.3.6.2 Water:

Water supply is not a major problem. However these are unprotected and open to contamination. Protected spring boxes and shallow lined hand dug wells offer the simplest and easiest solution to prevent contamination. A spring box and well programme would be initiated from the Sike wereda MoA office using food for work.

6.4 PLANNING ZONE 4: THE DEGRADED WOINA DEGA.

6.4.1 Key Problems and Potential.

6.4.1.1 Key Problems:

The major problem of this zone is the large extent of currently unusable badland amounting to 16 800 ha or 33% of the zone. Although population density is relatively low, there is a shortage of crop land, with 27 out the 36 PAs at or above their crop land support capacity. This is compounded by the zone having the lowest proportion of suitable crop land. Rainfall is variable in amount and timing, with a crop failure (less than 50% of normal yield) occurring 1 year in 5. Fuel wood is in extremely short supply and dung and crop residues are being used. During the dry season water for humans and livestock is in short supply and current supplies are unprotected. In recent years bacterial wilt has decimated enset, and aphids have totally anhilated horsebean. Most of the zone is too dry for coffee. There are considerable areas of poorly drained vertisols, vertic and gleyic cambisols all with surface ponding and topsoil waterlogging problems.

6.4.1.2 Potential:

Higher temperatures in this zone result in shorter growing periods for most crops. Construction of broad beds and furrows could improve yields on some 10 700 ha of vertic soils with drainage constraints. Approximately 50 % of the badlands appear to have stabilised, with little or no active erosion, and the exposed substrate is often soft weathered tuffs. These areas although they can not be reclaimed for cropping can be reclaimed for forage and fuel wood production. Careful selection of bacterial wilt resistant varieties of enset, coupled with manuring and mulching will enable the re-establishment of this valuable crop. The Zone is particularly suited for chillie and nigerseed cultivation, two cash crops currently only cultivated on a small scale. With shade and mulching expanded coffee production would be possible on the freely drained cambisols and nitosols on the foothills above the plains. Access to and within the Zone is very good being traversed by the main Butajira - Hosaina all-weather road, making the zone a four hours drive from Addis Ababa.

6.4.2 Increased Crop Production

6.4.2.1 Suitable Crops and Varieties:

Sorghum, teff, and finger millet are the most suitable crops for this zone, followed by maize, barley and wheat. Bird attack restricts the area of sorghum which can be cultivated. Of the pulses chickpea, vetch and lentils are more suited to the poor drainage conditions than field pea, haricot bean, and horse bean. However recently aphids have been so severe as to nearly eliminate horse bean and other pulses from the area. Enset is marginal in the eastern part of the zone having being decimated by drought and shoot rot disease in 1984/85. However in the western foot hills enset and coffee are suitable. Niger seed and flax are the most suitable oil seed crops. Enkoy and A551/552 are recommended varieties of wheat and maize.

6.4.2.2 Improved Inputs for Food Crops:

Total improved seed requirements of maize and wheat are:

Maize : 265 mt (88 mt annually)
Wheat : 290 mt (97 mt annually)

Assuming maize, teff, and wheat are fertilised at current recommended rates, and that an adoption rate of 70 % can be achieved, then 1 540 mt of DAP and 770 mt of urea would be required. The PAs which have exceeded their crop land support capacity and would receive priority input supply are:

0207	Adanicho Ebala	(Angacha Wereda)
0211	Bonga	(" ")
0212	Kejima Bocha	(" ")
0305	Megere	(Kedida Gamela Wereda)
0420	Sheshana Gimba	(Limu Wereda)
0430	Deneba	(" ")
0431	Doisha Meten	(" ")
0441	Homa Agera	(" ")
0442	Biramorana Kemo	(" ")
0505	Koro	(Dalocha Wereda)
0510	Koro Gole	(" ")
0513	Talikesa	(" ")
0515	Shama Imoshea	(" ")
0525	Todea	(" ")
0551	Chaki Lefo	(" ")
0553	Achamo	(" ")
0631	Albazer Zamoshodige	(Silti Wereda)
0632	Delie Date Weer	(" ")

6.4.2.3 Other Improvement Measures:

The major improvement measure for this zone would be the control of surface ponding and improved topsoil drainage on 11 000 ha of land by the construction of broad beds and furrows (BBF) with the ox drawn BBF maker. This would increase yields of most crops on these soils but particularly of maize, wheat, horsebean, and niger seed. The BBF maker recently redesigned by ILCA would be demonstrated.

The second major improvement measure would be the control of aphids using insecticide. Farmers near Butajira were reported (AACM/ADD,1986) to have successfully used "Rogor" a systemic insecticide on field pea. Insecticide and sprayers would be made available to all PAs in this zone. DA's and private agrochemical traders would receive training in insect monitoring and insecticide application methods.

The Zone would partake in the enset screening programme to identify and propagate wilt-resistant varieties. In addition efforts would be made to identify drought tolerant varieties suitable for the drier eastern part of the zone, and to test the potential of heavy mulching to retain soil moisture. Storage chemical (lindane) would also be made available at SC stores and with private traders particularly for the protection of maize.

6.4.2.4 Increased Cash Crop Production:

Increased production and expansion of three cash crops would be promoted: coffee, oilcrops (niger seed), and spices (chillies, garlic, azmud). A coffee development programme similar to that in Hosaina South focused on the western foothills would demonstrate pruning and improved tree husbandry methods, make available seedlings of CBD resistant varieties, and mulching. Development of oil crops would be enhanced by improved drainage conditions resulting from the construction of broadbeds, and the establishment of local oil seed presses located at Dalocha, Wilbareg and Fonko. Improved marketing of chillies and other spices would follow the methods proposed for PZs 1, 3 and 5 with AID Bank credit support for storage, and with links to Addis Ababa based Spice Extraction Share Company.

6.4.3 Soil Conservation and the Stabilisation and Reclamation of Badlands

6.4.3.1 Physical Soil conservation Measures on Crop Land:

Just over 15 % of the area requires physical soil conservation measures. An unknown but considerable proportion of this area already has had some physical works constructed. The Physical Land Use Plan indicates areas recommended for strips (2 500 ha) and bunds (4 600 ha). Detailed specifications are given in Annex 3.

6.4.3.2 Stabilisation of Active Badland:

Piping, tunnelling, and stripping are the dominant processes of badland formation in this zone. The main active areas are found on the western edges of the large expanse of badland found in the Dijo embayment between Alkesa and Werabay PAs in Silti wereda, with more limited stream edge stripping occurring on the Wilbareg plains. These areas are indicated on the Physical Land Use Plan. The stripping in the Dijo embayment is on a wide front and the active edge is often 10-20 meters high. The breaking down and levelling of "scarps" of this order is impossible using hand labour. The strategy would be to isolate an area 100 meters back from the front by excluding all access. A thick ground cover of grass and herbs would thus be naturally established, with leguminous trees (Casuaraena, Leacaena, Sesbania) or lowland and highland bamboo planted at a density not exceeding 1 600 per ha in order not to shade out the ground cover.

Where active gulleys are cutting into or are part of an active front, cut-off drains leading to waterways would be constructed. Where the active stripping front is only 1-2 meters high the scarp can be broken down as described in Annex 3, and planted to grasses and leguminous trees. In these cases the exclusion zone behind the front could be limited to 50 meters.

In the areas of active massive slope failure which are occurring on the residual hills west of Dalocha, and on the first of the western escarpments, closure above and below the active front will be required. In the case of the residual hills this would mean they would be closed entirely . The west facing scarp

in the south-east of the zone (Deneba PA) with its torrent rills on the main face and piping on the upper convex slope would be similarly closed upto 100 meters behind the convex slope.

Active gulleys which pose a hazard to crop land and stabilised badland recommended for reclamation have been identified on the Physical Land Use Plan. These would be stabilised by check dams, and where possible the diversion of water from the gulley head into nearly streams. Areas above gulley heads where not closed for other reasons would be totally closed for at least 100 meters around the head of the main gulley, as well as heads of side gulleys. Multipurpose tree planting including bamboo would be at a density not exceeding 1 600 per ha.

6.4.3.3 Reclamation of Stabilised Badlands:

More than 60 % of the badlands are inactive, with varying thicknesses of soil stripped away exposing unweathered tuffs, unconsolidated ashes, and occasionally consolidated welded tuffs. These areas would be totally closed. Where the substrate permitted multipurpose trees would be planted at a density of not more than 1 600 per ha. No physical works would be constructed. The area affected is approximately 6 800 ha. Cut and carry of forage would be permitted after 2 - 3 years. PA committees have indicated that they would levy charges for the cutting of such communal forage.

6.4.4 Forage and Livestock Development.

6.4.4.1 Undersown and Row Planted Legumes:

The use of undersown legumes would be confined to the higher and wetter parts of the zone on the freely drained Nitosols and Cambisols. On the lower areas which have not been bunded row planted tree legumes (leaucaena, sesbania) would be used, planted along the contour at 20 meter spacing. Bunds would be planted to improved grasses and tree legumes. A full list of suitable spaces is given in Annex 3.

6.4.4.2 Grazing Management:

There are 700 ha of restricted dry season (ie wetland) grazing, and 150 ha of restricted wet season grazing. Unused arable land is very short with 26 of the 36 PAs having none. Where these PAs have wetland it would be preferable to close these areas, and only use the forage on a cut and carry basis.

6.4.4.3 Improved Dairy Development:

This Zone is too far from the Kale Heywot CDP breeding facilities, and there are no proposals to establish such facilities in Hosaina North.

6.4.5 Access to Resources.

6.4.5.1 Physical Access:

Most of the Zone has good access, except for an area north of the main Hosaina road in Yedisabola and Ambericho Kite SCs. A new RR10 road is proposed from Obisona Ilorito PA northwards through Dalocha to Gumer weredas. A tentative alignment is indicated on the Physical Land Use Plan.

6.4.5.2 Land Resources:

Currently 27 out of the 36 PAs are at or above their crop land support capacity, and this number rises to 35 PAs by 1994. This is the most land deficit of all the Zones. The large number of PAs which are deficit and the precarious position of the adjoining PAs which are currently not in excess precludes boundary changes or amalgamation of PAs as a solution. The main strategy would be the intensification of crop production on existing crop land through the use of improved inputs and soil drainage.

6.4.5.3 Draught Oxen:

Despite the relatively large number of oxen in the Zone, ownership is highly skewed, with 16 % of farmers owning 60 % of the oxen. The farmers with no oxen experience shortages at the critical land preparation time in March and April. These shortages are exacerbated if the belg rains are delayed. These farmers require 70 ox-pair days per annum, representing a hire cost of EB210 or 70 - 100 days of labour, or the grain equivalent. An estimated 2 400 farmers would be targeted for the ox purchase credit scheme. Most oxen purchased would come from within the Zone or from the enset farmers in the adjoining Zones. One external source would eventually be the cross-bred oxen from Hosaina South, and which would be suitable for the single ox plough.

4.4.6 Wood and Water.

4.4.6.1 Construction and Fuel Wood:

This is the most critical of all the Zones, with an annual estimated deficit of nearly 30 000 cu m. This will require 2 500 ha of planted trees, mainly E.camuldalensis and E.saligna. A good proportion of this could be planted on the reclaimed badlands as communal woodlots, with the balance being made up as individual plantings around homesteads and as field boundaries.

4.4.6.2 Water Supplies:

During the dry season water shortages for humans and livestock occur. A few ponds have been constructed by hand, but these are insufficient. On the level terrain found in most of the Zone ox-drawn scoop ponds would be the simplest solution. Twenty scoops per SC would be made available for pond construction. Ponds for human supply would be enclosed with live fences, and stone piers constructed to prevent muddy water.

6.5 PLANNING ZONE 5: THE FLAT WOINA DEGA OF HOSAINA SOUTH.

6.5.1 Key Problems and Potential.

6.5.1.1 Problems:

This Zone has the highest human and the second highest livestock population densities in the project area, with 440 persons per km^2 and 234 TLUs per km^2 respectively. Currently 12 of the 18 PAs are at or above their crop land support capacity, and this will rise to 17 PAs by 1994. The Zone is recovering from a serious attack of bacterial wilt which decimated the enset crop in 1983/83. The soils are mainly solodic planosols which suffer from perched water tables in the middle of the rains. Only 1 PA has sufficient forage for its livestock numbers. There is a high incidence of coffee berry disease, tree husbandry is poor, trees are often old and of unimproved varieties. There is no coffee development programme in the Zone. No coffee washing facilities are available. Although near to the main Shashemene - Soddu road, the connecting RR10 road is poorly maintained, with poor bridge structures, and is often impassable during the rainy season.

6.5.1.2 Potential:

The Zone is climatically suited to a wide range of food and cash crops, and the LGP is sufficiently long to allow relay and sequential cropping. The food crop mix is wide including roots, enset, and cereals. Cash cropping of coffee, chat, tobacco, and chillies is well established. There is a large unmet demand for fertiliser and improved maize seed. There are two potential sites for small scale irrigation. The erosion hazard is low, and the current area of badland is small.