AGRO-ECOLOGICAL ZONES
OF ETHIOPIA

Natural Resources Management
& Regulatory Department
MoA

With Support Of:
German Agency For Technical Cooperation (GTZ)

MARCH, 1998
ADDIS ABABA
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LAND USE AND LAND COVER

EXPLANATION

This map was compiled from the following main sources: imagery interpretation of 71 frames of Landsat satellite imagery (mainly covering the period 1973 to 1976), field traverses, existing publications, reports and maps concerning Ethiopia, and agro-climatic information generated by the “Assistance to Land use Planning project” ETH/78/003. An explanation follows regarding the main components of the map legend.

MAJOR CLASS: Classes indicate the general nature of the land use and land cover types included, e.g. 2-cultivated land, 3-afroalpine and sub afro-alpine vegetation, 4-forest land, etc.

MAPPING UNIT: Mapping units are of two main types: those with single codes (e.g. 5.2) and those with complex codes (e.g. 5.2/2.3). Complex units result from inherent limitations of the present 1:1,000,000 scale of mapping. These limitations do not always enable the separation of different (component) land use and land cover types into independently mapable units and thus combined units represented by complex codes are necessary in such cases. Complex mapping units are estimated to be divided randomly into their two components in the proportion 60/40, the first mentioned component (i.e. 5.2 in the above example) in each complex unit is designated as occupying the larger area proportion (i.e. 60%) and the second component (2.3) the smaller proportion (i.e. 40%), in all cases.

LAND USE AND LAND COVER TYPE: Classification of the land use and land cover incorporates elements of the work of Andersone et al. (1970) and Pratt and Gwynne (1977). The former places reliance on remote sensors, the latter is designed for use in range land areas and recognizes the allocation of remote sensing in land use and land cover mapping. From both sources, only the more generalized levels are relevant due to the scale of the present work.

MAIN LAND USE ACTIVITIES: The upper case letters A to G represent the major kinds of land use activities occurring within map units as follows: A = annual crops, B = Perennial crops, C = grassland, D = forest, E = Bush shrubland, F = currently unproductive.
TOTAL AREA (Km2): the areas shown in the legend reflect several levels of area assessment as indicated in the following example.

<table>
<thead>
<tr>
<th>Mapping Unit</th>
<th>Unit area (km²)</th>
<th>Total area (km²)</th>
<th>Land use and Land cover</th>
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<td>5.2</td>
<td>16920</td>
<td>19164</td>
<td>open woodland</td>
</tr>
<tr>
<td>5.2/2.3</td>
<td>1926</td>
<td></td>
<td>open woodland/moderately cultivated</td>
</tr>
<tr>
<td>5.2/2.4</td>
<td>318</td>
<td></td>
<td>open woodland/perennial crop cultivation</td>
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</tbody>
</table>

In the above case, open woodland occurs as both the homogeneous category 5.2, or within the complexes 5.2/2.3 and 5.2/2.4. The total land area falling within the category 5.2 therefore incorporates the proportional area contribution (60% in both examples) from the 5.2 component in each of the two complexes.

The user should note that the complex codes 5.2/2.3 and 5.2/2.4 occur again in the legend under the codes 2.3 and 2.4 respectively. Since the total area calculated for either of these latter two units must also incorporate the area contribution (40% respectively of 5.2/2.3 or 5.2/2.4) from the relevant complex units, to accurately determine the total area of either 2.3 or 2.4. Assessment of total areas of all units which have components included in complex mapping units is done in this manner.
<table>
<thead>
<tr>
<th>MAJOR MAPPING CLASS UNIT</th>
<th>TOTAL AREA(Km²)</th>
<th>LAND USE AND LAND COVER TYPE</th>
<th>MAIN LAND USE ACTIVITIES</th>
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</thead>
</table>
| 3. Afro-alpine and sub afro-alpine vegetation | 2000 | Afro-alpine health vegetation | a) Sedentary peasant livestock grazing and browsing  
b) Rainfed peasant crop cultivation where terrain permits |
| 4. High Forest | 1430 | Dense coniferous high forest | Forest wood harvesting |
| 4.1 | 28510 | Dense mixed high forest | Forest wood harvesting  
see under 4.2 and 2.3 |
| 4.2/2.3 | 2520 | Disturbed high forest | a) Forest wood harvesting  
b) Rainfed peasant mixed agriculture (annuals and perennials)  
see under 4.3 and 2.3  
see under 4.3 and 2.4  
see under 2.4 and 4.3 |
| 5. Woodland | 9900 | Dense Woodland | a) Livestock grazing and browsing  
b) Rainfed peasant mixed agriculture  
c) Forest harvesting  
see under 5.1 and 2.4  
see under 5.1 and 7.3 |
| 5.1/2.4 | 1182 | Dense woodland/Perenn. crop cult. | a) Livestock grazing and browsing  
b) Rainfed peasant mixed agriculture in patches  
c) Forest harvesting  
see under 5.1 and 2.4 |
| 5.1/7.3 | 324 | Dense woodland/lowland Bamboo bushland |
| 5.3 | 16920 | Open woodland | a) Livestock grazing and browsing  
b) Rainfed peasant mixed agriculture in patches  
c) Forest harvesting  
see under 5.2 and 2.3  
see under 5.2 and 2.4 |
| 5.2/2.3 | 1926 | Open woodland/Moderately cultivated | a) Wood harvesting for domestic use  
b) Seasonal grazing |
| 5.2/2.4 | 318 | Open woodland/Perenn. crop cult. |
| 5.3 | 350 | Eucalyptus woodland |
| 6. Riparian Woodland or bushland | 7990 | Riparian Woodland or Bushland | a) Pastoral livestock grazing and browsing  
b) Scattered seasonal crop cultivation on flood plains |
<table>
<thead>
<tr>
<th>MAJOR MAPPING CLASS UNIT</th>
<th>UNIT AREA(Km²)</th>
<th>TOTAL AREA(Km²)</th>
<th>LAND USE AND LAND COVER TYPE</th>
<th>MAIN LAND USE ACTIVITIES</th>
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<td>1. Urban or Built up Land</td>
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<td>610</td>
<td>Urban or Built up Land</td>
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<td></td>
<td>2.2</td>
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<td>Intensively cultivated</td>
<td>b) Rainfed cultivation of cereals: teff, wheat, barley, maize, sorghum and oil seeds</td>
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<td>2.2/10.2b</td>
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<td>Intensively cultivated/seasonal marshes</td>
<td>c) Sedentary peasant livestock grazing on unimproved pasture and fallow see under 2.2 and 10.2b</td>
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<td>2.3</td>
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<td>135812</td>
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<td>see under 2.3 and 8.2</td>
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<td>see under 2.3 and 9.1</td>
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<td>19694</td>
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<td>b) Grain cultivation</td>
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<td>b) Wood and incense harvesting</td>
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<td>5290 5506 Lowland Bamboo bushland</td>
<td>a) Bamboo harvesting</td>
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<td>b) Pastoral and transhumance grazing and browsing</td>
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<td>a) Pastoral livestock grazing and browsing (more camels)</td>
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<td>78130 78130 Dense shrubland</td>
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<td>b) Wood and incense harvesting</td>
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<td>see under 9.1 and 2.3</td>
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<td>MAJOR MAPPING UNIT TOTAL</td>
<td>LAND USE AND LAND COVER TYPE</td>
<td>MAIN LAND USE ACTIVITIES</td>
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<td>CLASS UNIT</td>
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<td>AREA(Km²)</td>
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<td>10. Swamp and Marshes</td>
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<td>5990</td>
<td>Perennial swamp</td>
<td>Year around grazing on outer periphery</td>
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<td>Dry season grazing</td>
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<td>1860</td>
<td>Perennial March</td>
<td>Year around grazing on outer periphery</td>
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<td>686</td>
<td>Seasonal Marsh</td>
<td>Dry season grazing</td>
</tr>
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<td>2.2/10.2b</td>
<td>416</td>
<td></td>
<td>Intensively cultivated/seasonal marsh</td>
<td>see under 2.2 and 10.2b</td>
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<td>11. Salt flats, exposed rock or sand surface</td>
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<td>Browsing on occasional shrub</td>
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<td>6830</td>
<td>Water Body</td>
<td>Fishing, recreation, drinking water, hydropower</td>
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INTERPRETATION OF DESCRIPTORS

MAIN SYSTEMS

C  -  Cereals
E  -  Enset
P  -  Pastoral
S  -  Shifting cultivation

ENSET SUBSYSTEMS

E  -  Enset dominant
E (C) - Enset minor, cereals dominant
E (t) - Enset minor, tubers dominant
E (ct) - Enset minor, cereals and tubers dominant

ALTITUDINAL (CROP GROUP) SUBSYSTEMS

K  -  Kolla, T1/T2
WD - Woina dega, T3
D  -  Dega, T4
W  -  Wurch, T5/T6

DOMINANT CROP SUBSYSTEMS

B  -  Barley
T  -  Teff
W  -  Wheat
M  -  Maize
Mi - Millet
S  -  Sorghum
C  -  Cickpeas
Se - Sesame
Pot - Potatoes

COFFEE SUBSYSTEMS

Co - Coffee important

LIVESTOCK SUBSYSTEMS

Sh  -  sheep important
go - goat important
ca - cattle important
1. Preface

In the past years, many efforts have been made by different geographers and research workers to develop the agro-Ecological zones of the country. Since most of them were based on the traditional agro-climatic system and furthermore, were discipline oriented, none of them succeeded to properly develop the AEZ of the country. However, their efforts were the main basis for the development of the present AEZ.

It was only nine years back (1988), that the former Land Use Planning and Regulatory Department (EX-LUPRD) of the Ministry of Agriculture (MoA) in collaboration with the National Meteorological Services Agency (NMSA) after reviewing the past works and using The Climatic Resources of Ethiopia, 1989 as a basic source of information for their work that they came to the development and production of the Agro-Ecological Zones (AEZs) of Ethiopia.

By the time the AEZ of Ethiopia in 1989 was developed field verification of the land characteristics such as physiography, soils, climate, present landuse/cover type and farming systems of each of the sub-zone was not undertaken, also informations regarding crops, livestock wildlife and forestry and above all the agricultural potentials and constraints of each sub-zone were not completed. Therefore, the present work is the continuation and finalization of the past AEZ work.

Two months of intensive field survey has been conducted by two groups with three experts each (Agro-Ecologist, Soil Surveyor and Forester), one moving to the north and the other to the southern part of the country. During the field survey, field verification of the land characteristics already filled and completion of those with gaps was undertaken. After gathering all the required informations, do the analysis and making all the possible corrections, the groups have felt that they have completed the work.

The total number of major AEZ of the country is well in accordance with the previous work (18 major AEZs), whereas the number of sub-zones have been reduced from 62 to 49 due to the following reasons:

i) in the present work Eritrea has been excluded, hence a number of sub-zones which are found only in Eritrea do not exist.

(ii) the physiographic units have been revised and changed from 9 to 7, therefore, the combination matrix has been reduced.

(iii)
2. INTRODUCTION

2.1 Background

Ethiopia is situated in east Africa, located between 3° 24' and 14° 53' north and 32° 42' and 48° 12' east.

The great rift valley that runs from north east to almost south west, divides the country into two parts forming the western and eastern highland plateau. The country is rugged which constituted mountains, hills, plateau, plains, valleys and gorges.

The varied topographic features represent diversified elevations and slopes with lowest point at Danakil depression at about 126m below sea level and the highest on the top of Ras Dashen mountain which is about 4,620m a.s.l.

It is a vast country with a population of about 55 to 57 million and an area of 1.12 million square kilometer. Its economy is totally dependent on agriculture (i.e. crop and livestock production). Unfortunately, the country's current agricultural production does not meet the food requirement of the population, largely because of a high population growth and ecological degradation over the limited and scarce resources.

Ecological degradation in the country is caused by old traditional farming systems and misutilization and mismanagement of the land resources.

In order to improve the agricultural production and thereby improve the livelihood of the population concerned it is very important that the potential constraints and degradational threats of the diverse agro-ecological zones of the country be properly identified and understood.

Once these zones are recognized and characterized on a scientific basis, it would be possible to categorize the country into a fairly homogeneous resource types namely agro-ecological zones (AEZs) and at the same time to describe the associated environmental problems and suggest solutions of each on a zonal basis. Such a work not only enables us to organize and develop scientific land use plans and research networks but also help identify strategies for resource conservation, development, management and utilization. Some efforts have been made in the past to identify, classify and characterize the country's agricultural resources zones, mainly on the basis of the traditional agro-climatic classes, especially as they relate to land use, crop and livestock patterns.

Many of these system classifications and characterizations, however, were incomprehensive and discipline oriented which could not address the basic
objective from an ecological perspective. It is with this basic aim of including the fundamental ecological and related parameters of climate, physiography, soils and vegetation that the present work evolving a comprehensive AEZs of Ethiopia has been taken up.

2.2 Objective

The study aims at exploring, identifying and characterizing the zonal resource potentials and constraints of the country in order to exploit its potentials wisely and properly as they naturally relate to the proper land utilization types and conservation measures. In line with this, the country needs to be food self-sufficient through developing and improving the zonal resources of the country.

It is also aimed at producing surplus to meet the export and food security demand through utilizing and allocating the zones to the best matching land uses which do not cause competition and ecological degradation. These will be achieved only through full understanding of the potentials and constraints of the diversified climate, physiography, soils, vegetation and other related physical characteristics of the zones. Techniques of acquisitions of such valuable information coupled with multidisciplinary experiences are given due considerations to recognize and delineate the AEZs in a comprehensive manner. Based on these the country needs to establish areas specializing in production of cereals, pulses, oil crops, fiber crops, livestock, forest and wildlife whose requirements are properly and scientifically matching with environmental qualities and characteristics of the zones.
3. DEFINITIONS AND CATALOGUE OF THE EXISTING CLASSIFICATION SYSTEM

3.1 Definitions

Since the initiation of agricultural activities and human settlements in Ethiopia, the Ethiopian peasants have always recognized at least three major agro-climatic zones (as opposed to agro-ecological), mainly based on the relation between elevation and temperature. The temperature difference within the zones not only enabled them to recognize broad vegetation communities adapted to environmental conditions but also to select crops and livestock best suited for these temperature regimes.

The traditional agro-climatic zones of the country are known as kolla, woinadega and dega, although there is no clear distinction of their boundary limits. As population pressure increased and accordingly agricultural activities expanded, two additional zones at the higher and the lower temperature extremities were also recognized, namely, bereha and wuruch respectively. Recent discipline oriented studies distinguished and defined these traditional zones by linking the related factors of altitude, annual rainfall, and temperature (Table 1).

Table 1. Traditional climatic zones and their physical characteristics

<table>
<thead>
<tr>
<th>Traditional Zone</th>
<th>Climate</th>
<th>Altitude (m)</th>
<th>Average annual temperature (°C)</th>
<th>Average annual rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bereha</td>
<td>hot arid</td>
<td>&lt;500</td>
<td>&gt;27.5</td>
<td>&lt;200</td>
</tr>
<tr>
<td>Kola</td>
<td>warm semi-arid</td>
<td>500-1500/1800</td>
<td>27.5-20.0</td>
<td>200-800</td>
</tr>
<tr>
<td>Woinadega</td>
<td>cool sub-humid</td>
<td>1500/1800-2300/2400</td>
<td>20.0-17.5/16.0</td>
<td>800-1200</td>
</tr>
<tr>
<td>Dega</td>
<td>cool and humid</td>
<td>2300/2400-3200</td>
<td>17.5/16.0-11.5</td>
<td>1200-2200</td>
</tr>
<tr>
<td>Wurch</td>
<td>cold and moist</td>
<td>above 3200</td>
<td>&lt;11.5</td>
<td>above 2200</td>
</tr>
</tbody>
</table>

A more comprehensive and proper characterization of Ethiopian's AEZs should, however, link the interrelated physical, abiotic and biotic parameters of physiography, soils, vegetation, animals, and human activities with climate. Accordingly, agro-ecological zones could be defined appropriately as natural regions characterized by a fairly homogeneous climate, physiography (relief, slope), soils, vegetation, and animal species that typify the area. Precipitation and temperature are the two major climatic elements which play an important role in the determination of the biomass density, productivity, and community composition distribution of species in any agro-ecological zone. Hence, certain ranges of thermal and moisture conditions together with information on physiography, soils, and vegetation data could help delineate agro-ecological
zones. Sub agroecological zones, which are more homogeneous in characteristics, are also identified, particularly based on soils and physiography.

3.2 Catalogue of the existing classification systems

Apart from the traditional zones, a number of agroclimatic zonation and classification systems have been developed over the past few decades. Many of these systems, however, were evolved from the traditional agro-climatic classification system. Furthermore, they were designed to describe the environment attuned to a certain area of discipline and/or interest. The known and documented classification systems related to the characterization of the agro-ecological zones of Ethiopia include the efforts of various experts working particularly on topics such as climate, vegetation, soils and geomorphology, farming systems, agroecology, land use/land cover, and altitudinal zonation. These efforts are reviewed below.

Dove in 1890 recognized the following three agro-climatic and vegetational zones, mainly based upon the relation between elevation and temperature (4).

Kola or hot zone with average monthly temperature of 20°C and below 180m. elevation (a.s.l.)

Woinadega or temperature zone with average monthly temperature of 20°C during the warmest months and between 1800m and 2400m elevation a.s.l.

Dega or cool zone above 2400m elevation a.s.l. with the upper part as alpine region.

Later in 1961, Huffnagel et al. distinguished a fourth zone called Wurch or mountain zone above 3800m elevation (8).

In 1957 Pichi-Sermolli identified 21 vegetation types based on climatic variations, the vegetation response to climate, and environmental conditions (10). Mooney in 1961 identified 12 types, while Huffnagel et al. in the same year classified the country’s major vegetation types into 11 (8,9)

In 1975 E. Westphal generalized the work of Pichi-Sermolli into the following 16 major vegetation types which occur in different parts of the country (11).
- Desert (Danakil and Dalol)
- Semidesert and steppe (Danakil, Ogaden, Borena)
- Xerophyloous open woodland (arid and semiarid zones)
- Deciduous woodland (between elevations of 700-800m a.s.l. and 1400-1800m a.s.l.)
- Lowland bamboo thickets (Gojam, Welega, Begemedir, and Tekeze valley)
- Savanna (mixture of tall grasses, shrubs, and trees)
- Montane evergreen thicket (on slopes and plateau of the highlands between 900 and 1000m and 1800 and 2400m elevation)
- Montane savanna (woina dega and lower parts of dega)
- Montane dry evergreen forest (the community of valuable timber forests)
- Montane moist evergreen forest (Welega, Kefa, Sidamo where the rainfall is >1200mm annually)
- High level bamboo forest (Shewa, Welega, Kefa, Gamo Gofa, Bale, Arsi and Sidamo between 2300 and 3200m elevation)
- High mountain vegetation (Hagenia-Hypericum association)
- Afroalpine formations (Erica-Hellicrisum association and low grass formation)
- Coastal formations
- Swamp formations (along lake shores)
- Riparian formations (along dry and perennial streams)

Bounting (2) recognized 11 agro-ecological regions based on highland, lowland, lake area, administrative area and river area categorization and description of the climate, soils and the crop and livestock patterns of the region.

Amare Getahun (1) recognized the following four broad agrophysiographic regions in the highlands of Ethiopia (above 1500m elevation) based on the physical natural resources, demographic, and rural economic characteristics and descriptions.

- The high potential horticulture/livestock highlands
- The high potential cereal/livestock highlands
- The low potential cereal/livestock high-altitude degraded highland
- The low potential livestock/crop highland escarpment and low plateau

LUPRD (5) recognized 12 major land use and land cover types based on satellite imagery interpretation and analysis. LUPRD (6) identified the major agro-climatic regions based on the analysis of the existing climatic data to
identify and characterize the thermal zones and length of growing periods. Making use of the generalized agro-ecological as well as other related data generated by LUPRD, the Agricultural Development Department of MoA developed 30 agro-ecological zones with the objective of locating potential agricultural research network in 1985/86.

By studying past resource assessment and classification J.A. Wicks (12) found that not only there is a logical relationship among AEZs and farming systems but also that one or more farming systems could be identified in a specific agro-ecological zone. Based on more updated climatic data from the National Meteorological Service Agency (NMSA), the earliest generalized agro-ecological and the geomorphology and soils data compiled by LUPRD (6,7), and from more refined analysis of these data E. De. Pauw (3), LUPRD, and NMSA identified 15 major agro-ecological zones and 138 subzones in 1987.
4. BASIS FOR THE PAST CLASSIFICATION SYSTEMS AND THEIR MERITS AND DEMERITS

As already noted the earlier classification systems were discipline oriented and were more descriptions and characterizations of the physical environment, particularly as they relate to the specific objective of the study under consideration. But more importantly, most of the classification system dwelt upon quite extensively on limited climatic rather than ecological parameters. In particular, they were largely bound either to temperature regimes or altitude. Actually this was not without reason. Thermal zones have strong correlation with altitude. When altitude increases temperature and evapotranspiration decreases and rainfall increases. In the Ethiopian context, studies have shown that for every 100m rise in elevation the air temperature falls within the range of 0.6 and 0.7 °C. Thus, climatic changes could easily contribute to general changes in vegetation community and soil characteristics, which in turn influence the land use and crop/livestock patterns.

We also know that Ethiopia is characterized by rugged terrain, consisting of high mountains, hills, plateau, valleys, plains, gorges, and ravines, each of which could easily be typified on the basis of climate, soils and the vegetation communities etc. Unfortunately, none of the classifications are fully comprehensive in the deployment and assessment of the all the-more-basic ecological elements of climate, physiography, soils, vegetation, farming systems, etc. that can better characterize the diverse but still unique agro-ecological zones of the country. Moreover, it is worth noting that the earlier classification systems had the limitations of being a result of weak data bases. It is, therefore, imperative that these earlier classification systems and the present exercise be used with caution and that all possible modifications and improvements be made as and when new data are acquired and analytical systems are developed.
5. METHODOLOGY OF THE PRESENT CLASSIFICATION SYSTEMS

5.1 Data base

The major information input for the present classification system are:

- the revised climatic studies maps (i.e LGP and PET) and reports which were mainly modified on the basis of newly obtained and analysed climatic data;
- the map and legend of the physiopedomorphic study;
- the map and legend of the soil association study;
- maps and legends of thermal zone, rainfall variability, mean annual rainfall, drought probability, and farming system;
- maps and legends of the agricultural productions area specialization studies including forestry and wildlife.

Revision to modify the agro-climatic studies was based upon the review made on the studies done by LUPRD in 1984. In the modification study: actual and updated rainfall, temperature, windspeed, relative humidity, sunshine hours and 4 levels of soil water holding capacity estimates used for this study are 50, 100, 150, and 250mm which were supposed to represent the major soil water holding conditions in Ethiopia. In this study the underestimated values of potential evapotranspiration were in most cases rectified by measures of actual values of climatic elements to reflect actual situations. Hence, values of the moisture available periods were appropriately determined. The moisture available periods expressed in terms of length of growing periods (LGPs) were again statistically treated to determine the mean and median growing periods and the earliest possible planting time within areas of single and double growing periods were specified.

In order to facilitate this activity technical support was secured from FAO through the provision of an agro-climatology consultant.

Moisture and temperature regimes data base and the classification of the physio-pedomorphic regions were the principal information used to calibrate and characterize the major and sub agro-ecological zones. All technical possibilities for generalization and modifications of the information were done by the team.

The rest of the physical information were directly used to characterize the physical conditions of the zones.
5.2 Materials

Materials used for this study include:
- the length of growing period map at a scale of 1:2,000,000
- the thermal zones map at a scale of 1:2,000,000
- the physio-pedomorphic map at a scale of 1:2,000,000
- the soils association map at a scale of 1:2,000,000
- the land use and land cover map at a scale of 1:2,000,000
- the farming systems map at a scale of 1:2,000,000

and a topographic base map at a scale of 1:2,000,000 with their accompanying reports.

The materials were prepared and provided by the LUPRD of the Ministry of Agriculture (MoA) and the National Meteorological Services Agency of the WRDA.

5.3 Methodology

One of the methods applied for identifying, delineating and characterizing the Agroecological zones of the country is reviewing literature in order to learn from the experiences of other countries and pickup useful techniques and approaches which could help assist to standardize the study.

In regard to this the team of experts involved in this activity reviewed relevant documents which they thought are useful.


In Kenya major AEZs were identified by thermal conditions as they relate to altitude. Furthermore, subzones were categorized by five classes of length of growing periods (LGPs) determine at 60 percent probability of occurrences within the major zones. Again the subzones were defined and characterized by different levels of soil fertility.

The second document reviewed was the proceedings on Agroecological Zonation (Rome, 1986). The document being very recent had contained a lot of newly developed experiences from different countries. The document constituted approaches and techniques developed by various International Agricultural Research centers and high level scientists. Some of the chapters constituted information directly related to Agroecological zoning, characterizing and mapping. These were useful information directed views of our work.
Added to that, the team assessed the methodology applied by E. De Pauw, 1987, to classify the Agroecology of Ethiopia. The document contained information which guided efforts of the Technical Team of Experts. Other documents and maps reviewed by the team have also assisted to bridge the knowledge gap of Agroecological zoning. For instance, International Rice Research Institute (IRRS) used moisture, soil and farming systems data to delineate and characterize various AEZs.

Phillipa (1955), Trapnell and Griffiths (1960) used climatic and vegetation data to delineate Agroecological zones in Africa.

In Uganda Langdale Brown, Osmaston and Wilson (1964) mapped ecological zones based on actual and potential of climax vegetation. For the same country, pratt, Greenway, and Gwynne (1966) delineated AEZs based on moisture data and characterized the zones based on climax vegetation and land use.

Panabokke (1979) developed an agroecological zones map for south and southeast Asia based upon rainfall regimes and soil types information. He defined AEZs as "A major area of land that is broadly homogeneous in terms of its rainfall regime and grouping of soils that reflect broad similarities in respect to soil profile development.

Hence, the team has been well equipped to properly delineate, characterize, describe and define the AEZs of Ethiopia.

5.3.1 Conceptual techniques

The present agro-ecological zone classification and characterization system primarily focuses on potential biomass productivity and secondly on species composition and distribution of the plant community of an area or zone.

Biomass productivity is the function of climate, soils and management. However, the major environmental factor or characteristic which influences biomass growth, density and productivity is the availability of moisture which satisfies the areas of evaporation and transpiration requirements, provided that other environmental factors are not limiting.

Community or botanical composition and distribution in space and time is also a function of climate, physiography and edaphic conditions, although, temperature exerts major role to determine the community composition. It is, therefore, very important that the two limiting climatic elements i.e. the number of days in which adequate moisture is available for growth and development of plants and conducive temperature for adaptation of a certain
(botanical) community of plants and animals are given high priority and due considerations.

These were major guiding principles used for the classifications and calibration of the zones. To serve the principle, the moisture availability periods (in days) for the whole of the country was assessed based on long term rainfall data recorded at logically distributed weather stations in the country. The data represent durations from 15 to 30 years or more.

Moisture availability for plant growth was assessed using the water balance model by incorporating the concept of soil water holding capacity representing conditions in Ethiopia. The assessment, however, gave more attention to the length of growing period (LGP) concept which took care of the mean monthly rainfall and mean monthly evapotranspiration relationships. The onset, end and duration of length of growing periods in terms of mean and median values were determined statistically. (De Pauro, E. 1987)

By definition LGP is a continuous period during the year when the precipitation is greater than one half values of the evapotranspiration. A detailed account of the LGP concept is given in the report entitled "The Climatic Resources of Ethiopia, 1989" which is the basic source of information for this work.

The rainfall patterns in Ethiopia are both bimodal and unimodal. In this study, however, due emphasis was also given to the analysis and distribution assessment of these patterns as they have significant impact on crop growth and development of an area. Therefore, a probability assessment model was used to determine the onset, and duration of the growing periods.

For agricultural planning purposes, the concept of dependable growing period was introduced which is defined as minimum period that can be expected in 4 years out of 5 with sufficient moisture for optimal plant growth. After an assessment of the data single, double and no growing period zones were mapped to show the length of growing period pattern types distribution in the country (LGP map_)

5.3.2 Practical techniques

High and low biomass areas occurring during the moisture periods were determined by grouping the single and double growing periods into the following seven logical moisture regime classes.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A growing period of below 45 days</td>
</tr>
<tr>
<td>B</td>
<td>A growing period of 46-60 days</td>
</tr>
<tr>
<td>C</td>
<td>A growing period of 61-120 days</td>
</tr>
</tbody>
</table>
D A growing period of 121-180 days
F A growing period of 181-240 days
E A growing period of 241-300 days
G A growing period of >300 days

Later, LGP units, moisture conditions were transcribed into the following universal terminologies.

A Arid
B Semi-arid
C Sub-moist
D Moist
E Sub-humid
F Humid
G Per-humid

The second data requirement towards characterizing the major agro-ecological zones of the country was the thermal zone classes. This was important as it influences the distribution of the animal population and vegetation communities in a specific zone. Therefore, the six thermal zones (T1, T2, T3, T4, T5, and T6) found to occur in the country were grouped into three major classes by combining T1 and T2, T3 and T4, and T5 and T6, assuming that community variations as a result are very minimum. Then the units were delineated on the thermal zone map as follows.

T1 >27.5°C <500m elevation
T2 27.5°C - 21°C 500m - 1600m elevation
T3 21°C - 16°C 1600m - 2400m elevation
T4 16°C - 11°C 2400m - 3200m elevation
T5 11°C - 7.5°C 3200m - 3800m elevation
T6 <7.5°C >3800m elevation

Again in order to help create a common understanding, the thermal zones were translated into universal terminologies as follows.

T1 Hot
T2 Warm
T3 Tepid
T4 Cool
T5 Cold
T6 Very cold
Finally, the seven generalized moisture availability units map and the three generalized thermal zones were superimposed to help identify the major agro-ecological zones in the country.

The study carried out by combining seven major moisture and three thermal zone units resulted in the identification of the following 18 agro-ecological zones. (Table 2)

Table 2. The combination of the thermal and moisture regime

<table>
<thead>
<tr>
<th>Moisture regimes</th>
<th>Temperature Regimes</th>
<th>Temperature Regimes</th>
<th>Temperature Regimes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hot to Warm (1)</td>
<td>Tepid to cool (2)</td>
<td>cold to very cold (3)</td>
</tr>
<tr>
<td>Arid (A)</td>
<td>A1</td>
<td>A2</td>
<td>No</td>
</tr>
<tr>
<td>Semi-arid (B)</td>
<td>B1</td>
<td>B2</td>
<td>No</td>
</tr>
<tr>
<td>Sub-moist (C)</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
</tr>
<tr>
<td>Moist (D)</td>
<td>D1</td>
<td>D2</td>
<td>D3</td>
</tr>
<tr>
<td>Sub-humid (E)</td>
<td>E1</td>
<td>E2</td>
<td>E3</td>
</tr>
<tr>
<td>Humid (F)</td>
<td>F1</td>
<td>F2</td>
<td>F3</td>
</tr>
<tr>
<td>Per-humid (G)</td>
<td>G1</td>
<td>G2</td>
<td>No</td>
</tr>
</tbody>
</table>

No - does not occur in Ethiopia

As is revealed in the above table, 3 zones out of 21 possibilities do not occur in Ethiopia. These are cold to very cold arid, cold to very cold semi-arid, and cold to very cold per-humid zone.

Subzones were determined by combining the 18 major zones with the following seven physiographic regions identified for this study:

1. Lowland plains
2. Lakes and rift valleys
3. Valleys and escarpments
4. Gorges
5. Mountains and plateau
6. Plateau
7. Mountains

The physiographic regions used for sub-classification of the major agro-ecological zones were delineated on a 1:2,000,000 scale base map. Then by superimposing the seven physiographic regions map with the 18 major agro-ecological zones map, 49 subzones are recognized (Table 3).
Table 3  The possible sub-agroecological zones of Ethiopia
determined by combination of the major zones and
physiographic units

<table>
<thead>
<tr>
<th>Major ZEZ Unit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 A1-1</td>
<td>X</td>
<td>A1-3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>A1-7</td>
<td></td>
</tr>
<tr>
<td>A2 A2-2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>A2-7</td>
</tr>
<tr>
<td>SA1 SA1-1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>SA1-5</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SA2 X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SM1 SM1-1</td>
<td>SM1-2</td>
<td>SM1-2</td>
<td>SM1-4</td>
<td>X</td>
<td>X</td>
<td>SM1-7</td>
<td></td>
</tr>
<tr>
<td>SM2 SM2-1</td>
<td>SM2-2</td>
<td>X</td>
<td>X</td>
<td>SM2-5</td>
<td>X</td>
<td>SM2-7</td>
<td></td>
</tr>
<tr>
<td>SM3 X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>SM3-7</td>
<td></td>
</tr>
<tr>
<td>M1 M1-1</td>
<td>M1-2</td>
<td>M1-3</td>
<td>M1-4</td>
<td>X</td>
<td>X</td>
<td>M1-7</td>
<td></td>
</tr>
<tr>
<td>M2 M2-1</td>
<td>M2-2</td>
<td>X</td>
<td>X</td>
<td>M2-5</td>
<td>M2-6</td>
<td>M2-7</td>
<td></td>
</tr>
<tr>
<td>M3 X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>M3-7</td>
<td></td>
</tr>
<tr>
<td>SH1 SH1-1</td>
<td>SH1-2</td>
<td>X</td>
<td>SH1-4</td>
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<td>X</td>
<td>SH1-7</td>
<td></td>
</tr>
<tr>
<td>SH2 SH2-1</td>
<td>SH2-2</td>
<td>X</td>
<td>X</td>
<td>SH2-6</td>
<td>SH2-7</td>
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<td></td>
</tr>
<tr>
<td>SH3 X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>SH3-7</td>
<td></td>
</tr>
<tr>
<td>H1 H1-1</td>
<td>H1-2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>H1-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2 X</td>
<td>H2-2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>H2-6</td>
<td>H2-7</td>
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</tr>
<tr>
<td>H3 X</td>
<td>X</td>
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<td>H3-7</td>
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<tr>
<td>Ph1 X</td>
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<td>X</td>
<td>X</td>
<td>Ph-5</td>
<td>X</td>
<td>Ph1-7</td>
<td></td>
</tr>
<tr>
<td>Ph2 X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Ph2-7</td>
<td></td>
</tr>
</tbody>
</table>

X - does not exist
The subzones are more homogeneous in terms of moisture available periods, thermal conditions and physiographic characteristic (relief and slope) compared to the major zones.

This being the case, the possibilities of combination among the physiographic regions and the major agro-ecological zones are 126 (Table 3). However, the result was about 40% of the expectation.

Physiographic units were selected to help determine the sub-zones, because relief and slope conditions of a certain area or zone influence the rainfall amount, distribution and the farming system conditions.

The subzones are further characterized by parameters of climate, physiography, elevations, soils, land use and cover farming system crops wildlife and livestock, forestry and a summary of the agricultural potentials and constraints.
6. RESULT AND DISCUSSION

6.1 Major Agroecological Zones

The term based on temperature and moisture regimes classification data delineated 18 major AEZs. The zones are nomenclatured by terms commonly used to describe the broad temperature, moisture and elevation conditions of an area. The zones are the following as they are mapped with relative symbols reflecting the moisture condition of the broad area.

- **A1** Hot to warm arid lowland plains
- **A2** Tepid to cool arid mid highlands
- **SA1** Hot to warm semi-arid lowlands
- **SA2** Tepid to cool semi arid mid highlands
- **SM1** Hot to warm sub moist lowlands
- **SM2** Tepid to cool sub-moist mid highlands
- **SM3** Cold to very cold sub-moist sub-afroalpine to afroalpine
- **M1** Hot to warm moist lowlands
- **M2** Tepid to cool moist mid highlands
- **M3** Cold to very cold moist sub-afroalpine to afroalpine
- **SH1** Hot to warm sub-humid lowlands
- **SH2** Tepid to cool sub-humid mid highlands
- **SH3** Cold to very cold sub-humid sub-afroalpine to afroalpine
- **H1** Hot to warm humid lowlands
- **H2** Tepid to cool humid mid highlands
- **H3** Cold to very cold humid sub-afroalpine to afroalpine
- **Ph1** Hot to warm per-humid lowlands
- **Ph2** Tepid to cool per-humid mid highlands

6.2 Subzones

The study has identified 49 sub agroecological zones within the territory of Ethiopia. Subzones are more homogenous in terms of climate, physiography, soils, vegetation, landuse, farming system and animals. Plants and animals adapted to more homogeneous environment have relatively similar environmental and management requirements. In Ethiopia, the sub agroecological zones of the arid and semiarid agroecological zones are less cultivated than the semi moist, moist, semihumid and humid agroecological zones. This is because they receive less amount of rainfall and the distribution is less dependable.

The arid zones are sub-classified into 5 subzones, while the semiarid zones into 4 subzones. Each subzone reflects unique physical characteristics which determines the kind of plants and animals to occur. Currently, the arid
and semiarid agroecological zones are underutilized, because the environment
is harsh and difficult for life.

The arid zone which is less productive at the present level of technology
occupies about 35.5 million ha (i.e 31.50% of the country). (Table 4). The semi
arid zone which is less harsh (compared to the arid zone) for life occupies about
4.0 million ha (i.e 3.57% of the country).

In Ethiopia, agricultural lands mainly concentrate in sub-moist, moist,
sub-humid and humid agroecological zones. However, high concentration of the
agricultural activities are in these area except the sub-moist zone. The per-
humid zone is suited for perennial crops and forestry.

The agriculturally suitable zones except the sub-moist and the per-humid
zones are relatively suitable for crop cultivation except that they are susceptible
to erosion. They need conservation based development strategies to produce
more at a sustainable level.

The sub-moist agroecological zone which is sub-classified into 10 sub-
zones occupy about 22.2 million hectare (i.e about 19.10% of the country). This
zone is highly threatened by erosion compared to the other zones.

The moist zone which is sub-classified into 11 subzones is the most
important agricultural land of the country. It covers about 28.0 million hectares
(i.e about 24.90% of the country) It is less threatened by erosion compared to
the submoist zone. In this zone cereals are the dominant annual crops.

The sub-humid, humid and the per-humid agroecological zone are the
most stable zones of the country. The sub-humid zone is subdivided into 9
subzones, while, the humid zone into 7 (subzones). These zones cover 17.5
million (i.e about 15% of the country) and 4.4 million hectares (i.e 3.92% of the
country) respectively. They constituted ideal physical conditions for production
of annual and perennial crops. It is in these zones the remaining 27% forest
cover of the country is situated. Moreover, these zones are the zones where the
wildlife and natural plant species of the country are concentrated.

The last zone identified within the country is the per-humid zone which
is mainly situated in the south western part of the country. This zone receives
high amount of rainfall with good and reliable distribution. Perennial crops and
forests are common in this zone. The zone covers about 0.9 million hectares (i.e.
about 0.85% of the country).

Although possible subdivisions are made to narrow down the ecological
variations of the country, it cannot be stated that micro-environmental
variations do not exist within the sub agroecological zones of the country.
However, these variations could be identified when detail study for specific development purposes will be carried out.

Table 4  Area of the Agro-Ecological zones in hectare (ha)

<table>
<thead>
<tr>
<th>No.</th>
<th>Major AEZ Symbol</th>
<th>Sub-AEZ Symbol</th>
<th>Area in hectare</th>
<th>% of the country</th>
</tr>
</thead>
<tbody>
<tr>
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<td>A1-1</td>
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<tr>
<td>2</td>
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<tr>
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</tr>
<tr>
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Table 4 continued

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<th>No.</th>
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<th>Sub-AEZ Symbol</th>
<th>Area in hectare</th>
<th>% of the country</th>
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7. DESCRIPTION OF THE SUB-AEZs

A brief description of each of the sub-zones is as follows

(1) Hot to warm arid plains (A1-1)

This sub-zone refers to hot to warm arid plain of the Afar National Regional State and the Ogaden area of the Somalya National Regional State. Its total area is 33,848,000 ha. The altitude ranges from below sea level to 1200 m.a.s.l. The dominant soil types are Calcisol, Gypisol, Regosol, Vertisol and Fluvisol. The mean annual temperature is greater than 27°C. The mean annual rainfall ranges from 100 to 400mm and the potential evapotranspiration is estimated to be 1700 to 3000mm. It has no growing period from rainfall and irrigation is promptly for crop production.

The entire sub-zone is a bushed grass land except some patches of wooded grassland. Agricultural activity is seen only along Awash and Wabe shebele rivers (state farms). Cotton, maize and sorghum are the dominant annual crops grown. Among perennials are citrus, banana and mango. Livestock rearing (goat, lowland sheep, camel and cattle) is the major land use activity in this sub-zone. Among the wildlife wildass, zebra and ostrich known to exist in this sub-zone (Yangu-Divass park is located in this sub-zone). The dominant tree species identified include Prospis juliflora, Tamarix aphylla, Calatropis procera, Parkinsonia aculeata, Balanites aegyptiaca, Dodonaea, Angustitolae, Bumex neousus, Acacia spp., Combratem molle, and Azadirachta indica. It has a potential for livestock rearing, irrigated agriculture, wildlife and tourism. However, low rainfall, high temperature, infrastructure are the major constraints.

(2) Hot to warm arid valleys and escarpsments (A1-3)

Comprising of 440,000 ha of land, this sub-zone refers to hot to warm arid valley and escarpment located in the Afar Regional State. The altitude ranges from 0 to 1200 m.a.s.l. The dominant soil types are Leptisol, Cambisol and Fluvisols. The mean annual rainfall ranges from 100 to 600mm and the potential evapotranspiration is estimated to be 2000 to 2600mm. The mean annual temperature is more than 28°C. It has no growing period from rainfall unless irrigated.

It is sparsely cultivated (irrigation only) and it is covered by wooded grassland. Maize and sorghum are the major crops grown. Goat, sheep, camel and cattle exist in this sub-zone. Deer, Lion and Leopard are reported also to exist. The dominant tree species include Balanites aegyptiaca, Salix subserata,
Fluegga virosa, Carissa edulis, Rumex nervosus, Tamarindus indica, Uuclea schimperi and Acacia spp.

This sub-zone has a potential for livestock rearing and irrigated agriculture. Low rainfall, high temperature and lack of infrastructure are the major constraints.

(3) Hot to warm arid mountains (A1-7)

This sub-zone is located to the east of Dire Dawa - Aysha Dewelle road in the Somalia National Regional State and in the Dire Dawa Administrative Council.

It is mostly mountainous and covers about 600,000 ha. Its altitude is 1000 - 1400 m.a.s.l. The mean annual temperature is 16 - 21°C and its mean annual rainfall is 300 - 800 mm resulting a growing period below 45 days.

Soil units included are:- Eutric Cambisol, Vertic Cambisol, Eutric Regosol, Lithosol and Orthic Solonchac. Eutric Regosol and Lithosol are common. The fertility of the soil is poor to moderate.

Pastoral farming is exercised with cattle, goat, sheep, camel and donkey farming.

It consists of grassland, bushland and wooland vegetation in which case the lant species are mainly Acacia spp. and Balanities segyptica. Mongoose and Warthog are the major wildlife species indentified in this sub-zone.

Moisture, soil depth, texture, termite and topography are some of the constraints of this sub-zone. Thus, can be used for forestry and wildlife development.

(4) Tepid to cool arid plains (A2 - 1)

It is situated between Kebri Beyah and Artshek which is in the Somalia National Regional State.

The sub-zone has a total area of about 240,000 ha. with an altitudinal range of 1200 - 1600 m.a.s. l. The mean annual temperature of the sub-zone is 16-21°C, that of mean annual rainfall is 500 - 600 mm and hence results in having a growing period of below 45 days.
Soil units included are Rendzina, Chromic Vertisol, Calcic Cambisol and Vertic Cambisol of which Rendzina is the major one. The fertility status is poor to moderate.

Nomadic pastoralism, farming of cattle, goat, sheep and camel are widely practiced besides sorghum is also moderately cultivated.

The vegetation is identified as grassland and shrubland mainly dominated by Acacia spp. and Balanites aegyptica. The wildlife species commonly living in this sub-zone are: Sommerings Gazelle, Aard Wolf, Cheetah, Lion, Duicker, Dikdik, Jacal, Greater Kudu, Lesser Kudu and Gerenuk.

Because of having moisture and termite problem, it can only be used for livestock production.

(5) Tepid to cool arid mountains (A2 - 7)

Sub-zone A2 - 7 includes the area between Jijiga and Kebri Beyah which is in the Somalia National Regional State (SNRS).

It has a total area of about 380,000 ha. and its altitude ranges from 1400m in the lowlands to 2200 m.a.s.l. in the highlands. Thus the mean annual temperature varies from 16 to 21 °C and mean annual rainfall 350 - 800mm. The growing period is below 45 days.

Lithosol, Eurtirc Regosol, Eutric Cambisol, Cambic Arenosol and Eutric Fluvisol are the soil units which characterize this sub-zone. Out of which Lithosol, Eurtirc Regosol and Cambic Arenosol are the major ones. Its fertility status is poor.

Besides pastoral farming sorghum and chat are cultivated in small scale together with farming cattle, goat, sheep and camel. Sommering's Gazelle, Aard Wolf, Cheetah, Lion, Dikdik, Jacal, Gerenuk, Greater Kudu and Lesser Kudu are the main wildlife species found in this bu-zone.

Its vegetation is characterized by grassland, bushland and shrubland mainly dominated by different species of Acacia and Balanites aegyptica.

Moisture and termite are the constraints for future development of the sub-zone. It is of potential for livestocks rearing.
Hot to warm semi-arid plains (SA1-1)

This sub-zone refers to hot to warm semi-arid plains of the Humera area (western Tigray). Its total extent is 720,000ha. The altitude ranges from 500 to 1600 meters above sea level. The mean annual temperature ranges from 21 to greater than 28°C. The mean annual rainfall varies from 300 to 800mm and the estimated potential evapotranspiration ranges from 1900 to 2100mm. This sub-zone has a length of growing period of about 60 days. Vertisols are the dominant soil types of the sub-zone. Fluvisols and Leptisols occur in minor extent.

Hilly area and stony terrains are under wooded grass land and bushed grass land and the flat terrain is under mechanized (to a greater extent) rainfed crop cultivated such as sesame, teff and sorghum. No perennial crop cultivation has been observed. Natural tree species identified include Boswellia papyrifera, Acacia seyal, Acacia Senegal, Acacia nilotica, Zyzyphus spp., Diospyros mesquilliformis, Oxytenanthera abyssinica and Balanites aegyptiaca.

This sub-zone has potential for rainfed (drought resistant crops) agriculture, afforestation and insense harvesting. Low rainfall and infrastructure are the major constraints to agricultural development.

Hot to warm semi-arid lakes and rift valley (SA1-2)

The sub-zone is located north east of Alem Tena, Central part of the country in the Oromia National Regional State.

It has an elevation of 1000 - 2000 m.a.s.l. and covers an area of about 66,000 ha. The mean annual temperature and mean annual rainfall are 16-27.5°C and 650 - 700 mm respectively. The length of the growing period is 46 - 60 days.

Luvic Phaeozem is the major soil unit and others are Mollic Andosol, Lithosol and Eutric Regosol. Luvic Phaeozem is fertile but has the property of fixing potassium. Thus, fertilization is essential to fulfill the plant’s requirement for potassium.

Eventhough pastoralism is the major farming system, teff, sorghum, maize and vegetables as annuals and to some extent papaya and banana as perennials are also cultivated. Cattle, goat, sheep and donkey are the livestocks resource that the subzone has and the common wildlife species identified in this sub-zone are: Bushbuck, Grant’s Gazelle, Tortoise and Hipopotomus.
The vegetation type of which is open grassland and open woodland, it consists of Acacia spp., Balanites aegyptica, Cordia africana and Euphorbia candelabrum.

Provided that constraints like moisture, termite, soil depth and texture, wind erosion, etc are overcome the sub-zone has fertile soil and plain topography which makes it highly suitable for mechanized farming mainly for crop production.

(8) **Hot to warm semi-arid mountains and plateau (SA1-5)**

SA1-5 is ecologically broad and includes areas around Hamerbako which is within the Southern Nationals, Nationalities and Peoples Regional State.

The physiography is plain to plateau with an area of about 2,920,000 ha. and elevation of 400 - 1600 m.a.s.l. it has a mean annual temperature above 21°C, mean annual rainfall of 300 - 700 mm and a growing period 46 - 60 days.

The major soil units are chromic Luvisol and Eutric Cambisol, Lithosol, Vertic Andosol, Gleyic Solonchak, Orthic Solonchak, Eutric Fluvisol, Eutric Regosol and Chromic Vertisol are the other soil units included in the sub-zone. Its fertility status is fertile to very fertile. Nomadic pastoralism is the one which is practiced most. Besides sorghum is cultivated together with cattle, camel, goat and donkey farming.

Due to its vast area and little or no human interference, many wildlife species do exist some of which are: Reticulated Giraffe, Grant’s Gazelle, Oryx, Burchelle’s Zebra, Waterbuck, Elephant, Lion, Duicker, Greater Kudu, Lesser Kudu and Buffalo.

Eventhough moisture is a limiting factor the sub-zone has the potential for livestock production, wildlife protection and mechanized irrigation farming.

(9) **Tepid to cool semi-arid lakes and rift valleys (SA2-2)**

This sub-zone is found in the southern part of rift valley around Bulbula in the Oromia National Regional State. It has an area of about 320,000 ha. in which water body occupy certain part of it. The physiography of it is mostly plain with an elevation of 1600 - 2200 m.a.s.l. and mean annual temperature of 16 - 27.5°C. It has a mean annual rainfall of 600 - 800mm and a growing period of 46 - 60 days.
Vertic Andosol is the major soil unit in terms of area coverage and Lithosol and Eutric Regosol are the other soil units found in the sub-zone. Its fertility status is moderate.

Maize is cultivated besides cattle, goat, donkey and mule farming is also practiced.

Grant's Gazelle, Jacal and Caracal are the only major wildlife species living in this sub-zone.

The vegetation type is of wooded grassland and open woodland consisting mainly of different Acacia species.

Despite having termite problem and moisture deficiency the sub-zone is of potential for crop production and mechanized farming.

(10) Hot to warm sub-moist plains (SM1-1)

This sub-zone refers to hot to warm sub-moist plains in North-western part of the country (particularly around Metema). Its total extent is 7,184,000 ha. The altitude of this sub-zone ranges from 400 to 1400 meters above sea level. The mean annual temperature is higher than 21°C. The mean annual rainfall varies from 200 to 1000mm and the estimated mean annual potential evapotranspiration varies from 1500 to 2200mm. This sub-zone enjoys both double and single growing period (84 days for double and 120 days for single growing period areas). The dominant soil types of the sub-zone are vertisols, Cambisols, Fluvisols, and Leptosols.

Some part of the sub-zone is under rainfed annual crop production such as sesame, cotton and sorghum. The rest of the sub-zone is covered by bushed grass land. The natural tree species identified include Acacia seyal, Acacia senegal, Acacia nilotica, Balanites aegyptiaca, Ziziphus spp, Diospyros mesquitoliformis and Oxytenanthera abyssinica. The livestock population is composed of cattle, goat and donkey. Among the wildlife Lion, Duicker, Anubis Baboon, Leopard, Caracal, Serval Cat and Humadryas Baboon are reported to exist.

This sub-zone has a potential for rainfed and irrigated (though limited) agriculture, afforestation and livestock. The major constraints being low amounts of rainfall, deforestation, malaria and infrastructure.
(11) Hot to warm sub-moist lakes and rift valleys (SM1 - 2)

This sub-zone comprising an area of about 308,000 ha. is identified around Humbo (Southern Peoples Nation and Nationalities Regional State). The physiographic unit is described as lakes and rift valleys with an altitude range of 1000 - 1600m (amsl).

The mean annual rainfall is scanty ranging from 400-800mm and cannot satisfy the potential evapotranspiration demand of 1400 - 1700 mm. This results to a shorter length of growing period of 61 - 120 days and as a result the climate is not so favourable for surplus crop production. The annual temperature is also 21 - 27.5°C. The soil units that dominantly occur in the sub-zone are orthic Acrisol (A0) and eutric Nitosols (Ne). These soils, more specifically the Acrisols are less productive soils and better left for plantation. Other soils that exist in this unit are lithosols (I), mollic Andosols (Tm), dystric Nitosols (Nd), eutric Regosols (Re).

With regard to land use annual crops such as tuber, cotton and sorghum are common. Coffee, Chat, Papaya and Banana are the perennials. Livestock production includes cattle, goat and sheep. From the wildlife animals Crocodile, Grant's Gazelle, Caracal, Klipspringer, Duicker, Anubis Baboon, Leopard, Lion and phython are commonly found in this sub-zone.

Hence, the farming system generally can be classified as:

Cultivation and livestock grazing: The land cover consists of different tree species, such as Olea, Croton, Podocarpus, Cordia, Ficus spp., Balanites, Acacia spp. and Moringa spp.

This sub-zone with its stony, shallow and degraded soils is better left for forestry and wild life. In addition the area is not suitable for settlement because of malaria and other diseases.

(12) Hot to warm sub-moist valleys and escarpments (SM1-3)

This sub-zone refers to hot to warm sub-moist valley and escarpment of the Amhara Regional State. Its total area is 880,000 ha. The altitude varies between 1400 - 2000 m.a.s.l. The dominant soil types are Eutric Fluvisols, Lithosols, Eutric cambisols, Eutric Regosols, Orthic Luvisols and Vertisols. The mean annual rainfall varies from 300 - 1400 mm and the potential evapotranspiration is estimated to be between 1300 - 2600 mm. The dependable growing period is about 3.5 - 5 months.
This sub-zone is intensively cultivated and the cover type is shrub grass land. The farming system of this sub-zone is cereal/livestock. Among the annual crops the dominant are sorghum, maize paper, teff, barley, wheat and irrigated vegetables. Among the perennials coffee and "chat" are dominant. The livestock in this sub-zone includes, cattle, sheep, goat, donkey and camel. The dominant wildlife is monkey. The dominant forest species are the following: Balanties aegyptica, Euphorbia tirucalli, Juniperus procera, Carissa edulis, Olea africana, Dodonea viscosa, Euclea schimperi, Shinus molle, Leucaneae leucocephla, Acacia spp. Eucalyptus globulus.

This sub-zone has potential for rainfed and irrigated agriculture and afforestation. The major constraints are erratic rainfall, deforestation and erosion.

(13) Hot to warm sub-moist river gorges (SM1-4)

This sub-zone refers to hot to warm sub-moist plains and deserted river gorge of the Tigray Regional State. Its total area is 3,300,000 ha. The altitude ranges between 800 - 1000 m.a.s.l. The dominant soil types are Eutric cambisols, Chromic vertisols and Leptosol. The mean annual rainfall varies from 700 - 1000mm and the potential evapotranspiration is estimated to be between 1800 - 1900 mm. The dependable growing period is about 2.5 - 3 months.

This sub-zone is sparsely cultivated and the land cover is wooded grassland. The farming system of this sub-zone is cereal/livestock. Among annual crops the dominant are sorghum, fingermillet, lentils and cheak pea. Among the livestock the dominant are cattle, goat, sheep, camel, donkey and mule. The dominant wildlife include Greater kudu (Tragelophus buxtoni) Duiker (cephalophus spp) and Guinea towe. The dominant forest species are Boswellia papyrifera, Anogissus leiocarpus, Tamarindus indica, Acacia nilotica, Sterculia africana, Combretum molle, Adansonia digitata, Ficus sur, Xlimesta americana, Terminalia brownii, and Sterospermum kunthianum.

This sub-zone has potential in incense harvesting and livestock rearing. Erratic rainfall, erosion and deforestation are the main constraints of this sub-zone. In addition to these problems the population has no direct benefit for the sale of the incense.
(14) Hot to warm sub-moist mountains (SM1 - 7)

SM1 - 7 is the sub-zone south of Babile with an area of about 1,468,000 ha and an elevation of 1400 - 2000 m.a.s.l. The mean annual temperature is above 21°C and mean annual rainfall 150 - 700 mm. LGP 61 - 120 days.

Calcic Xerosol, Eutric Regosol, Lithosol, Eutric Cambisol, Eutric, Regosol, Lithosol, Eutric Fluvisol and Chronic. Luvisol are the soil units of the sub-zone. Out of these, Eutric Regosol, Lithosol and Eutric Cambisol are the main soil units. The soil is poor to moderately fertile.

Sorghum, groundnut, mango and chat are cultivated with animal farming of cattle, goat, sheep and camel.

The common wildlife species identified in this sub-zone are: Elephant, Leopard, Caracal and Duicker.

The vegetation is composed of grassland, bushland, shrubland and forest mainly having Acacia spp., Ficus spp. and Balanites aegyptica.

The sub-zone is degraded with moisture stress, shallow soil, stoniness, etc. It is potential for crop and livestock production.

(15) Tepid to coll sub-moist plains. (SM2-1)

This sub-zone was observed in Assela zone from Dera to Sire. It comprises of about 1,016,000 ha of land. It has an altitude that ranges between 1000 and 2000 m a.m.s.l. with flat to almost flat topography (plain). The mean annual rainfall and the mean annual PET ranges between 500 - 900 and 1400 - 1900 mm respectively. This shows us that shortage of moisture is severe in the sub-zone. The mean annual temperature is about 16 - 21 °C and the length of growing period ranges between 61 and 120 days.

The major soils are lithosols (I) and mollic Andosols (Tm). Lithosols are stony with very shallow depth and very susceptible to water erosion, while the Andosols give good yield in crop production provided phosphorous fertilizer application is very frequently. Other soils inclusive is vertic Cambisols (Bv). The farming system include both crop cultivation and livestock production. The annual crops are mostly wheat, teff, maize and sorghum. The livestock population is composed of cattle, goat, sheep, donkey, horse and mule. Bushpig Duicker and Warthog are the major wildlife species identified for this sub-zone.
The land cover shows different tree species such as; Acacia spp., Balanites, Croton, Ficus spp, Cordia, Euphorbia, etc.

With all the constraints, such as soil depth, surface stoniness, land degradation and moisture stress, the sub-zone has potential for crop production, livestock and forest production but with effective soil conservation measures specially to the degraded parts of the sub-zone.

(16) Tepid to cool sub-moist lakes and rift valleys (SM2 -2)

This sub-zone include areas around Ziway town of the Oromiya National Regional State and comprises an area of about 708,000 ha. of land. The physiography is classified as lakes and rift valleys and its altitude ranges from 1400 - 1800 m.a.s.l. The mean annual precipitation range between 700 and 1200 mm. The mean annual PET (1400 - 1700mm) which is greater than the mean annual precipitation indicates moisture deficiency in this sub-zone. Therefore, the climate which is most of the time explained by mean annual precipitation and mean annual temperature favours only a single season production due to the moisture stress observed in this sub-zone. Hence, the length of growing period is supposed to be in the range of 61 and 120 days.

The major soil unit indentified in the sub-zone is vertic Andosols. This soil, given an adequate supply of moisture is among the most productive soils in the world (high natural fertility). But, high application of phosphate fertilizer is needed to overcome phosphorous fixation by amorphous clay minerals. Other soils that are found in the sub-zone include, luvic Phaeozems (He) and Lithosols (I). Thus, fertility status can be grouped as fairly fertile - fertile.

Both, crop production and animal husbandary are important land uses practiced in the sub-zone. Major annual crops are maize and sorghum; while livestock production include cattle, goat, sheep, donkey and mule. The land cover types are predominantly of Acacia spp., Balanites and Croton.

The wildlife species mainly exhibiting this sub-zone are: Great White Pelican, Flamingo, Hippopotamus, Ostrich, Bushbuck, Duicker and Warthog.

The major potential of the sub-zone could be crop production had it not been for the moisture stress. Wind erosion show pronounced effect toward soil degradation, while termite activities are enormously spread in the sub-zone.
(17) **Tepid to cool sub-moist plains and mountains and plateau (SM2-5)**

This sub-zone refers to cool sub-moist plains and mountains of the Tigray and Amhara Regional States. Its total area is 6,300,000 ha. The altitude varies between 1600 - 2200 m.a.s.l. The dominant soil types are Eutric Cambisols, vertic Luvisols and Vertisols. The mean annual rainfall varies from 700 - 1200 mm and the potential evapotranspiration is estimated to be between 1800 - 1900 mm. The dependable growing period is about 3 - 5.5 months.

This sub-zone is intensively cultivated. The farming system of this sub-zone is cereal/livestock. Among the annual crops the dominant are Teff, Wheat, Sorghum and Pulses. The livestock in this sub-zone include cattle, sheep, goat and donkey. Wildlife species is not observed in this sub-zone. The dominant forest species are the following:- Ficus sur, Ficus vasta, Andonsonia digitata, Anogeissus leiocarpus, Boswellia papyrifera, Diospyrus mespituforms, Tamarindis indica, Sterculia africana, Combretum molle, Dichrostachys cinerea, Lannea truticossa, Calatropis procera, Rumers nervosus.

This sub-zone has potential for rainfed agriculture on the plains and afforestation on mountains area. The constraints of this sub-zone are erosion and deforestation.

(18) **Tepid to cool sub-moist mountains (SM2-7)**

Areas southwest of Bisidimo belong to this sub-zone and covers about 564,000 ha. It has an elevation of 1600 - 2000 m.a.s.l. The mean annual temperature is 16 - 21°C and that of mean annual rainfall 300 - 1000 mm and hence the length of the growing period is 61 - 120 days.

Rendzina is the major soil unit and calcaric Regosol and cambic Avenosol are the other soil units. The soil is poor to moderately fertile.

Sorghum, tobacco, manago and chat are cultivated besides cattle, goat, sheep and donkey farming.

Duicker, Serval Cat and Mongoose are some of the common wildlife species identified in this sub-zone.

The vegetation consists of grassland, bushland, shrubland and woodland mainly inhabited by Acacia spp., Terminalia spp., Erythrina spp., Ficus spp., Balanites segyptica, Cordia africana and Zizyphus spp.
The sub-zone is highly potential for crop, livestock, forestry and wild-life production, provided moisture which is the major constraint of the sub-zone is available. Other problems worth mentioning include soil depth and stoniness.

(21) Hot to warm moist lakes and rift valleys (M1-2)

This sub-zone covers an area of about 116,000 ha. of land and its physiography falls under units of lakes and rift valleys. The altitude ranges between 1000-1600m (amsl) and it is located around Bedeso (between Sodo and Boditi) (Southern People Nation and Nationalities Regional State).

The mean annual PET (1500 - 1600mm) is greater than the mean annual precipitation (700 - 1300mm) and hence deficiency of moisture availability is inevitable. The mean annual temperature varies from 16°C - 27°C and the LGP also varies from 4 months (120 days) - 6 months (180 days).

The major crops crown include annuals such as sorghum, maize and tubers, while enset, coffee, banana, papaya, sugar cane, mango and zeituna are among the perennials. Livestock production of cattle, goat, sheep, donkey, mule and horse is also another major activity in the sub-zone.

The major wildlife species identified in this sub-zone are Crocodile, Grantis Gazelle and Aard Wolf.

The major soil units are eutric Regosol and Lithosols. Other soil units that are found in this sub-zone are eutric Cambisols, dystric Nitosols, eutric Fluvisols, eutric Nitosols and vitric Andosols. The fertility status can be classified as moderately fertile to fertile.

The land cover consists mainly of trees species like Juniperus, Podocarpus, Acacia spp., Moringa, Olea, Croton, Ficus spp. Balanites, Cordia, Celtis, Erythrina.

Generally the sub-zone has potential for crop and forest production, although soil depth, moisture, topography and population density are the major constraints. Therefore, conservation based reforestation shall be practiced to overcome degradation hazard mainly caused by population pressure.

(22) Hot to warm moist valleys and escarpments (M1-3)

Comprising of about 880,000 ha. of land. This sub-zone refers to hot to warm moist valleys and escarpments located in the Amhara National Regional State (in the vicinity of Shewa Robit) and Benshangul-Gumuz Regional State.
Conservation based forestry is essential since the sub-zone is very degraded as witnessed by having shallow soil, moisture stress, exposed stones, etc.

(19) Cold to very cold sub-moist mountains (SM3-7)

This sub-zone refers to cold to very cold sub-moist mountains of the Ahmara Regional State. Its total area is 472,000 ha. The altitude varies between 2800 - 4000 m.a.s.l. The dominant soil types are Haplic phaeozems and Rendzinas. The fertility of the soil is medium. The dependable growing period is about 5 - 7 months.

This sub-zone is intensively cultivated together with some eucalyptus plantation. The farming system of this sub-zone is cereal/livestock. The annual crops in this sub-zone include, barley, horse bean and pea. The livestock include cattle, sheep, horse and donkey. The dominant forest species are the following: Juniperus procera, Erica arborea, Hagenia abyssinica, Hypericum revolutum, Olea africana.

This sub-zone has high potential for afforestation and low potential for agriculture. The major constraints are low temp, soil erosion and deforestation.

(20) Hot to warm moist plains (M1-1)

This sub zone extend from Mega to Moyale. It covers an area of 8,960,000 ha. The altitude varies from 400 - 1800 m.a.s.l. Its physiographic unit is plain with a mean annual rainfall that varies from 250 - 1500mm and a mean annual PET that also vary from 1300 - 1600mm. The mean annual temperature is about 21 - 27.5°C and the length of growing period range between 121 - 180 days. In general the climate is favorable for draught resistance crops. The major soil unit at Moyale is luvic Xerosols (Xl): As it name implies this soils are of dry areas occuring under an aridic moisture regime. Other major soils within the sub-zone include eutric Regosols (Re) and chromic Luvisols (Lc): eutric Fluvisols (Je), Litoisols (I), eutric Cambisols (Be), luvic Phaeozems (He), chromic Vertisols (Vc), pellic Vertisols (Vp) and vitric Andosols (Tv) also occur.

The main farming system is livestock production accompanied by crop production of annuals like maize and sorghum. The animal hasbandary consists of cattle, goat, sheep, camel, donkey, mule and horse. The main tree secies are Acacia spp. Euphorbia and Balanites.

The wildlife species living in abundance in this sub-zone are: Prince Ruspolis Tauraco, White-tailed Swallow, Stresemann’s Bushbuck, Lesser Kudu, Elephant, Bufalo, Eland and Nubian Giraffe.
The altitude ranges from 400 to 1800 meters above sea level. The mean annual temperature varies from 21 to 28°C. The mean annual rainfall varies from 250 to 1200mm and the estimated mean annual potential evapotranspiration varies from 1400 to 2200mm. It has a double growing period of about 180 days (by bridging the two periods). The dominant soil types are Fluvisol, yertisol, Regosol and Leptosol.

The valley units are under intensive crop cultivation (irrigation is also practiced), while the ridges and escarpments are covered by degraded shrub grass land. Both perennial (mango, papaya, banana and citrus) and annual crops (maize, sorghum, teff and vegetables) are adapted in this agro-climate. The livestock population is composed of cattle, sheep, goat, donkey and camel. No wildlife has been observed. The natural tree species identified include Cordia africana, Croton macrostachys, Dodonea angustifolia, Carissa edulis and Acacia spp. Boswellia papyrifera becomes dominant in Benshangul-Gumuz National State (in the vicinity of Gizen and Guba).

This sub-zone has a potential for both rainfed and irrigated agriculture, livestock and afforestation on steep land. The major constraints to agriculture are moisture stress, malaria, erosion and flooding.

(23) Hot to warm moist gorges (M1-4)

This sub-zone refers to warm moist gorge (Abay River Gorge). Its total extent is 3,300,000 ha. The altitude ranges from 1000 to 2000 m.a.s.l. The mean annual temperature varies from 16 to 28°C. The mean annual rainfall varies from 600 to 1600mm and the estimated mean annual potential evapotranspiration varies from 1500 to 2000mm. it has a double growing period of about 120 days (bridging the two periods). The dominant soil types in the area are Leptosol Cambisol and Fluvisol.

The natural vegetation cover has been very much destroyed. Only patches of remnant open wood land and shrubs are left. Gently sloping facets are under intensive crop (only annuals) cultivation such as maize, sorghum and teff. The livestock population consists of cattle, goat and donkey. The natural tree species identified include Prunus africana, Juniperus procera, Olea wethifschii, Ziziphus mucronata, Allophylus abyssinicus, Ramanus pinoides, Dodonna angustifolia, and Acacia spp. In the lower parts of the gorge (Benshangul-Gumuz Region) Boswellia papyrifera and Oxytenathera abyssinica become dominant.

This sub-zone has a potential for afforestation, incense and bamboo harvesting. The major constraints to agriculture are topography, erosion and deforestation.
(24) **Hot to warm moist mountains (M1-7)**

The extent of this sub-zone is about 1,460,000 ha. This sub-zone is found around Chelelektu and comprises of mountainous physiography with varying altitude of 1000 - 2000 m.a.s.l. The mean annual rainfall and mean annual PET varies from 600 - 1600mm and from 1500 - 2000mm respectively. The mean annual temperature ranges between 16 - 27.5°C. The length of growing period is about 121 - 180 days.

Major soil units include orthic Acrisols and eutric Nitosols. Other soils that occur in the sub-zone are pellic Vertisols, eutric Fluvisols, and dystric Cambisols. The fertility is high and give good crop yields, but with good managment practices. The farming system consists of cultivation and animal husbandry. The cultivation is mainly annuals, such as sorghum, maize and tubers. Perennials also grow in the sub-zone and include crops like Enset, Coffee, Banana and Sugar cane. Cattle, Sheep, Goats and donkey are the main livestock members in the unit. Waterbuck, Ducker, Bushbuck and Warthog are the common wildlife species identified in this sub-zone. Moreover, a variety of tree species make up the land cover within the sub-zone. The identified one's being Acacia spp., Croton, Milletia, Albizia Spp., Cordia, Erythrina, Podocarpus, Pygeum, Euphorbia, Combretum, Polystias, Ekebergia, Syzygium, Ficus spp., Celtis and Dracaena.

The sub-zone is potentially suitable for crop and livestock production as well as forestry and wild-life. The major constraints are soil depth, workability and soil drainage.

(25) **Tepid to cool moist plains (M2-1)**

This sub-zone refers to tepid moist plains around lake Tana (particularly Gorgora area). Its total extent is 1,280,000. The altitude ranges from 1000 to 2000 meters above sea level. The mean annual temperature varies from 16°C to 21°C and the estimated mean annual potential evapotranspiration varies from 1400 to 2200mm. This sub-zone has a double growing periods of about 90 to 120 days and 40 to 60 days each. Vertisols, Nitosols and Leptisols are the dominant soil types.

A greater proportion of the sub-zone is under intensive cultivation. Isolated ridges, hills and crucks are covered by open shrub land. The natural tree species identified include Croton macrostachys, Cordia africana, Ficus vasta, Olea africana, Ziziphus mucronata, Maytenus arbutufolia and Acacia spp. Regarding crop production, sorghum, teff, sufflower and cheek pea are major annuals. Among perennials chat, coffee and punica are the dominant ones. No wildlife except hippopotamus (lake Tana) has been reported.
This sub-zone has a high potential for rainfed crop production, livestock and fishery. The major constraints to agriculture are workability of the Vertisols and malaria.

(26) Tepid to cool moist lakes and rift valley (M2-2)

This sub-zone is found between Alaba and Aje in Southern People Nation and Nationalities Regional State. It covers an area of about 320,000 ha of land with an altitude ranging between 1800 - 2200 m.a.s.l.

The physiographic unit given for this sub-zone is lakes and rift valleys from the existing natural features. The unit has a mean annual rainfall of 700 - 1100 mm and a mean annual temperature of about 27.5°C. The mean annual PET is 1400 - 1600 mm and the length of growing period ranges between 121 and 180 days. The dominant soil type is Andosols. This soil has inherent natural fertility but with some limitation. The amorphous clay minerals fix the available phosphorous and high application of phosphate fertilizer is required to overcome the limitation. Both vitric and mollic Andosols make up the soil unit of this sub-zone. Other soil that occur in this unit is Lithosols (shallow soils on hard rock).

The present land use is mostly cultivation of maize and sorghum accompanied by grazing of cattle, goat, sheep, donkey, mule and horse. The forest cover is dominated by Acacia species, although Cordia, Balanites, Croton, Ficuss spp. and Olea are observed. Swayne's Hartebeast is the common wildlife animal living in this sub-zone.

The sub-zone has potential for mechanized crop production provided enough moisture. But at present moisture deficiency is a major constraint. The termite activity besides its positive impact in pedo-turbation may cause root damage and aggravate the wind erosion that prevails in the sub-zone.

(27) Tepid to cool moist mountains and plateau (M2 - 5)

This sub-zone refers to tepid to cool moist plateau and mountains. It is located mainly in Amhara National Regional State. Its total extent is 6,864,000 ha. The altitude ranges from 2000 to 3600 meters above sea level. The mean annual temperature varies from 11 to 16°C. The mean annual rainfall varies from 1000 to 1800mm and the estimated mean annual potential evapotranspiration varies from 1300 to 1850 mm. This sub-zone enjoys both single and double growing period. Areas with single growing period have about 180 days of LGP and those with double growing period have 60 and 100 days of
LGP. The dominant soil types that occur in the sub-zone are Vertisol, Luvisol, Nitosol, Regosol and Leptosol.

A greater proportion of the sub-zone is under intensive crop cultivation. Natural vegetation cover (open woodland) is seen on areas either not suited for crop cultivation or afforested sites. A variety of annual crops are known to grow in this sub-zone. Coffee and Chat (though not extensive) also grow well. Among livestock cattle, sheep, goat, horse, mule and donkey are the most common ones. No wildlife exist in this sub-zone. Natural tree species identified include Croton macrostachys, Cordia africana, Syzygium guineense, Phoenix reclinata, Olea africana, Ficus spp., Erythrina brucei/abyssinica and Acacia spp.

This sub-zone has a high potential for rainfed and irrigated (though limited) agriculture, livestock production and afforestation. The major constraints to agriculture are soil erosion, deforestation and vertisol workability problem.

(28) Tepid to cool moist plateau (M2 - 6)

This sub-zone refers to tepid moist plateau located in the northern part of the country. Its total extent is 376,000 ha. The altitude ranges between 1600 and 1800 meters above sea level. The mean annual temperature varies from 16 to 21°C. The mean annual rainfall varies between 1200 and 1500mm and the estimated mean annual potential evapotranspiration varies from 1800 to 1950. This sub-zone has a single growing period of about 180 days. The dominant soil types that occur in the sub-zone are Leptosols and Acrisols.

A greater proportion of the unit is under intensive crop cultivation (mainly teff, maize and sorghum). Patches of steep lands and crucks are under degraded bush cover. No wildlife has been reported. The livestock population is composed of cattle, goat, sheep and donkey. The natural tree species identified include Cordia africana, Croton macrostachys, Ficus spp., Dodonaea angustifolia and Acacia spp.

This sub-zone has a potential for rainfed agriculture and afforestation. The major constraints to agriculture being soil erosion and deforestation.

(29) Tepid to cool moist mountains (M2-7)

This sub-zone is found at and between Agere Mariam and Yabelo, (Oromiya National Regional state). The area coverage is about 3,780,000 ha. It is physiographically mountainous with an altitude range of 1000-3000m a.s.l. The climate is favourable for crop cultivation and livestock grazing. The mean
annual rainfall varies from 600 - 2200 mm, with mean annual PET ranging between 1300 - 2100 mm. The mean annual temperature also varies from 11°C - 21°C and the length of growing period extends from 121 - 180 days. Accordingly, the present land use is imposed of perennials and annuals accompanied by livestock at subsistence level. The annuals include maize, tubers, barley, wheat, sorghum and pulses. Among the perennials enset, coffee, banana and chat are the major ones. In the case of livestock cattle, sheep, goat, donkey, mule, horse and camel grazing is practiced. The tree species that are commonly found in the sub-zone are: Hygenia, Olea spp., Ficus spp., Croton, Cordia, Milletia, Ekebergia, Erythrina. from the wildlife species Grants Gazelle and Burchell’s Zebra are the common one found in this sub-zone.

The major soils units are orthic Acrisols (Ac) dystric and eutric Cambisols (Bd, Be) followed by dystric Nitosols (Nd). They have fairly high inherent fertility and can be adapted to a variety of systems of land use, more importantly to mixed farming. Despite the rockiness, stoniness and steepness of some of the areas in the sub-zone it has good potential for crop cultivation, livestock, forestry and wildlife production. In Bale zone and around Asossa, the topography fits very much for mechanized farming and has great potential for large scale cultivation. The land cover in Bale include tree species like Arundo, Podocarpus, Syzgium, Celtis, Pygeum, Euphorbia, Polyscias, Apodytes, Schefflera, Accacia spp., Juniperous Albizia, Terminalia, Balanites, Dedonia and Phoenix. In Asassa, there is wind erosion hazard and fire wood scarcity. Hence, energy source is from cow dung. The few planted trees are for construction purposes.

(30) Cold to very cold moist mountains (M3-7)

This sub-zone refers to cold to very cold moist mountains of the Amhara Regional State. Its total area is 724,000 ha. The altitude varies between 2800 - 3200 m.a.s.l. The dominant soil types are haplic Phaeozems and Leptisols. The fertility of the soil is medium. The mean annual rainfall varies from 1000 - 1800mm and the potential evapotranspiration is estimated to be between 1300 - 1800mm. The dependable growing period is about 5 - 7 months.

This sub-zone is intensively cultivated. The farming system of this sub-zone is cereal/livestock. The annual crops in this sub-zone include barley, teff and horse bean. The livestock includes cattle, horse, sheep and donkey. The dominant wildlife are Walia Ibex, Gelada baboon (Papio gelada) Abssinian wolf (Simieria simrisis) Leopard (panthera parfus) Klipoprimeger (Oreotraqu oretragus) Bushbuck (Tragelaphus scriptus) Duiker (cepholophwt spp.) Lamergyes spp.
The dominant forest species are the following:-

Erica arborea, Hypericum revolutum, Hagenia abyssinica, Juniperus procera, Dombeya tonidi, Lobelia rhynchoptalem, Rumex nervosus.

This sub-zone has potential for sheep rearing and afforestation. The major constraints are steep slopes, low temperature erosion and deforestation.

(31) Hot to warm sub-humid plains (SH1-1)

This sub-zone refers to warm sub-humid plains in the Gambela and Benshangul Gumuz National Regional States (boundering Sudan). Its total extent is 4,712,000 ha. The altitude of this sub-zone ranges from 400 to 1000 meters above sea level. The mean annual rainfall varies from 700 in the western part of the sub-zone to 1000mm in the eastern part. The mean annual temperature varies from 16 to 28°C and the potential evapotranspiration is estimated to range from 1400 to 1500mm.

The major soil types occurring in this sub-zone are Vertisols, Fluvisols, Regosols and Leptosols.

The natural vegetation cover is wooded grassland and cultivation is practiced mainly along major rivers such as Baro and Akobo. Cotton, sorghum, maize and rice are the major annual crops cultivated and the perennials are mango and sugarcane. Natural tree species identified in this sub-zone are Ficus spp., Vitex doniona, Anogeissus leiocarpus, Petrocarpus lucens, Terminalia schmpetriaria, Ziziphus spina cristi and others. This sub-zone is well known for its wildlife, such as lion, elephant, buffalo, giraff, leopard, colobus monkey, hippopotamus, crocodile and others.

This sub-zone has a potential for irrigated crop production, forest development and utilization, livestock and wildlife (park). Tsetse fly, malaria and workability of vertisols are the major constraints in this sub-zone.

(32) Hot to warm sub-humid lakes and rift valleys (SH1-2)

This sub-zone is found in the Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPRS), specifically located in the Kambata, Alaba, Tibmbaro Zone, mainly between Alaba Kulito and Shone towns. It comprises of about 56,000 ha. of land. The climatic and edaphic conditions are conducive for the growth and development of many plant and animal species.
The topography being lakes and rift valleys, its altitude is in the range of 1400m to 2000m a.s.l. and the mean annual temperature varies from 18.5°C in the highlands to 22.0°C in lowland areas. The mean annual rainfall of this sub-zone varies from 1000mm to 1400mm and the mean annual PET is in the range of 1400mm to 1500mm, hence, its LGP varies from 181 days to 240 days. The major soil types identified for this sub-zone are: mollic Andosols, eutric Regosols, eutric Fluvisols and Lithosols with moderately fertile to fertile soils.

Cereal cultivation and Enset cultivation are the only two farming systems practiced in this sub-zone. The major annual crops grown are maize, sorghum, teff and tubers and Coffee, Enset, Chat, Banana, Papaya, Sugarcane, Avocado and Mango are the perennial crops grown mostly used as cash crops. In parallel with the crop, livestock production of mainly cattle, goat, sheep, donkey, mule and horse is also undertaken in this sub-zone. Striped Hyena is the only wildlife species commonly seen in this sub-zone.

The present land use/cover types exhibiting this sub-zone are: (a) Cultivated land: state farms and moderately cultivated lands; (b) Riparian woodland or Bushland; (c) Shrubland: dense and open shrubland and (d) water bodies. The major natural tree species identified in this sub-zone are: Acacia spp, Ficus spp, Olea africana, Croton mycrostakis, Podocarpus gracilior, Albizia and Erythrina.

This sub-zone is highly potential mainly for crop production at both small scale peasant farming and large scale mechanized farming. Topography and shallow soil depth are the major constraints to agricultural production identified in this sub-zone. Land degradation is very serious in some parts of this sub-zone, therefore, reforestation and physical conservation should be undertaken in order to rehabilitate the degraded lands.

(33) Hot to warm sub-humid gorges (SH1-4)

This sub-zone is found in both the Oromya National Regional State (ONRS) and the Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPRS), specifically located in the gorges of Gibe, Gojeb and Omo rivers. Because of their hot temperature conditions mainly lowland plant and animal species exhibit in this sub-zone. It comprises of about 984,000 ha. of land.

The topography of this sub-zone being gorge, its altitude ranges from 1000m to 2000m a.s.l. and its mean annual temperature varies from 18.5°C in the highlands to above 25.0°C in the lowland areas. The mean annual rainfall
varies from 1000mm to 2000mm and its PET is in the range of 1350mm to
1450mm, hence its LGP varies from 181 days to 240 days. The major soil types
identified in this sub-zone are mostly Lithosols, eutric Regosols and orthic
Acrisols with poor to fair soil fertility.

Cereal cultivation and shifting cultivation are the main farming systems
practiced in this sub-zone and the major annual crops grown are sorghum,
maize and cotton. Very rare fruit trees such as Banana and Papaya also do
grow as perennials in this sub-zone. Like crop, livestock production of mainly
cattle, goat, sheep, donkey and mule is also undertaken in this sub-zone. The
common wildlife species residing in this sub-zone are: Caracal, Lesser Kudu,
Black Leopard and Swayneis Hartebeast.

The present landuse/cover type of this sub-zone comprises mainly of: (a)
Cultivated Land: intensively, moderately and perennial crop cultivation; (b)
Woodland: dense woodland; (c) High Forest: dense mixed high forest; (d)
Shrubland: dense and open shrublands; and (e) Grassland; open grassland and
bush and shrubbed grassland. The natural tree species exhibiting this sub-zone
are mainly of lowland type such as Cobretum molle, Acacia spp and Ficus spp.

Very shallow soil depth, very steep slope poor soil fertility and
unfavourable climate are the major constraints identified in this sub-zone.
Therefore, this sub-zone is highly potential for forestry (natural) and wildlife
production. Peculiar to this sub-zone are: i) small scale irrigation farming is
undertaken; (ii) frequent forest fire is observed and (iii) charcoal production is
very common.

(34) Hot to warm sub-humid low to mid highlands mountains (SH1-7)

This sub-zone is a vast area, comprising of about 2,644,000 ha. of land
and it is found located in different zones of both Oromya National Regional
State (OMRS) and Southern Ethiopia Nations and Nationalities Peoples
Regional State (SENNPRS). Due to its conducive climatic conditions, it is
favourable for the growth and development of many plant and animal species.

The topography of this sub-zone is mainly mountain with altitude
ranging from 800m to 2200m a.s.l. and its mean annual temperature varies
from 17.5°C in the highlands to 25.5°C in the lowland areas. The mean annual
rainfall of this sub-zone varies from 900mm to 2200mm, while its PET is within
the range of 1300mm to 1700mm, therefore the LGP varies from 181 days to
240 days. The major soil types identified in this sub-zone are: dystric Nitosols,
cambic Arenosols, haplic Phaeozems, orthic Acrisols, Lithosols, eutric Fluvisols
and dystric Cambisols with poor to moderately fertile soils.
Cereal cultivation and Enset cultivation being the major farming systems practiced, in few areas of this sub-zone also nomadic pastoralism is practiced. The major annual crops grown in this sub-zone are: sorghum, maize, wheat, barley and a variety of tubers and the main perennial crops grown are: enset, coffee, chat and a variety of fruit crops such as Banana, Papaya, Mango, Sugarcane and Citrus. Besides crop, livestock production of mainly cattle, goat, sheep, donkey, mule and horse is also under taken in this sub-zone. From the wildlife species, Colobus Monkey and Mountain Nyla are those which are found in abundance in this sub-zone.

The present land use/cover type mainly exhibiting this sub-zone are: (a) Cultivated land: state farms, intensively, moderately and perennial crop cultivation; (b) High forest: dense mixed high forest and disturbed high forest; (c) Woodland: Dense and open woodlands; (d) Bushland: dense bushland and lowland bamboo bushland; (e) Shrublands open shrublands; (f) Grassland: open grassland, bushed shrubbed grassland and wooded grassland; and (g) Swamp and Marsh: perennial swamp. The main natural tree species identified in this sub-zone are: Acacia spp, Ficus spp, Podocarpus gracilior, Phoenix, Cordia africana, Albizia, Croton macrostachys, Erythrina, Arundinaria alpina and combretum molle.

Rugged topography, shallow soil depth, stoniness, rock out-crop being the major constraints identified in this sub-zone, therefore, it is highly potential for forestry and wildlife production. The peculiar things observed in this sub-zone is that most of the area is very degraded and it is not feasible for crop husbandry and settlement. Therefore, if crop and livestock production is to be undertaken it should be on a conservation based development basis.

(35) Tepid to cool sub-humid plains (SH2-1)

This sub-zone refers to tepid sub-humid undulating plains of the western Ethiopia (particularly in Wellega). Its total extent is 260,000 ha. The mean annual rainfall varies from 700 to 1500mm. The altitude ranges from 1000 to 2000 meters above sea level. The mean annual temperature varies from 16 to 21°C. The estimated mean annual potential evapotranspiration varies from 1400 to 1600mm and the length of growing period ranges from 150 to 240 days. Nitosols and Fluvisols are the dominant soil types that occur in this sub-zone.

A greater proportion of the sub-zone is under intensive crop cultivation. Natural vegetation cover (open wood land) is seen only on steep slopes and along streams and cruks. Crops such as teff, maize, sorghum and finger millet are cultivated annually. Among perennials mango, avocado, coffee, chat, banana, citrus and papaya grow well under rainfed condition. Natural tree species identified include Cordia africana, Croton macrostachys, Albizia
gummifera, Ficus spp., Syzygium guineense, and Acacia spp. No wildlife has been reported.

This sub-zone has a potential for rainfed agriculture and afforestation. However, erosion and deforestation should be controlled.

(36) **Tepid to cool sub-humid lakes and rift valleys (SH2-2)**

This sub-zone is found in the middle of the Ethiopian rift valley, specifically located between Butajira and Ziway towns. It comprises of about 440,000 ha. of land. Due to its moderately conducive climatic and edaphic conditions, this sub-zone is favourable for the growth and development of only few plant and animal species.

The topography of this sub-zone being lakes and rift valley, its altitude is in the range of 1400m to 2000m a.s.l. and its mean annual temperature varies from 18.5°C in the highlands to 22.0°C in the lowland areas. The mean annual rainfall varies from 800mm around Ziway area to 1600mm around Butajira area and its PET is in the range of 1300mm to 1700mm, hence, its LGP varies from 181 days to 240 days. The major soil types identified in this sub-zone are: mollic Andesols, eutric Fluvisols, eutric Regosols and haplic Phaeozems which are moderately fertile to fertile soils.

The only farming systems practiced in this sub-zone are cereal cultivation and Enset cultivation with maize, sorghum, teff and wheat as the major annual crops and enset and chat as the major perennial crops. Along with the crop, livestock production of mainly cattle, goat, sheep, donkey and mule is also undertaken in this sub-zone. In this subzone the major wildlife species identified are Aardvark, Klipspringer, Gerenuk and Warthog.

The present landuse/cover type which exhibits in this sub-zone are: (a) Cultivated Land, state farm, intensively and moderately cultivated lands; (b) Grass lands: open grasslands; and (c) Swamp and Marsh perennial swamp. Acacia spp., Cordia africana, Croton mycrostakis, Ficus spp and Euphorbia candelabrum are the only natural tree species identified in this sub-zone.

Moisture stress and termite problem being the major constraints to agricultural production as identified in this sub-zone, it is highly potential to crop production. If moisture stress is overcome in this sub-zone, its flat to gentle sloping terrain makes it very feasible to large scale mechanized farming.
A vast area, comprising of about 1,248,000 ha of land, this sub-zone is found located in different parts of Oromiya National Regional State (ONRS) and in the Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPRS). Its conducive climate and flat to gentle sloping terrain makes it very favourable for the production of cereal crops which supply to almost all over the country.

The topography of this sub-zone being plateau, its altitude is in the range of 2000m to 2800m a.s.l. and its mean annual temperature varies from 13.5°C in the highlands to 18.5°C in the lowland areas. The mean annual rainfall of this sub-zone varies from 900mm to 2000mm and its mean annual PET is in the range of 1300mm to 1600mm, hence, its LGP varies from 181 days to 240 days. Because of its vast area, a variety of soil types are identified in this sub-zone, and these are: orthic Acrisols, pellic Vertisols, Lithosols, vertic Cambisols, chromic Luvisols, chromic yertisols, orthic Luvisols and dystric Cambisols with fair to moderately fertile soils.

The two farming systems prevailing in this sub-zone are: cereal cultivation and Enset cultivation in which case, the major annual crops grown are: sorghum, maize, teff, wheat, barley and a variety of pulses. While the perennial crops dominantly grown are: Enset, Chat and Coffee. Besides crop, livestock production of mainly cattle, sheep, goat, donkey, mule and horse is also undertaken in this sub-zone. Due to its intensity of cultivation, striped Hyena and Civet are the only wildlife species identified.

The present landuse/cover types mainly exhibiting in this sub-zone are:- (a) Cultivated land: intensively and moderately cultivated lands; (b) High forest: dense and open woodlands; (d) Shrubland: open shrubland; (e) Grassland: open grassland and bushed shrubbed grassland; (f) Swamp and Marsh; perennial march; and (g) Water body. The major natural tree species identified in this sub-zone are: Corda africana, Acacia spp, Ficus spp, and Croton myrostachis.

Due to its conducive climate, this sub-zone is highly potential mainly to crop and livestock production and to some extent the hilly terrains in this sub-zone, are highly potential for forest production. Shallow soil depth degraded topography and to some extent workability (drainage) are some of the major constraints observed in this sub-zone. Even if in most parts of this sub-zone there is no fuel wood shortage, in some parts shortage of fuelwood is observed, which is very critical. Dung cakes are used in areas with shortage of wood which instead could have been used as manure in the farm plots.
This sub-zone is very vast, comprising of about 6,664,000 ha. of land and is found located in different zones of Oromya National Regional State (ONRS) and in Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPRS). Its conducive climate and fertile soil makes it favourable for the growth and development of many plant and animal species.

The topography of this sub-zone is mountain with altitude ranging from 1600m to 3200m a.s.l. and its mean annual temperature varies from 11.0°C in the highlands to 21.0°C in the lowland areas. The mean annual rainfall varies from 700mm to 2200mm and mean annual PET is in the range of 1200mm to 1700mm, hence its LGP varies from 181 days to 240 days. The soil types identified in this sub-zone are: dystric Nitosols, orthic Acrisols, Lithosols, dystric Cambisols, pellic Vertisols, haplic Phaeozems, eutric Nitosols, chromic Luvisols, and eutric Cambisols which are fertile to very fertile soils.

In this sub-zone, three farming systems are practiced, cereal cultivation and enset cultivation as the major ones and nomadic pastoralism to some extent. The major annual crops grown in this sub-zone are maize, sorghum, teff, pulses and a variety of tubers, while the major perennial crop grown are Coffee, Chat, Enset, and a variety of fruit trees such as Banana, Papaya, Mango, Citrus and Sugarcane. Along with the crop, livestock production of mainly cattle sheep, goat, donkey, horse and mules is also undertaken. From the wildlife species mountain Nyala, Menelik's Bushbuck, Colobus Monkey and Mountain Reedbuck are the major ones living in this sub-zone.

The present land use/cover type found in this sub-zone are: (a) Cultivated land, state farm, intensively, moderately and perennial crop cultivation; (b) Afro-alpine and sub Afro-alpine vegetation (c) High Forest: dense coniferous high forest and disturbed high forest; (d) Bushland: dense bushland; (f) Shrubland: Dense and open shrubland; (g) Grassland: open grass land, bushed shrubbed grassland, wooded grassland; (h) Swamps and Marshes: perennial swamp and seasonal marsh. The major natural tree species identified in this sub-zone are: Albizia spp., Milletia spp, Podocarpus gracilior, Acacia spp, Croton myochrostakis, Cordia africana, Ekebergia, Juniperus procera, Hygenia, Euphorbia candelabrum Ficus spp and Erythrina.

Due to its favourable climate and soil, this sub-zone is highly potential for crop, livestock, forestry and wildlife production. In some parts of this sub-zone it is potential for mechanized farming. Topography being the major constraint identified in this sub-zone, in some parts shallow soil depth, stoniness and workability (drainage) problem are also observed.
(39) Cold to very cold sub-humid mountains (SH3-7)

This sub-zone is found in both the Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPS) and Oromya National Regional State (ONRS), specifically located in Semien Omo zone, south west of Chencha at mt. Guge and Jima zone, southwest of Omo Nada. It comprises of about 532,000 ha of land. Because of its cold temperature only limited plant and animal species do exist.

The topography of this sub-zone being mountain, its altitude is in the range of 2600m to 4300m a.s.l. and its mean annual temperature varies from less than 7.5°C at the higher peaks to 15.0°C in the lowland areas. The mean annual rainfall of this sub-zone varies from 700mm to 1500mm and its mean annual PET is in the range of 800mm to 1200mm, therefore its LGP varies from 181 days to 240 days. The major soil types observed in this sub-zone are: Humic Cabisols, orthic Acrisols, dystric Nitosols, chromic Vertisols, pellic Vertisols, Lithosols and eutric Regosols.

The only two farming systems practiced in this sub-zone are: Cereal cultivation and Enset cultivation. The major annual crops grown in this sub-zone are: barley, wheat, teff and pulses and enset and chat are the only perennial crops which grow in this sub-zone. In parallel with the crop production, livestock production of mainly cattle, sheep, horse, mule and donkey is also undertaken. Beira Antelope, Colobus Monkey and Klip-springer are the dominant wildlife species exhibiting this sub-zone.

The present landuse/cover type observed in this sub-zone are: (a) Cultivated Land: intensively and moderately cultivated land; (b) Afro alpine and sub Afro-alpine vegetation; (c) High Forest: dense coniferous high forest and dense mixed high forest; (d) Woodland: dense woodland and open woodland; (e) Bushland: dense bushland; (f) Grassland: bushed shrubbed grassland. The mainly identified natural tree species in this subzone are: Juniperus procera, Hygenia abyssinica, Podocarpus gracilior, Olea africana, Erythrina, Euphorbia candelubrum and Ekebergia.

This sub-zone is highly potential for forestry and wildlife production, on the other hand rugged topography, very shallow soil, stoniness, rock out-crop and workability (drainage) problem are the major constraints observed.
(40) Hot to warm humid lowland plains (H1-1)

This sub-zone which comprises of about 48,000 ha of land is found located in the south-western part of the country. Because of its conducive climate, this sub-zone is favourable for the growth and development of most lowland plant and animal species.

The topography of this sub-zone being plain its altitude varies from 600m to 1400m a.s.l. and its mean annual temperature ranges from 22.0°C in the highland areas to 26.0°C in the lowland areas. The mean annual rainfall varies from 1500mm to 2000mm and its mean annual PET from 1500mm to 1550mm hence, its LGP ranges from 241 to 300 days. Dystric Nitosol being the major soil type identified in this sub-zone, orthic Acrisols is also found scattered here and there which have moderate to fertile soils.

Cereal cultivation and shifting cultivation are the only two farming systems practiced in this sub-zone and the major annual crops grown are Sorghum, Maize and a variety of Tubers. While the perennial crops grown are Coffee, Mango and Papaya. Besides crop production livestock production of mainly cattle, goat, sheep and donkey as a means of transportation is also undertaken side by side in this sub-zone. The common wildlife species found in this sub-zone are Leopard, Black Leopard and Giant Forest Hog.

In this sub-zone the present landuse/cover type is mainly restricted to Dense and Open woodland, Lowland Bamboo Bushland and Open and Wooded grassland. The major natural tree species identified are of lowland type such as Acacia spp, Balanites aegyptica, lowland Bamboo, Ficus spp, Cordia africana and Croton mychrostakis.

This sub-zone is highly potential for crop, livestock, forestry and wildlife production at a small scale farming and its major constraints are stoniness, shallow soil depth and topography.

(41) Hot to warm humid lakes and rift valleys (H1-2)

This sub-zone is found in the southern part of the rift valley, specifically located to the south of Lake Chamo on the way from Arba Minch to Konso. It comprises of about 28,000 ha. of land. Because of its conducive climatic and edaphic conditions, this sub zone is favourable for the growth and development of most lowland plant and animal species.

The topography of this sub-zone is low to midland rift valley and its altitude ranges from 1200m to 2000m a.s.l., consequently its mean annual
temperature varies from 18.0°C in the highland area to 23.5°C in the lowland areas. The mean annual rainfall varies from 1200mm to 1500mm and its mean annual PET is in the range of 1525 mm to 1550mm. Accordingly, the LGP of this sub-zone ranges from 241 to 300 days. The major soil types identified in this sub-zone being dystric Nitosols and chromic Vertisols also eutric Regosols and eutric Cambisols are found in association. Generally the soils in this sub-zone are fertile.

Cereal cultivation is the main farming system practiced in this sub-zone, with sorghum and maize as the major annual crops and to some extent cotton, sunflower and a variety of tubers are also grown. Banana and Papaya are the major perennial fruit crops which presently grow in this sub-zone. Along with the crop cultivation, livestock production of mainly cattle, goat, sheep and donkey is also undertaken in this sub-zone. Likewise the wildlife species found in abundance in this sub-zone are: Crocodile, Burchell’s Zebra, Hyrax, Dikdik and Waterbuck.

The present land use/cover type found in this sub-zone are cultivation and open shrubland and the major natural tree species identified are mostly of lowland types such as Acacia spp., Cordia africana, Balanites aegyptica, Ficus spp and Moringa.

Due to its flat to gentle sloping topography and available water resources, this sub-zone is highly potential for mechanized irrigated farming. Because of vertic property of the soil drainage is the major constraint seen in this sub-zone.

(42) Hot to warm humid low to mid highland mountains (H1-7)

This sub-one is found in the south western and southern part of the country, specifically located around Tepi, Jinka Bulki, Basketo and Chelelektu areas. It comprises of about 940,000 ha of land. Due to its conducive climatic and edaphic conditions it is favourable for the growth and development of most plant and animal life forms.

The topography of this sub-zone is mountain with altitude ranging from 800m to 2200m a.s.l. and the mean annual temperature varies from 16.5°C in the highlands and 25.5°C in the lowlands. The mean annual rainfall of this sub-zone ranges from 500mm to 2000mm and its mean annual PET varies from 1350mm to 1,600mm in which case its LGP ranges from 241 to 300 days. Dystric Nitosols being the major soil type identified in this sub-zone, dystric Cambisols, orthic Acrisols, eutric Fluvisols and pellic vertisols are the other type of soils commonly found in association.
Cultivation of cereal and Enset and shifting cultivation are the two major farming systems practiced in this sub-zone. Maize and sorghum being the major annual crops grown in this sub-zone, to some extent finger millet, sunflower and a variety of spices and Tuber do grow. The major perennial crops grown in this sub-zone are Coffee, Enset, Chat and a variety of fruit crops such as, Banana, Papaya, Mango, Citrus and Sugarcane all of which are cash crops. At farm level livestock production of mainly cattle, sheep, goat, donkey, horse and mule is undertaken along with the crop production. Lion, Crocodile, Giant forest Hog, Black Leopard, Caracal and Leopard are the major wildlife species exhibiting this sub-zone.

The present landuse/cover type is very complex in which case the main ones identified are Cultivation, Forests, Woodlands, Bushlands and Grasslands and the major natural tree species identified in this sub-zone are Anyngeria spp, Celtis spp, Olea spp, Polyscia, Scheffera, Acacia spp, Dracaena, Phoneix, Ficus spp, Croton mycrostakisa and Cordia africana.

In most of the area of this sub-zone topography is a major constrait to large scale mechanized agricultural production and the other minor constraints are landslide and drainage. For small scale peasant farming, this subzone is highly potential for crop, livestock, forestry and wildlife production.

The landslide around Bulki is more pronounced and requires immediate protection through reforestation and physical conservation.

The Tepi Coffee Development Project is found in this sub-zone, specifically located near-by the Tepi town.

(43) **Tepid to cool humid lakes and rift valley (H2-2)**

This sub-zone is found in the southern rift valley, specifically located to the east of Goidole town. It is a very small unit comprising of only 28,000 ha of land. This sub-zone has a conducive climate on the other hand edaphycally is not favourable.

The topography of this sub-zone is low to mid highland rift-valley with altitude ranging from 1600m to 2000m a.s.l. and the mean annual temperature varies from 17.5°C in the highland to 21.0°C in the lowland areas. The mean annual rainfall is in the range of 1200mm to 1400mm and its mean annual PET varies from 1550mm to 1600mm, therefore, its LGP is in the range of 241 to 300 days. The major soil types identified in this sub-zone are dystric Nitosols, orthic Acrisols cambic Arenosols and Lithosols with poor to moderately fertile soils.
The prevailing farming system in this sub-zone is cereal cultivation in which case the major annual crops grown are sorghum, maize, cotton and sunflower in the lowland and wheat and barley in the highland. The major perennial crops grown in this sub-zone are sugarcane, banana, papaya and coffee. Along with the crop production also livestock production of mainly cattle, goat, sheep and donkey is also undertaken in this sub-zone. Warthog, Duicker and Serval Cat are some of the common wildlife species found in this sub-zone.

The present land use/cover type found in this sub-zone is a mixture of open shrub land and moderately cultivated land. The natural tree species identified are mainly Cordia africana, Moringa, Balanites aegyptica, Acacia spp, Ficus spp, Croton mycrostakis, Albizia spp, Dracaena and Olea africana.

Topography shallow soil depth and stoniness being the major constraints, therefore, it is potential for reforestation only otherwise, it is potential for crop production if and only if conservation based development is practiced.

(44) Tepid to cool humid plateau (H2-6)

This sub-zone is found located in the surrounding of Addis Ababa city and Shenen town in West Shoa Zone of Oromya National Regional State (ONRS). It comprises of about 64,000 ha. of land and its climatic condition is favourable for the growth of many mid and highland crops.

The topography of this sub-zone being plateau with altitude ranging from 2000m to 3000m a.s.l. and its mean annual temperature varies from 12.5°C in the highland to 18.0°C in the lowland areas. The mean annual rainfall varies from 900mm to 2000mm and its annual PET is in the range of 1300mm to 1500mm, hence its LGP varies from 241 days to 300 days. The major soil types identified in this sub-zone are chromic Luvisols, haplic Phaeozems, pellic vertisols, eutric Cambisols and eutric Regosols with fertile to very fertile soils.

Cereal cultivation is the only farming system undertaken in this sub-zone with teff, wheat, barle and pulses as the major annual crops and to some extent perennial crops such as chat and enset are also grown around homesteads. Besides the crop production livestock production of mainly cattle, sheep, donkey, horses and mules is also undertaken in this sub-zone.

The wildlife species mainly identified in this sub-zone are: Klips pringer, Gelada Baboon, Mountain Reedbuck, Striped Hyena and Civet.

The present landuse/cover type of this sub-zone is mainly cultivation with some open shrubland, open grassland and Eucalyptus woodland and the
major natural tree species identified in this sub-zone are Juniperus procera, Podocarpus gracilior, Olea africana, Acacia spp, Ficus spp and Hygenia.

The flat to gentle sloping areas of this sub-zone are highly potential for crop and livestock production at both small scale peasant farming and large scale mechanized farming and the hilly areas are potential for forestry production. Topography, shallow soil depth and drainage are some of the major constraints identified in this sub-zone. The agricultural land around the Addis Ababa city is expected to reduce in size in the long run due to the expansion of the city.

(45) Tepid to cool humid highland mountains (H2-7)

This sub-zone is very vast comprising of about 2,704,000 ha of land mostly found in Oromya National Regional State (ONRS), specifically located in Bale, Borena and Jimma zones. Due to its conducive climatic and edaphic conditions it is favourable for the growth and development of many plant and animal species.

The topography of this sub-zone is mainly mountains with altitude ranging from 2000m to 3200m a.s.l. and its mean annual temperature varying from 11.0°C in the highlands to 18.0°C in the lowland areas. The mean annual rainfall varies from 700mm to 2200mm and its mean annual PET is in the range of 1200mm to 1700mm, hence its LGP varies from 241 days to 300 days. Because of its vast area, a variety of soil types are identified in this sub-zone mainly, dystric Nitosols, eutric Nitosols, orthic Acrisols, pellic Vertisols, dystric Cambisols, Lithosols, humic Cambisols, haplic Phaeozems and eutric Cambisols which are moderately fertile to fertile soils.

Cereal cultivation and Enset cultivation being the major farming system practiced in this sub-zone, to some extent nomadic Pastoralism is also practiced. Teff, Maize, Sorghum, Wheat, Barley, Flax, Pulses and Tubers are the major annual crops, while Coffee, Chat, Enset, Banana, Papaya, Mango and Sugarcane are the major perennial crops grown in this sub-zone. In parallel with the crop production, livestock production of mainly Cattle, Sheep, Goat, Camels, Donkey, Horse and Mule is also undertaken. Elephant, Defessa Waterbuck, Colobus Monkey Bushpig, Bohor Reedbuck, Serval Cat, Warthog, Anubis Baboon, Leopard, Greater Kudu and Roan Antelope are some of the wildlife species identified in this sub-zone.

The present land use/cover type mostly found in this sub-zone are (a) cultivated lands: state farms, intensively and moderately cultivated land and perennial crop cultivation (b) High forests: dense mixed high forest and disturbed high forest (c) Woodlands: dense woodland; (d) Bushland: dense bushland and lowland bamboo bushland (e) Shrublands: open shrublands (f)
dense bushland. The major natural plant species identified in this sub-zone are: Erica arborea, Hypericum, Jaint Lobelia, Hygenia abyssinca, Juniperus procera and Schefflera spp.

This sub-zone is highly potential for forestry and wildlife production mainly. The major constraints identified in this sub-zone are: cold temperature, rugged topography, shallow soil depth, stoniness, rock out-crop and wind erosion.

(47) Hot to warm per-humid mountains and planteau (Ph1-5)

This sub-zone is found in the south western part of the country, specifically located in southern part of Bench Maji Zone of the SENNPRS. Its total area comprises of about 72,000 ha of land. Like the other per humid areas, this sub-zone is also favourable for the growth and development of any life forms because of its conducive climatic and edaphic conditions.

In particular the topography of this sub-zone being composed of mountains and plateau, its altitude varies from 800m to 1200m a.s.l. and its mean annual temperature ranges from 23.5°C in the highland areas to 25.5°C in the lowland areas. The mean annual rainfall is in the range of 1100mm to 1500mm and the mean annual PET varies from 1300mm to 1450mm, hence, the LGP of this sub-zone is greater than 300 days. The major soil types identified in this sub-zone are eutric Fluvisols and eutric Cambisols which are moderately fertile to fertile soils.

Shifting cultivation being the major farming system practiced in this sub-zone to some extent also cereal and enset cultivation is practiced. The present landuse/cover types commonly found in this sub-zone are disturbed high forest, dense woodland, open wood land and wooded grassland. Besides patches of cultivated lands of annual crops mainly sorghum and maize and perennial crops mainly coffee, chat, enset and a variety of fruit crops are also found in this sub-zone. Parallel to the crop production, livestock and forestry production is also undertaken in this sub-zone. Cattle, goat and sheep being the major livestock type, as a means of transportation donkey is also present in this sub-zone.

The natural tree species grown in the forest areas of this sub-zone are mainly Acacia spp, Balanites aegyptica, Erytrina, Cordia africana, Olea spp, lowland Bamboo, Ficus spp and Croton mychrostakis.

The wildlife species commonly identified in this sub-zone are: Lion, Lepard, Waterbuck, Grantis Gazelle, Lesser kudu, Greater kudu, Bufalo and Duicker.
Grasslands: open grasslands, bushed shrubbed grasslands and wooded grasslands and (g) Swamp and Marsh: Perennial swamp. The major natural tree species identified in this sub-zone are: Acacia spp, Albizia spp, Anyneria, Podocarpus gracilior, Cordia africana, Pygeoum africanum, Croton mycrostatikis, Ficus spp, Hygrnea, Juniperus procera, Olea spp, Phoenix, Euphorbia canolelabrum, Syzygium, Scheflera, Polyscias, Arundinaria alpina, Erica, Hypericum, Allophylus, Fagaropsis, Celtis, Trema, Diospyros and Erythrina.

Most of the area of this sub-zone is highly potential for crop, livestock, forestry and wildlife production at both large and small scale and the major constraints facing this sub-zone are topography, shallow soil depth, stoniness, workability (drainage) and scarcity of fire wood.

(46) Cold to very cold humid highland mountains (H3-7)

Comprising of about 604,000 ha of lands. This sub-zone is mostly found in Oromya National Regional State, Bale and Arsi zones, specifically located in the Bale mountains and a part of it is found in Southern Ethiopia Nations and Nationalities Peoples Regional State (SENNPRS) Gideo zone, specifically located in the Burji mountains. Its cold temperature restricts the growth and development of very few plant and animal species.

The topography of this sub-zone being mostly mountain, its altitude varies from 3000m to 4200m a.s.l. consequently the mean annual temperature is in the range of less than 7.5°C in the highlands to 12.0°C in the lowland areas. The mean annual rainfall varies from 900mm to 1800mm and the mean annual PET is in the range of 800 mm to 1200 mm, therefore, its LGP varies from 241 days to 300 days. The soil type identified in this sub-zone are dystric Nitosols, orthic Acrisols, chromic Luvisols, pellic Vertisols, Lithosols, eutric Regosols and humic Cambisols.

The two major farming systems practiced in this sub-zone are cereal cultivation and Enset cultivation with barley, wheat and pulses as the major annual crops grown and enset as the major perennial crop mainly grown around homesteads. Besides crop, livestock production of mainly cattle, sheep, donkey and horse is also undertaken in this sub-zone. This sub-zone is the habitat of wildlife species such as Simen fox, mountain Nyla, Menelik’s Bush buck, Klipspringer, Caracal, Leopard and Jackal.

The present landuse/cover type mostly found in this sub-zone are (a) Cultivated land: intensively and moderately cultivated lands; (b) Afro-Alpine and sub Afro-Alpine vegetation; (c) High Forest dense mixed high forest and disturbed high forest (d) Woodland: dense and open woodland and (e) Bushland:
Undulating to rolling topography being the major constraint to large scale mechanized farming, while on small scale peasant farming, this sub-zone is highly potential for crop, livestock, forestry and wildlife production.

(48) Hot to warm per-humid mountains (Ph1-7)

This sub-zone is also found in the south western part of the country, specifically with similar location as that of Ph2-7. Comprising of about 416,000 ha of land. Due to its favourable climatic as well as edaphic conditions, this sub-zone enjoys the growth and development of all life forms.

Specifically its physiographic unit being mountaint, the altitude varies from 1000m to 2000m a.s.l. and the mean annual temperature of this sub-zone varies from 17.5 °C at higher altitudes to 25.0 °C at lower altitudes. The mean annual rainfall of this sub-zone varies from 1100mm to 2200mm and its mean annual potential evapotranspiration (PET) from 1300 to 1500mm, accordingly the length of the growing period (LGP) of this sub-zone is greater than 300 days. The major soil types identified in this sub-zone are chromic Luvisols, distric Nitosols, eutric Cambisols, Cambic, Acriosols which are fertile to very fertile soils and orthic Acrisols, eutric Regosols and Lithosols which are less fertile soils.

Cereal and Enset cultivation and shifting cultivation are the major farming systems practiced in this sub-zone. The major land cover types identified in this sub-zone are, cultivation, dense high forest, disturbed high forest, open wood land, lowland bamboo bushland and open grassland. The major annual crops grown are Maize, Sorghum and Tubers and the perennials are Coffee, Chat, Enset mainly used as cash crops and fruit crops such as Banana, Papaya, Mango, Sugarcane and Citrus. Along with the crop production, livestock and forest production is also undertaken in this sub-zone. Cattle, sheep, goat being the major livestock types, donkey, horse and mule are also present to some extent as a means of transportation. Elephant, Defassa Waterbuck, Colubus monkey, Serval cat, Warthog, Bushpig and Leopard are some of the major wildlife species identified in this sub-zone.

Within the forest areas, the major natural tree species identified in this sub-zone are Albizia, Anyngeria spp, Celtis spp, Olea spp, Polyscias, Schefflera, Acacia spp, Dracaena, Phoenix, Ficuss spp, Chroton mycrostakis, and Cordia africana.

On small scale farming, this sub-zone is highly potential for crop, livestock, forestry and wildlife production. Topography and to some extent landslide are the major constraints to agricultural production in this sub-zone.
Comprising of 468,000 ha of land, this sub-zone is found in the south western part of the country specifically located in the Kefacho Shekacho and Bench Maji zones of the Southern Ethiopian Nation and Nationalities Peoples Regional State (SENNPRS). As its name stands, this sub-zone has a very conducive climatic condition in which case it is favourable for the growth and development of any kind of plant and animal species.

He general physiographic unit of this sub-zone is mountain with altitude varying from 1000m to 2800 m.a.s.l. Accordingly the mean annual temperature varies from 13.5°C at higher altitudes to 25.0°C at lower altitudes. The mean annual rainfall varies from 1100mm to 2200mm and the mean annual potential evapotranspiration (PET) from 1350mm to 1500mm, hence, the length of the growing period (LGP) of this sub-zone is above 300 days. Distric Nitosols being the major soil type, orthic Acrisols and chromic Luvisols are the other type of soils commonly found in this sub-zone.

Perennial crop cultivation of mainly Enset, Coffee and a variety of fruit crops such as Banana, Papaya, Mango and Sugarcane and annual crop cultivation of mainly Maize, Sorghum and a variety of Tubers being the major land using activities undertaken, livestock production of cattle, sheep and goat is also practiced side by side.

The wildlife species mainly identified in this sub-zone are: Bufalo, Rhinoceros, De Brazza's Monkey, Greater Kudu, Lesser Kudu, Lion, Leopard, Water buck, Grantis Gazelle and Duicker.

Besides cultivation, the other land cover identified in this sub-zone are: Disturbed high forest, dense high forest, open woodland and wooded grassland and the major natural tree species identified are Erythrina spp, Miletia, Ficus spp, Celtis spp, Cordia africana, Arundinaria alpina, Pygeon african, Croton and Schefflera. The major farming system practiced in this sub-zone are cultivation of cereals and enset and shifting cultivation.

This sub-zone is highly potential for crop, livestock, forestry as well as wildlife production at a small scale farming. Topography is the major constraint of this sub-zone which impeds the use of large scale mechanized farming.
8. CHARACTERIZATION OF AGRO-ECOLOGICAL ZONES OF ETHIOPIA

The sub-zones are characterized by climate, physiography, soils, land/cover type, farming systems etc. in the preceding chapter.

The presently identified, described and defined AEZs reveal the qualities, potential and constraints of the agricultural resources to help plan studies at different levels for specific purposes coped with the zones. They also give several indications for delineating areas requiring resource conservation programs for the agricultural lands, forest areas, degraded lands, areas of tourist attraction and natural vegetation and wildlife areas.

If the development of agriculture is considered (livestock as well as crop production) through either intensification or expansion, AEZs indicate where and what need to be prioritized for detailed evaluation and planning. The physical characteristics of the sub-zones guide to appropriate land use objectives. For example areas with high, low or marginal moisture condition indicate the levels of irrigation requirements, i.e., none supplementary or fully. Thermal and soil conditions of the zones on the other hand, help to identify the crop types, varieties, and/or improved farming system suitable for an area. Moreover, the combined environmental conditions of the zones, i.e., climate, soils and landforms help to evaluate the potential and constraints of the zones for perennials, annuals or livestock production systems. In general, the physical characteristics of the AEZs open up possibilities for detailed studies. They could guide researchers and climatologists as to where to establish research centers and weather stations from which results could be extrapolated to areas with similar resource endowment, not to mention to substantial potentials for use by planners and decision makers at least at the macro level.

The present AEZ classification is largely based on macro-level information and does not accordingly take care of internal variations fully, especially, as they relate to micro-environmental characteristics. Hence precise characterization in terms of elaboration of the farming systems could be accomplished only when detailed studies are carried out in the future.

In fact, as the results of the present exercise are documented at an explanatory level, i.e., 1:2000000, they are meant to indicate areas of high and low levels of agricultural potentials and constraints in general terms. Nevertheless, it is hoped that they would at least help initiate interest in this area for further research work. This document will be useful only when it will be used with the accompanying agro-ecological zones map of Ethiopia (Scale 1:2000000).
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm arid lowland plains
1.1 Mapping Symbol: A1
1.2 Sub Zone: Hot to warm arid plains
1.3 Mapping Symbol: A1-1
1.4 Area (ha): 33,848,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plains
2.2 Altitude (m): below sea level- 1200

2.3 Soil
   a) Type: X, Lc, Zo, Re, Yy, Vc, Xk, E, I, Je
   b) Moisture: AR1, AR2, XR1, XR2
   c) Fertility: low to medium

2.4 Climate
   a) Mean annual rainfall (mm): 100 - 400
   b) Mean annual PET (mm): 1700 - 3000
   c) Mean annual temperature: T1 - T2
   d) LGP: N0, N1, N2
   e) Rainfall variability (%): 20 - 80
   f) Drought probability: 0.4 - 0.9

2.5 Present Land use/cover type: 2.1*, 2.3, 6.0, 8.1, 8.2, 9.1, 9.2, 9.3, 10.1a, 10.1b, 10.2b, 11.1, 11.2, 11.3, 11.4, 7.1

2.6 Farming System: P1

2.7 Crops
   a) Annuals: To, C, M
   b) Perennials:

2.8 Livestock: G, S, Ca, C, D, Li, Vm, Ak

2.9 Wildlife: Wa, Z, Os, Sq, Ch, Or, Zk

2.10 Forestry: A, Ba, F, Ta, Cp, Pk, Rx, Cm

3. Summary of Agricultural potential and constraints
   a) Potential: Irrig. agril, livestock, wildlife and tourism
   b) Constraints: Moisture stress, shallow soil, stoniness, salinity, wind erosion

4. Remark: *Irrigation water supplied from Awash and Wabe-Shebele rivers.
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm arid lowland plains
   1.1 Mapping Symbol: A1
   1.2 Sub Zone: Hot to warm arid valleys and escarpments
   1.3 Mapping Symbol: A1-3
   1.4 Area (ha): 440,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Valley and escarpments
   2.2 Altitude (m): 0 - 1400
   2.3 Soil
      a) Type: Re, I, Tv, Zo, Bv, Jc
      b) Moisture: AR1, XR1, XR2
      c) Fertility: moderate
   2.4 Climate
      a) Mean annual rainfall (mm): 100 - 600
      b) Mean annual PET (mm): 1800 - 2600
      c) Mean annual temperature: T1 - T2
      d) LGP: N2
      e) Rainfall variability (%): 15 - 70
      f) Drought probability: 0.7 - 0.9
   2.5 Present Land use/cover type: 2.3, 8.1, 8.2, 11.1, 11.5
   2.6 Farming System: C2/C29, P1
   2.7 Crops
      a) Annuals: M, W, Ba
      b) Perennials:
   2.8 Livestock: G, S, Ca, C, D
   2.9 Wildlife: Le, Li, Gk, Di
   2.10 Forestry: Ba, S, Ce, Rx, Ti, Es, A

3. Summary of Agricultural potential and constraints
   a) Potential: salt mining, livestock rearing medicinal salts
   b) Constraints: moisture stress, infrastructure

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm arid lowland plains
1.1 Mapping Symbol: A1
1.2 Sub Zone: Hot to warm arid mountain
1.3 Mapping Symbol: A1-7
1.4 Area (ha): 600,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 1000 - 1400

2.3 Soil
   a) Type: Be, Re, I, Zo
   b) Moisture: AR1, XR1, XR3, US1
   c) Fertility: low to medium

2.4 Climate
   a) Mean annual rainfall (mm): 300 - 800
   b) Mean annual PET (mm): 1500 - 2400
   c) Mean annual temperature: T2
   d) LGP: N2, N3, N4
   e) Rainfall variability (%): 35 - 60
   f) Drought probability: 0.3 - 0.8

2.5 Present Land use/cover type: 2.2, 2.3, 5.1, 5.2, 6.0, 7.1, 8.2/2.3, 9.1, 9.2, 9.3, 11.1, 11.4, 11.5.

2.6 Farming System: C9/C30, C41/C39, P1

2.7 Crops
   a) Annuals:
   b) Perennials:

2.8 Livestock: C, G, S, Ca, D

2.9 Wildlife: M, Wa

2.10 Forestry: A, Ba

3. Summary of Agricultural potential and constraints
   a) Potential: forestry and wildlife production
   b) Constraints: moisture stress, termite, shallow soil, topography

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool mid highlands

1.1 Mapping Symbol: A2

1.2 Sub Zone: Tepid to cool arid plain

1.3 Mapping Symbol: A2-1

1.4 Area (ha): 240,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plains

2.2 Altitude (m): 1200 - 1600

2.3 Soil
   a) Type: Bv, Vc, Bk
   b) Moisture: XR2
   c) Fertility: low to medium

2.4 Climate
   a) Mean annual rainfall (mm): 500 - 600
   b) Mean annual PET (mm): 1800 - 2000
   c) Mean annual temperature: T3
   d) LGP: N2
   e) Rainfall variability (%): 20 - 30
   f) Drought probability: 0.6 - 0.7

2.5 Present Land use/cover type: 9.1, 8.1, 2.3, 8.2

2.6 Farming System: P1

2.7 Crops
   a) Annuals: S
   b) Perennials:

2.8 Livestock: C, G, S, Ca, D

2.9 Wildlife: Sg, Aw, Ch, Li, Di, D, J, Gk, Lk, Cr

2.10 Forestry: A, Ba

3. Summary of Agricultural potential and constraints
   a) Potential: livestock production
   b) Constraints: moisture stress, termite

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool arid mid highlands
   1.1 Mapping Symbol: A2
   1.2 Sub Zone: Tepid to cool arid mountains
   1.3 Mapping Symbol: A2-7
   1.4 Area (ha): 380,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 1400 - 2200

2.3 Soil
   a) Type: I, Re, Be, Qc, Je
   b) Moisture: XR1, XR3, US1
   c) Fertility: low to medium

2.4 Climate
   a) Mean annual rainfall (mm): 350 - 800
   b) Mean annual PET (mm): 1800 - 2000
   c) Mean annual temperature: T3
   d) LGP: N2, N4
   e) Rainfall variability (%): 35 - 50
   f) Drought probability: 0.5 - 0.7

2.5 Present Land use/cover type: 7.2/2.3, 2.1*, 9.1, 2.2, 2.3, 8.2, 9., 11.5

2.6 Farming System: P1, C41/C39

2.7 Crops
   a) Annuals: S
   b) Perennials: Ch

2.8 Livestock: C, G, S, Ca, D

2.9 Wildlife: Sq, Aw, Ca, Li, D, J, G, Gk, Lk

2.10 Forestry: A, Ba

3. Summary of Agricultural potential and constraints
   a) Potential: livestock production
   b) Constraints: moisture stress, termite

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE**: Hot to warm semi-arid lowlands

1.1 Mapping Symbol: SAl

1.2 Sub Zone: Hot to warm semi arid plains

1.3 Mapping Symbol: SAl-1

1.4 Area (ha): 720,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Plains

2.2 Altitude (m): 500 - 1600

2.3 Soil
   a) Type: Vc, Lv, Be, Lo
   b) Moisture: XR1, XR2, XR3, US1
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 300 - 800
   b) Mean annual PET (mm): 1900 - 2100
   c) Mean annual temperature: T1 - T2
   d) LGP: S0-2
   e) Rainfall variability (%): 30 - 40
   f) Drought probability: 0.2 - 0.9

2.5 Present Land use/cover type: 2.2, 2.3, 6.0, 8.2, 9.1, 9.2

2.6 Farming System: P1/C10, P1/C11, S4

2.7 Crops
   a) Annuals: Sc, S, T, M
   b) Perennials:

2.8 Livestock: C, G, S, D

2.9 Wildlife: not observed

2.10 Forestry: Bp, Asy, Asg, An, Zse, Da, Ox, Ba

3. **Summary of Agricultural potential and constraints**
   a) Potential: crop production and livestock rearing
   b) Constraints: moisture stress, infrastructure

4. **Remark:**
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm semi-arid lowlands
   1.1 Mapping Symbol: SA1
   1.2 Sub Zone: Hot to warm semi-arid lakes and rift valleys
   1.3 Mapping Symbol: SA1-2
   1.4 Area (ha): 66,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Lakes and rift valleys
2.2 Altitude (m): 1400 - 2000
2.3 Soil
   a) Type: Tm, Hl, I, Re
   b) Moisture: XR3
   c) Fertility: fertile
2.4 Climate
   a) Mean annual rainfall (mm): 650 - 700
   b) Mean annual PET (mm): 1650 - 1750
   c) Mean annual temperature: T2 - T3
   d) LGP: S0-3
   e) Rainfall variability (%): 25 - 30
   f) Drought probability: 0.5
2.5 Present Land use/cover type: 2.2, 9.1/2.3, 5.2
2.6 Farming System: C5, C22, P1
2.7 Crops
   a) Annuals: T, S, M, V
   b) Perennials: Pa, B,
2.8 Livestock: C, G, S, D
2.9 Wildlife: Bb, Gg, To, Hi
2.10 Forestry: A, Ba, Cor, Epc

3. Summary of Agricultural potential and constraints
   a) Potential: mechanized farming
   b) Constraints: moisture, soil depth, termite, stoniness, wind erosion

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm semi-arid lowlands
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm semi-arid lowlands
1.1 Mapping Symbol: SAl
1.2 Sub Zone: Hot to warm arid lowlands and plateau remnants
1.3 Mapping Symbol: SAl-5
1.4 Area (ha): 2,920,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountains and plateau
2.2 Altitude (m): 400 - 1600

2.3 Soil
   a) Type: I, Tv, Zg, Zo, Je, Re, Lc, Be, Vc
   b) Moisture: AR2, XR1, XR2, XR3
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 300 - 500
   b) Mean annual PET (mm): 1600 - 1700
   c) Mean annual temperature: T1 - T2
   d) LGP: N2, N4
   e) Rainfall variability (%): 40 - 50
   f) Drought probability: 0.4 - 0.5

2.5 Present Land use/cover type: 2.3, 5.1, 5.2, 6.0, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 9.3, 10.1a, 11.1, 11.2, 11.3, 11.4, 11.5

2.6 Farming System: C9/C30, P1, P3

2.7 Crops
   a) Annuals: S, M, C, Sun
   b) Perennials:

2.8 Livestock: C, G, D

2.9 Wildlife: Wb, Gk, Lk, Gg, Bz, E, Li, Di, B, Or

2.10 Forestry: A, Ba, Cm, C, Tb

3. Summary of Agricultural potential and constraints
   a) Potential: livestock and wildlife production, mechanized farming
   b) Constraints: moisture, termite

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool semi-arid mid highalnds
   1.1 Mapping Symbol: SA2
   1.2 Sub Zone: Tepid to cool semi-arid lakes and rift valleys
   1.3 Mapping Symbol: SA2-2
   1.4 Area (ha): 320,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Lakes and rift valleys
   2.2 Altitude (m): 1600 - 2200
   2.3 Soil
      a) Type: I, Re, Tv
      b) Moisture: XR3, US1
      c) Fertility: moderately fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 600 - 800
      b) Mean annual PET (mm): 1500 - 1700
      c) Mean annual temperature: T2 - T3
      d) LGP: S0-3
      e) Rainfall variability (%): 20 - 40
      f) Drought probability: 0.5
   2.5 Present Land use/cover type: 2.3, 5.2, 9.3, 10.2a, 11.3
   2.6 Farming System: C5
   2.7 Crops
      a) Annuals: M
      b) Perennials:
   2.8 Livestock: C, G, S, D, M
   2.9 Wildlife: Gg, J, C
   2.10 Forestry: A, Ba

3. Summary of Agricultural potential and constraints
   a) Potential: crop production
   b) Constraints: very low moisture, termite

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-moist lowlands
1.1 Mapping Symbol: SM1
1.2 Sub Zone: Hot to warm sub-moist lowland plains
1.3 Mapping Symbol: SM1-1
1.4 Area (ha): 7,184,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plains
2.2 Altitude (m): 400 - 1400

2.3 Soil
   a) Type: I, Yy, Bk, Bv, Bc, E, Ne, Nd, Bh
   b) Moisture: AR2, XR1, XR2, XR3, US1, US2
   c) Fertility: moderately fertile to fertile

2.4 Climate
   a) Mean annual rainfall (mm): 200 - 1000
   b) Mean annual PET (mm): 1500 - 2200
   c) Mean annual temperature: T1 - T2
   d) LGP: D3-2, D3-3, S1-6, S1-8, S1-9
   e) Rainfall variability (%): 20 - 45
   f) Drought probability: 0.3 - 0.5

2.5 Present Land use/cover type: 2.2, 2.3, 6.0, 7.1, 8.1, 8.2, 9.1, 9.2, 9.3, 9.1/9.2, 10.1a, 11.1, 11.4

2.6 Farming System: C6, C22, S4, P1, P2

2.7 Crops
   a) Annuals: Sc, C, S
   b) Perennials:

2.8 Livestock: C, G, D

2.9 Wildlife: not observed

2.10 Forestry: Acy, Acg, An, Zsc, Da, Ox, Ba

3. Summary of Agricultural potential and constraints
   a) Potential: rainfed agriculture, livestock development
   b) Constraints: low rainfall, malaria and infrastructure problems

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE:** Hot to warm sub-moist lowlands
   1.1 **Mapping Symbol:** SM1
   1.2 **Sub Zone:** Hot to warm sub-moist lakes and rift valleys
   1.3 **Mapping Symbol:** SM1-2
   1.4 **Area (ha):** 308,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 **Physoigraphy:** Lakes and rift valleys
2.2 **Altitude (m):** 1000 - 1600

2.3 **Soil**
   a) **Type:** I, Tm, H1, Nd, Ne, Re, Ao
   b) **Moisture:** XR3, US1, US2
   c) **Fertility:** fairly to moderately fertile

2.4 **Climate**
   a) **Mean annual rainfall (mm):** 400 - 800
   b) **Mean annual PET (mm):** 1400 - 1700
   c) **Mean annual temperature:** T2
   d) **LGP:** S1-9, S0-4
   e) **Rainfall variability (%):** 25-50
   f) **Drought probability:** 0.4 - 0.5

2.5 **Present Land use/cover type:** 2.1, 2.2, 2.3, 2.4, 7.1, 9.2, 10.1a, 12.0

2.6 **Farming System:** C5/C20, C6/C35, C22

2.7 **Crops**
   a) **Annuals:** S, C, Tu
   b) **Perennials:** Co, Ch, Pa, B

2.8 **Livestock:** C, G, S

2.9 **Wildlife:** C, Ks, Di, Ab, Le, Li, Py

2.10 **Forestry:** Ola, C, Po, Cov, F, Ba, A, Mo

3. **Summary of Agricultural potential and constraints**
   a) **Potential:** forestry and wildlife production
   b) **Constraints:** stoniness, shallow soil, malaria problem

4. **Remark:** degradation is very severe
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-moist lowlands
   1.1 Mapping Symbol: SM1
   1.2 Sub Zone: Hot to warm sub-moist valley and escarpments
   1.3 Mapping Symbol: SM1-3
   1.4 Area (ha): 880,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physiography: Valley and escarpments
   2.2 Altitude (m): 400 - 2000
   2.3 Soil
      a) Type: Je, I, Be, Xh, Bv, Re, Bc, Lo, Lv, Ao, Qc
      b) Moisture: US, UD
      c) Fertility: very fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 300 - 1400
      b) Mean annual PET (mm): 1300 - 2600
      c) Mean annual temperature: T1 - T2
      d) LGP: S1-1, S1-2, S0-1, S1-8
      e) Rainfall variability (%): 15 - 70
      f) Drought probability: 0.2 - 0.9
   2.5 Present Land use/cover type: 2.2, 2.3, 2.3/7.2, 7.1, 8.1, 8.2, 8.3/2.3, 9.2, 9.3, 11.1, 11.2, 11.3, 11.5
   2.6 Farming System: C2, C13/C34, C22, C28, C29, C27/C49, C12/33, C2/C29, C3, P1
   2.7 Crops
      a) Annuals: S, M, T, Pap, Ba, W, V
      b) Perennials: Ch, Co
   2.8 Livestock: G, S, C, Ca, D
   2.9 Wildlife: Vm, Hy
   2.10 Forestry: Ba, Jp, Ola, Ept, Ce, Dv, es, A

3. Summary of Agricultural potential and constraints
   a) Potential: rainfed and irrig. agriculture, afforestation
   b) Constraints: erratic and low rainfall, deforestation, erosion

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-moist lowland
   1.1 Mapping Symbol: SM1
   1.2 Sub Zone: Hot to warm sub-most river gorges
   1.3 Mapping Symbol: SM1-4
   1.4 Area (ha): 3,300,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Gorges
   2.2 Altitude (m): 800 - 1000
   2.3 Soil
      a) Type: Be, Lv, Ne Le, Ve, Lo, Z
      b) Moisture: XR2, XR3, US1, US2
      c) Fertility: poor
   2.4 Climate
      a) Mean annual rainfall (mm): 700 - 1000
      b) Mean annual PET (mm): 1800-1900
      c) Mean annual temperature: T2
      d) LGP: S1-1, S1-2, S1-6
      e) Rainfall variability (%): 25 - 35
      f) Drought probability: 0.2 - 0.6
   2.5 Present Land use/cover type: 2.2, 2.3, 8.1, 9.1, 9.2, 9.3
   2.6 Farming System: C2, C13/C14, C3, P1
   2.7 Crops
      a) Annuals: S, FM, T, Du
      b) Perennials:
   2.8 Livestock: C, G, S, Ca
   2.9 Wildlife: Gk, Di, Gg, Ks, Fr, Gf
   2.10 Forestry: Bp, An, Cp, Da, Ti, An, St, Cm, Ad, Fs, Dyc, Lf, X

3. Summary of Agricultural potential and constraints
   a) Potential: Incence harvesting, livestock rearing
   b) Constraints: low rainfall, erosion, deforestation.

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE:** Hot to warm sub-moist lowlands
   1.1 Mapping Symbol: SM1
   1.2 Sub Zone: Hot to warm sub-moist mountains
   1.3 Mapping Symbol: SM1-7
   1.4 Area (ha): 1,468,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 1400 - 2000

2.3 Soil
   a) Type: Xk, Re, I, Be, Je, Lc
   b) Moisture: AR1, XR1, XR2, XR3, US1, US2
   c) Fertility: moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 150 - 700
   b) Mean annual PET (mm): 1300 - 2400
   c) Mean annual temperature: T1 - T2
   d) LGP: S1-1, S0-1, S1-17, D3-3, S0-4, D3-2
   e) Rainfall variability (%): 20 - 65
   f) Drought probability: 0.4 - 0.9

2.5 Present Land use/cover type: 2.2, 2.3, 4.3, 7.1, 8.1, 8.2, 9.1, 9.2, 9.3, 10.1a, 11.1, 11.3, 11.5, 2.3/8.2

2.6 Farming System: C1, C3, C7, C6/C35, C6/C38, C2/C29, C13/C34, C41/C39, E2, E4/E17, P1, P1/C10

2.7 Crops
   a) Annuals: S, Gv
   b) Perennials: Ma, Ch

2.8 Livestock: S, Gv

2.9 Wildlife: E, Le, C, Di

2.10 Forestry: A, Ba, F

3. **Summary of Agricultural potential and constraints**
   a) Potential: crop and livestock production
   b) Constraints: moisture stress, shallow soil stoniness, sandy texture

4. **Remark:**
1. **MAJOR AGROECOLOGICAL ZONE**: Tepid to cool sub-moist mid highlands

1.1 Mapping Symbol: SM2
1.2 Sub Zone: Tepid to cool sub-moist plains
1.3 Mapping Symbol: SM2-1
1.4 Area (ha): 1,016,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Plains
2.2 Altitude (m): 1000 - 2000

2.3 Soil
   a) Type: I, Tm, Bv
   b) Moisture: XR2, US1, US2
   c) Fertility: poorly to moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 500 - 900
   b) Mean annual PET (mm): 1400 - 1900
   c) Mean annual temperature: T3
   d) LGP: S1-9, D3-3
   e) Rainfall variability (%): 20 - 30
   f) Drought probability: 0.4 - 0.6

2.5 Present Land use/cover type: 2.2, 4.3, 7.1, 8.1, 8.2, 9.1, 9.2

2.6 Farming System: C22, P1, P2

2.7 Crops
   a) Annuals: W, T, M, S
   b) Perennials:

2.8 Livestock: C, G, S, D, H, M

2.9 Wildlife: Bo, Di, Wa

2.10 Forestry: A, Ba, C, F, Cov, Epc

3. **Summary of Agricultural potential and constraints**
   a) Potential: crop, livestock and forest production
   b) Constraints: moisture stress, soil depth, stoniness termite, workability (drainage)

4. **Remark**: highly degraded area, hence needs conservation measures. If moisture stress is overcomed, mechanized farming is feasible.
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub-moist mid-highlands

1.1 Mapping Symbol: SM2
1.2 Sub Zone: Tepid to cool sub-moist lakes and rift valleys
1.3 Mapping Symbol: SM2-2
1.4 Area (ha): 708,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Lakes and rift valleys
2.2 Altitude (m): 1400 - 1800

2.3 Soil
   a) Type: H, Be, I, Tv
   b) Moisture: XR3, US1, US2
   c) Fertility: fairly to moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 700 - 1200
   b) Mean annual PET (mm): 1400 - 1700
   c) Mean annual temperature: T2 - T3
   d) LGP: S1 - 8, S1-9
   e) Rainfall variability (%): 20 - 40
   f) Drought probability: 0.3 - 0.5

2.5 Present Land use/cover type: 2.2, 2.3, 5.1, 5.2, 9.1, 9.1/2.3, 9.3

2.6 Farming System: C22

2.7 Crops
   a) Annuals: M, S
   b) Perennials:

2.8 Livestock: C, G, S, D, M

2.9 Wildlife: Bb, Di, Wa

2.10 Forestry: A, Ba, C

3. Summary of Agricultural potential and constraints
   a) Potential: Crop production
   b) Constraints: Moisture stress, termite is very serious

4. Remark: highly feasible for mechanized farming provided moisture stress is overcomed
   highly susceptible to wind erosion.
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub-moist mid highlands

1.1 Mapping Symbol: SM2
1.2 Sub Zone: Tepid to cool sub-moist mountains and plateau
1.3 Mapping Symbol: SM2 - 5
1.4 Area (ha): 6,300,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: mountains and plateau
2.2 Altitude (m): 1600 - 2200

2.3 Soil
   a) Type: Be, Lv, Vertisols
   b) Moisture: XR2, XR3, US2
   c) Fertility: moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 700 - 1200
   b) Mean annual PET (mm): 1800 - 1900
   c) Mean annual temperature: T2 - T3
   d) LGP: S1-1, S1-2
   e) Rainfall variability (%): 15 - 35
   f) Drought probability: 0.2 - 0.5

2.5 Present Land use/cover type: 2.2, 2.3, 8.1, 9.3

2.6 Farming System: C21, C13/C34, C12/33, C27/C49, P1/C10

2.7 Crops
   a) Annuals: T, W, S, Pu
   b) Perennials:

2.8 Livestock: C, S, G, D

2.9 Wildlife: not common

2.10 Forestry: Forestry: Fs, Fv, An, Bp, Da, Ti, St, Cm, Dye, Lf, Cp, Rx

3. Summary of Agricultural potential and constraints
   a) Potential: rainfed crop production on plains afforestation on mountains
   b) Constraints: erosion, deforestation

4. Remark:
MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub-moist mid highlands

1.1 Mapping Symbol: SM2
1.2 Sub Zone: Tepid to cool sub-moist mountains
1.3 Mapping Symbol: SM2-7
1.4 Area (ha): 564,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 1600 - 2000

2.3 Soil
a) Type: Be, Bv, Lv, I, Re, Ac
b) Moisture: XR1, XR2, XR3, US1, US2
c) Fertility: poor to moderate

2.4 Climate
a) Mean annual rainfall (mm): 300 - 1000
b) Mean annual PET (mm): 1200 - 2000
c) Mean annual temperature: T3
d) LGP: S0-1, S1-1, S1-9, D3-3
e) Rainfall variability (%): 20 - 40
f) Drought probability: 0.2 - 0.7

2.5 Present Land use/cover type: 2.2, 2.3, 2.3/8.2, 8.1, 8.2, 5.2, 7.1, 9.1, 9.2, 11.5

2.6 Farming System: C3, C6/C38, C13/C34, C22, C30, C32, C18, C41/C39, P1/C10, P2.

2.7 Crops
a) Annuals: S, To
b) Perennials: Ma, Ch

2.8 Livestock: C, G, S, D, Ca

2.9 Wildlife: Di, Sc, M

2.10 Forestry: A, Era, To, Ba, Cov, F, Zsc

3. Summary of Agricultural potential and constraints
a) Potential: forestry and wildlife production
b) Constraints: stoniness, topography, soil depth, moisture, termites

4. Remark: Soil and water conservation should be practiced here
1. MAJOR AGROECOLOGICAL ZONE: Cold to very cold sub-moist sub-fro-alpine to afro-alpine
   1.1 Mapping Symbol: SM3
   1.2 Sub Zone: Cold to very cold sub-moist mountain peaks
   1.3 Mapping Symbol: SM3-7
   1.4 Area (ha): 472,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoiography: Mountains
   2.2 Altitude (m): 2800 - 4100
   2.3 Soil
      a) Type: Hh, E
      b) Moisture: XR2, XR3, US1, US2, UD1, UD2
      c) Fertility: medium
   2.4 Climate
      a) Mean annual rainfall (mm): 700 - 1600
      b) Mean annual PET (mm): 1300 - 1800
      c) Mean annual temperature: T4 - T6
      d) LGP: D2a-i, S1-1, S1-2
      e) Rainfall variability (%): 15 - 40
      f) Drought probability: 0.2 - 0.6
   2.5 Present Land use/cover type: 2.2, 2.3, 3.0, 8.2, 9.1
   2.6 Farming System: C18, C27/C49, C42, C47, C48/C52
   2.7 Crops
      a) Annuals: Ba, Pu
      b) Perennials:
   2.8 Livestock: C, S, H, D
   2.9 Wildlife: not observed
   2.10 Forestry: Jp, Er, Hr, Ha, Ola

3. Summary of Agricultural potential and constraints
   a) Potential: afforestation
   b) Constraints: deforestation, soil erosion, low temperature

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm moist lowlands
   1.1 Mapping Symbol: M1
   1.2 Sub Zone: Hot to warm moist plain
   1.3 Mapping Symbol: M1-1
   1.4 Area (ha): 8,960,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plains
2.2 Altitude (m): 400 - 1800
2.3 Soil  
   a) Type: Lc, Je, Vc, Ne, Ao, Lo, Jc, Nd, Bk, Hh, I, Yl, Rc, Vp, Zo, Be, Xi, Ac, Je  
   b) Moisture: AR2, XR1, XR2, XR3, US1, US2, UD1  
   c) Fertility: poor to moderate
2.4 Climate  
   a) Mean annual rainfall (mm): 250 - 1200  
   b) Mean annual PET (mm): 1400 - 220  
   c) Mean annual temperature: T1 - T2  
   d) LGP: D2i/1, D2i-2, D3-1, D3-4, Dli-1, Dli-2, S1-3, S1-4, S1-7  
   e) Rainfall variability (%): 10 - 45  
   f) Drought probability: 0.1 - 0.9
2.5 Present Land use/cover type: 2.2, 2.3, 4.3, 5.1, 6.0, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 9.3, 10.2, 11.1, 11.3, 11.4, 12.0, 2.3/7.1, 8.2/2.3, 9.1/9.2
2.6 Farming System: C2/C17, C4/C36, C6, C6/C35, C17, C22, C25, C27/C49, C41/C39, S4, P1, P2
2.7 Crops  
   a) Annuals: S, M  
   b) Perennials:
2.8 Livestock: C, G, Ca, S, D
2.9 Wildlife: Bb, Bp, Wa, Li, Wb, Gg, Sg, Gk, Lk
2.10 Forestry: A, Ba, Com

3. Summary of Agricultural potential and constraints  
   a) Potential: livestock, forestry and wildlife production  
   b) Constraints: stoniness, shallow soil, moisture stress, termite, salinity.

4. Remark: topographically feasible for crop production if not for the moisture stress.
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm moist lowlands
   1.1 Mapping Symbol: M1
   1.2 Sub Zone: Hot to warm moist lakes and rift valleys
   1.3 Mapping Symbol: M1-2
   1.4 Area (ha): 116,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Lakes and rift valleys
   2.2 Altitude (m): 1000 - 1600
   2.3 Soil
      a) Type: Be, Nd, Re, Je, Ne, I, Tv
      b) Moisture: XR2, US2, UD1, UD2
      c) Fertility: moderately fertile to fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 700 - 1300
      b) Mean annual PET (mm): 1500 - 1600
      c) Mean annual temperature: T2 - T3
      d) LGP: Dli-1, Dli-4, D2a-2, D3-4
      e) Rainfall variability (%): 25 - 40
      f) Drought probability: 0.4 - 0.5
   2.5 Present Land use/cover type: 2.1, 2.3, 6.0, 7.2, 8.2, 9.1/2.3, 12.0
   2.6 Farming System: C6/C35
   2.7 Crops
      a) Annuals: S, M, Tu
      b) Perennials: E, Co, B, Pa, Su, Cg
   2.8 Livestock: C, G, S, D, M, H
   2.9 Wildlife: not observed
   2.10 Forestry: Jp, Po, A, Mo, Olea, C, F, Ba, Cor, Ca, Era

3. Summary of Agricultural potential and constraints
   a) Potential: crop and forestry production
   b) Constraints: shallow soil, topography, population pressure, moisture stress

4. Remark: high population density caused pressure on the land as a result land degradation has became very serious
1. **MAJOR AGROECOLOGICAL ZONE:** Hot to warm moist lowlands
   1.1 **Mapping Symbol:** M1
   1.2 **Sub Zone:** Hot to warm moist valleys and escarpments
   1.3 **Mapping Symbol:** M1-3
   1.4 **Area (ha):** 880,000

2. **CHARACTERISTICS OF THE SUB-ZONE**
   2.1 **Physoigraphy:** valley and escarpments
   2.2 **Altitude (m):** 400 - 1800
   2.3 **Soil**
      a) **Type:** Lo, Vc, Ne, Ao, Nd, Bk, Hh, I, Yy, Rc, Vp, Zo
      b) **Moisture:** AR2, XR1, XR2, XR3, US1, US2, UDI
      c) **Fertility:** high
   2.4 **Climate**
      a) **Mean annual rainfall (mm):** 250 - 1200
      b) **Mean annual PET (mm):** 1400 - 2200
      c) **Mean annual temperature:** T1 - T2
      d) **LGP:** D2i/1, D2i-2, D3-1, D3-4, D1i-1, D1i-2, S1-3, S1-4, S1-7
      e) **Rainfall variability (%):** 10 - 45
      f) **Drought probability:** 0.1 - 0.9
   2.5 **Present Land use/cover type:** 2.2, 2.3, 4.3, 5.1, 6.0, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 9.3, 10.2a, 11.1, 11.3, 11.4, 12.0, 2.3/7.1, 8.2/2.3, 9.1/9.2
   2.6 **Farming System:** C2/C17, C4/C36, C6/C35, C17, C22, C25, C27/C49, C41/C39, S4, P1, P2
   2.7 **Crops**
      a) **Annuals:** M, S, T, V
      b) **Perennials:** Ma, Pa, Ci, B
   2.8 **Livestock:** C, G
   2.9 **Wildlife:** not observed
   2.10 **Forestry:** C, A, Cov, Dv

3. **Summary of Agricultural potential and constraints**
   a) **Potential:** Rainfall and irrigated agriculture, livestock
   b) **Constraints:** moisture stress, malaria, erosion, flooding

4. **Remark:**

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1. MAJOR AGROECOLOGICAL ZONE: Hot to warm moist lowlands
1.1 Mapping Symbol: M1
1.2 Sub Zone: Hot to warm moist gorge
1.3 Mapping Symbol: M1 -4
1.4 Area (ha): 3,300,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Gorge
2.2 Altitude (m): 600 - 1600

2.3 Soil
   a) Type: Nd, Ao, Qc, E, Vp, Je, Bd, Z, Nd, Qc
   b) Moisture: US2, UD1
   c) Fertility: low

2.4 Climate
   a) Mean annual rainfall (mm): 1000 - 1500
   b) Mean annual PET (mm): 1400 - 1800
   c) Mean annual temperature: T1 - T2
   d) LGP: S1 - 4, S1-7
   e) Rainfall variability (%): 15 - 3
   f) Drought probability: 0.1 - 0.3

2.5 Present Land use/cover type: 2.3, 5.2, 6.0, 8.1, 8.2, 9.1, 9.1/9.2, 9.2
2.6 Farming System: C6, C7/C22, S4
2.7 Crops
   a) Annuals: M, S, T
   b) Perennials:

2.8 Livestock: C, G, D

2.9 Wildlife: not observed

2.10 Forestry: Olo, Jp, Zm, Alo, Da, A, Bp, Ox

3. Summary of Agricultural potential and constraints
   a) Potential: afforestation
   b) Constraints: topography, erosion, stoniness, soil depth

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE**: Hot to warm moist lowlands

1.1 Mapping Symbol: M1

1.2 Sub Zone: Hot to warm moist mountain

1.3 Mapping Symbol: M1-7

1.4 Area (ha): 1,460,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Mountains

2.2 Altitude (m): 1000 - 2000

2.3 Soil
   a) Type: Vp, Je, Ao, Bd, Ne, Bh, Be, Vc, Lo, Hh
   b) Moisture: XR2, XR3, US1, US2, UD1, UD2
   c) Fertility: 1,460,000

2.4 Climate
   a) Mean annual rainfall (mm): 600 - 1600
   b) Mean annual PET (mm): 1500 - 2000
   c) Mean annual temperature: T2 - T3
   d) LGP: Dli-1, Dli-2, D2i-2, D3-4, S1-3, S1-7
   e) Rainfall variability (%): 10 - 45
   f) Drought probability: 0.1 - 0.6

2.5 Present Land use/cover type: 2.2, 2.3, 4.2, 4.3, 5.2, 5.2, 6.0, 7.1, 8.1, 8.2, 9.1, 9.2, 9.3, 10.1a

2.6 Farming System: C4/C36, C5/E12, C6, C6/C35, C7, C7/C22, C17, C9/C30, C41/C39, E4/E17, S2, S4, P1

2.7 Crops
   a) Annuals: S, M, T, Tu
   b) Perennials: Co, E, B, Pa, Su, Ch

2.8 Livestock: G, S, C, D, Ca

2.9 Wildlife: Wo, di, B6, Wa

2.10 Forestry: A,C, Mf, As, Cov, Sy, Era, Po, Epc, Cm, Pf, Ek, Pa, Ds, F, Ca, Dv

3. **Summary of Agricultural potential and constraints**
   a) Potential: crop, livestock, forestry and wildlife production
   b) Constraints: topography, workability (drainage) soil depth, soil, erosion, deforestation

4. **Remark:**
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool moist mid highlands

1.1 Mapping Symbol: M2
1.2 Sub Zone: Tepid to cool moist plains
1.3 Mapping Symbol: M2-1
1.4 Area (ha): 1,280,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plain
2.2 Altitude (m): 1000 - 2200

2.3 Soil
   a) Type: Lo, Bh, Ao, Ne, Hh, Vc, Lc, I, Be, Bd, Bk
   b) Moisture: XR2, XR3, US1, US2, UD1, UD2
   c) Fertility:

2.4 Climate
   a) Mean annual rainfall (mm): 500 - 1500
   b) Mean annual PET (mm): 1400 - 2200
   c) Mean annual temperature: T3
   d) LGP: Dli-1, Dli-2, D2i/1, D2i-2, D3-4, S1-3, S1-4
   e) Rainfall variability (%): 15 - 45
   f) Drought probability: 0.2 - 0.6

2.5 Present Land use/cover type: 2.2, 2.3, 2.3/7.2, 7.1, 8.1, 8.2/2.3, 9.1, 9.2, 9.1/9.2, 12.0

2.6 Farming System: C2/C17, C6/C35, C17, C22, C25, C25, C27/C49, C31, S4, P1

2.7 Crops
   a) Annuals: S, T, Suf, Pu
   b) Perennials: Co, Ch, Ci, B, Pa

2.8 Livestock: C, G, Ca, S, D

2.9 Wildlife: Bo, Bp, Sg, Gk, Lk, Gg, Wb, Wa, Li

2.10 Forestry: A, Ba, Tb, C, Epc, Cm, Cov, Fv, Ola, Zm

3. Summary of Agricultural potential and constraints
   a) Potential: rainfed agriculture, livestock, forestry and wildlife production
   b) Constraints: termite, moisture stress, stoniness, workability (drainage) malaria, deforestation

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool moist mid highland
   1.1 Mapping Symbol: M2
   1.2 Sub Zone: Tepid to cool moist lakes and rift valleys
   1.3 Mapping Symbol: M2-2
   1.4 Area (ha): 320,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Lakes and rift valleys
   2.2 Altitude (m): 1800 - 2200
   2.3 Soil
      a) Type: Tm, Tv, I
      b) Moisture: US2
      c) Fertility: fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 700 - 1100
      b) Mean annual PET (mm): 1400 - 1600
      c) Mean annual temperature: T3
      d) LGP: Dli-1, Dli-4, D3-4
      e) Rainfall variability (%): 15 - 35
      f) Drought probability: 0.3 - 0.5
   2.5 Present Land use/cover type: 2.1, 2.2, 2.3, 5.2, 6.0, 7.2, 8.1
   2.6 Farming System: C6/C35
   2.7 Crops
      a) Annuals: M, S
      b) Perennials:
   2.8 Livestock: C, G, S, O, H, M
   2.9 Wildlife: J, Swh
   2.10 Forestry: Forestry: A, Cov, Ba, C, F, Ola

3. Summary of Agricultural potential and constraints
   a) Potential: Crop production
   b) Constraints: moisture stress, nutrient fixation, soil depth, termite, wind erosion.

4. Remark: If moisture stress is overcome, this sub-zone is highly feasible for mechanized farming.
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool moist mid highland
   1.1 Mapping Symbol: M2
   1.2 Sub Zone: Tepid to cool moist mountains and plateau
   1.3 Mapping Symbol: M2-5
   1.4 Area (ha): 6,864,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountains and plateau
2.2 Altitude (m): 1500 - 2700

2.3 Soil
   a) Type: Ac, Lc, Be, I, Re, Tv, Vp, Je, Ne, Z
   b) Moisture: XR2, XR3, US1, US2
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 500 - 1000
   b) Mean annual PET (mm): 1550 - 1650
   c) Mean annual temperature: T3 - T4
   d) LGP: Dli-1, D3-4
   e) Rainfall variability (%): 15 - 25
   f) Drought probability: 0.4 - 0.5

2.5 Present Land use/cover type: 2.3, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 9.3

2.6 Farming System: C4/C36, P1

2.7 Crops
   a) Annuals: S, T, M, PM, Suf, Pu
   b) Perennials: Co, Ch, Ci, B, Pa

2.8 Livestock: C, S, G, H, D, M

2.9 Wildlife: not observed

2.10 Forestry: A, Ba, To, Epc, Dv, C, Cov, Sy, Ph, Olea, Fs, Era

3. Summary of Agricultural potential and constraints
   a) Potential: livestock, protective forestry and wildlife production
   b) Constraints: termite, soil depth, stoniness, moisture stress, topography, land shortage, workability, fuel wood shortage.

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE**: Tepid to cool moist mid highland
   1.1 Mapping Symbol: M2
   1.2 Sub Zone: Tepid to cool moist plateau
   1.3 Mapping Symbol: M2-6
   1.4 Area (ha): 376,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

   2.1 Physoigraphy: Plateau
   2.2 Altitude (m): 1600 - 1800

   2.3 Soil
      - a) Type: Ao
      - b) Moisture: US2, UD1
      - c) Fertility: Low

   2.4 Climate
      - a) Mean annual rainfall (mm): 1200 - 1500
      - b) Mean annual PET (mm): 1800 - 1950
      - c) Mean annual temperature: T3
      - d) LGP: S1-3
      - e) Rainfall variability (%): 25 - 30
      - f) Drought probability: 0.2 - 0.3

   2.5 Present Land use/cover type: 2.3/7.2, 5.1, 8.2/2.3

   2.6 Farming System: C27/C49, P1/C10

   2.7 Crops
      - a) Annuals: M, S, T
      - b) Perennials:

   2.8 Livestock: C, S, G, D

   2.9 Wildlife: not observed

   2.10 Forestry: Cov, C, F, Ov

3. **Summary of Agricultural potential and constraints**
   - a) Potential: rainfed agriculture and afforestation
   - b) Constraints: soil erosion, deforestation

4. **Remark:**
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool moist mid highlands
   1.1 Mapping Symbol: M2
   1.2 Sub Zone: Tepid to cool moist mountains
   1.3 Mapping Symbol: M2-7
   1.4 Area (ha): 3,780,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Mountains
   2.2 Altitude (m): 1000 - 3000
   2.3 Soil
      a) Type: Bd, Ao, Nd, Be, Z
      b) Moisture: US1, US2, UD1, UD2, UD3, AQ
      c) Fertility: fertile to very fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 600 - 2200
      b) Mean annual PET (mm): 1300 - 2100
      c) Mean annual temperature: T3 - T4
      d) LGP: Dli-1, Dli-2, Dli-3, Dli-4, D2i-2, D2i-3, D2i-4, D3-4, m, S1-3, S1-4, S1-16
      e) Rainfall variability (%): 10 - 45
      f) Drought probability: 0.2 - 0.5
   2.5 Present Land use/cover type: 2.1, 2.2, 2.3, 4.1, 4.2, 4.3, 4.3/2.4, 5.2, 6.0, 7.1, 7.2, 8.2, 9.1, 9.2, 9.3, 10.1a
   2.7 Crops
      a) Annuals: M, Tu, Ba, W, S, Pu
      b) Perennials: E, Co, B, Pa, Ch
   2.8 Livestock: C, S, G, D, M, H, Ca
   2.9 Wildlife: Bb, Bp, Gg, Sg, Li, Gk, Lk, Wb
   2.10 Forestry: Ar, Ha, Ola, F, C, Cov, Mf, Ek, Era, Po, Ca, Pa, Sy, Epc, Pf, Ap, Sch, A, Jp, As, Tb, Ba, Dy, Ph

3. Summary of Agricultural potential and constraints
   a) Potential: crop, livestock, forestry and wildlife production
   b) Constraints: to pography, stoniness, termite moisture stress

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE**: cold to very cold moist sub-afro-alpine to afro-alpine

1.1 Mapping Symbol: M3
1.2 Sub Zone: cold to very cold moist mountains
1.3 Mapping Symbol: M3-7
1.4 Area (ha): 724,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Plateau
2.2 Altitude (m): 2800 - 4200

2.3 Soil
   a) Type: Ne, Bh, J, Lc, Hh, I
   b) Moisture: US2, UD1, UD2
   c) Fertility: moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1000 - 1800
   b) Mean annual PET (mm): 1300 - 1800
   c) Mean annual temperature: T4 - T6
   d) LGP: D2a-i, D2i-1, S1-3, S1-4
   e) Rainfall variability (%): (%) 15 - 45
   f) Drought probability: 0.1 - 0.3

2.5 Present Land use/cover type: 2.2, 2.3, 8.1, 8.2, 9.1, 9.2

2.6 Farming System: C16/C41, C25, C27/C49, C42, C43, C46, C47, C48/C52, C51

2.7 Crops
   a) Annuals: B, T, Pu
   b) Perennials:

2.8 Livestock: C, H, S, D, G

2.9 Wildlife: Wi, Gb, Sf

2.10 Forestry: Ha, Jp, Hv, Er

3. **Summary of Agricultural potential and constraints**
   a) Potential: sheep rearing and afforestation, tourism
   b) Constraints: low temperature, erosion, deforestation, topography

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-humid lowland plains

1.1 Mapping Symbol: SH1
1.2 Sub Zone: Hot to warm sub-humid plain
1.3 Mapping Symbol: SH1-1
1.4 Area (ha): 4,712,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plains
2.2 Altitude (m): 200 - 1600

2.3 Soil
   a) Type: Ao, Nd, Vp, Bd, Od, Tm, Re, Ve, Fc, R, Z
   b) Moisture: US2, UD1, UD2, AQ
   c) Fertility: moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1000 - 1800
   b) Mean annual PET (mm): 1400 - 1700
   c) Mean annual temperature: T1 - T2
   d) LGP: S1-5, S1-10, S1-11
   e) Rainfall variability (%): 15 - 50
   f) Drought probability: 0.1 - 0.4

2.5 Present Land use/cover type: 2.2, 2.3, 5.1, 5.2, 8.2, 9.1, 9.2, 9.3/2.3, 9.3/9.2, 9.3, 10.1a, 10.1b, 10.2a

2.6 Farming System: C6, C7, C19/C45, S1, S3/C6, N

2.7 Crops
   a) Annuals: C, S, M, R
   b) Perennials: Ma, Su

2.8 Livestock: C, G, D

2.9 Wildlife: Li, E, B, Ng, Le, Cm, Hi, Cr, Ra, Br, Wek

2.10 Forestry: Fey, Vd, An, Pt, To, Zse, Xa, Sl, Ba, Gl, Sr, Era

3. Summary of Agricultural potential and constraints
   a) Potential: irrigated agriculture, park development, afforestation
   b) Constraints: forest fire, tsetse, malaria, infrastructure

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-humid lowlands

1.1 Mapping Symbol: SH1
1.2 Sub Zone: Hot to warm sub-humid lakes and rift valleys
1.3 Mapping Symbol: SH1-2
1.4 Area (ha): 56,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Lakes and rift valleys
2.2 Altitude (m): 1400 - 2000

2.3 Soil
   a) Type: Tm, Re, Je, D
   b) Moisture: US2, UD1, UD2
   c) Fertility: fertile

2.4 Climate
   a) Mean annual rainfall (mm): 700 - 1400
   b) Mean annual PET (mm): 1400 - 1500
   c) Mean annual temperature: T2 - T3
   d) LGP: S0-4, S1-15, D2a-2
   e) Rainfall variability (%): 20 - 50
   f) Drought probability: 0.3 - 0.5

2.5 Present Land use/cover type: 2.1, 2.3, 6.0, 8.1, 8.2, 12.0

2.6 Farming System: C5/C20, C6/C35

2.7 Crops
   a) Annuals: M, T, Tu, S
   b) Perennials: E, Co, ch, B, Pa, Su, Ma, A

2.8 Livestock: C, G, S, D, M, H

2.9 Wildlife: Bb, Hi, Swh, To, Gwp, Di, Gk, Gg, Fl

2.10 Forestry: A, F, Olea, C, Po, As, Era

3. Summary of Agricultural potential and constraints
   a) Potential: crop production
   b) Constraints: topography, soil depth

4. Remark: in some parts of this sub-zone degradation is very serious.
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-humid lowlands

1.1 Mapping Symbol: SH1
1.2 Sub Zone: Hot to warm sub-humid river gorges
1.3 Mapping Symbol: SH1-4
1.4 Area (ha): 984,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: River gorge
2.2 Altitude (m): 1000 - 1800

2.3 Soil a) Type: Bd, Nd, Vp, Ne, I, Re, Ao, Lc
b) Moisture: US2, UD1
c) Fertility: moderately fertile

2.4 Climate a) Mean annual rainfall (mm): 1000 - 1400
b) Mean annual PET (mm): 1350 - 1600
c) Mean annual temperature: T2 - T3
d) LGP: S1 - 5, S1-1, S1-11
e) Rainfall variability (%): 15 - 30
f) Drought probability: 0.1 - 0.3

2.5 Present Land use/cover type: 2.2, 2.3, 4.3, 5.1, 9.1, 9.2

2.6 Farming System: C6, S4

2.7 Crops a) Annuals: S, M, C, Se, Pap
b) Perennials: Ma, B, Pa, Ci, Ch, Co

2.8 Livestock: C, G

2.9 Wildlife: Py, Li, Le, Wa, Di, Bb

2.10 Forestry: Cm, A, F, Sch, Sk, Vov, Sy, Gf, Ec, Gl, C

3. Summary of Agricultural potential and constraints
a) Potential: rainfed and irrigatd farming, livestock, forestry and wild life production incence and bamboo harvesting.
b) Constraints: tsetse, malaria, infrastructure rugged topography, shallow soil.

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm sub-humid lowlands

1.1 Mapping Symbol: SH1
1.2 Sub Zone: Hot to warm sub-humid mountains
1.3 Mapping Symbol: SH1-7
1.4 Area (ha): 2,644,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 800 - 2000

2.3 Soil
   a) Type: Vp, Nd, Qc, Hh, Ao, I, Je, Bd, Re, Le
   b) Moisture: US2, UD1, UD2, UD3, AQ
   c) Fertility: low to moderate

2.4 Climate
   a) Mean annual rainfall (mm): 900 - 2200
   b) Mean annual PET (mm): 1300 - 1700
   c) Mean annual temperature: T2
   d) LGP: D1a-3, D2a/DS1, D2i-3, S1-5, S1-10, S1-11, S1-15
   e) Rainfall variability (%): 10 - 40
   f) Drought probability: 0.1 - 0.4

2.5 Present Land use/cover type: 2.1, 2.2, 2.3, 2.4, 2.4/4.3, 4.2, 4.3, 5.1, 5.2, 7.1, 7.3, 8.2, 9.2, 9.1, 9.2/2.3, 9.3, 9.2/9.2, 9.3, 10.1a

2.6 Farming System: C6, C7, C16, C20, C21, C22, C5/C12, C8/C24, S3/C6, E2, E6, E11, E1/E5, E4/E17, E10/E19, S1, P2

2.7 Crops
   a) Annuals: S, M, Ba, W, Tu
   b) Perennials: E, B, Pa, Ma, Su, Ci

2.8 Livestock: C, G, M, H, S, D

2.9 Wildlife: Wa, Ab, Bb, Le, Li, Hi, Py, Gk, B

2.10 Forestry: A, F, Po, Cov, Ph, As, C, Era, Ar, Cm, Gb, Da, ti, Si, Sk, Gl, Sl, Pt, Ox, An

3. Summary of Agricultural potential and constraints
   a) Potential: forestry and wildlife production tourism development
   b) Constraints: topography, shallow soil, stoniness, malaria, forest fine.

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub-humid mid highlands
   1.1 Mapping Symbol: SH2
   1.2 Sub Zone: Tepid to cool sub-humid plains
   1.3 Mapping Symbol: SH2-1
   1.4 Area (ha): 260,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoiography: Plain
2.2 Altitude (m): 1000 - 2200
2.3 Soil a) Type: Je, Bd, Nd, Ao,
      b) Moisture: US2, UD1, UD2
      c) Fertility: moderately fertile
2.4 Climate a) Mean annual rainfall (mm): 700 - 1500
      b) Mean annual PET (mm): 1400 - 1600
      c) Mean annual temperature: T3
      d) LGP: D2a/DS4, S1-5, S1-10, S1-11
      e) Rainfall variability (%): 15 - 25
      f) Drought probability: 0.1 - 0.5
2.5 Present Land use/cover type: 2.2, 2.3, 5.1, 8.2, 9.1/9.2, 9.3, 9.3/9.2
2.6 Farming System: C6, C7, C25, C6/C35, C19/C45, C41/C39, N
2.7 Crops a) Annuals: T, M, S, FM
      b) Perennials: Ma, A, Co, Ch, B, Ci
2.8 Livestock: C, S, D, G
2.9 Wildlife: not observed
2.10 Forestry: Cov, C, As, F, Sy, A

3. Summary of Agricultural potential and constraints
   a) Potential: rainfed crop production, afforestation
   b) Constraints: erosion, deforestation

4. Remark: conservation based development should be practiced in the crop land areas.
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<td>C36</td>
<td>C-WD(B,W)</td>
<td>E5</td>
<td>E(C) WD-(M,T)</td>
</tr>
<tr>
<td>C37</td>
<td>C-WD(B,W)</td>
<td>E5</td>
<td>E(C) WD-(M,T)</td>
</tr>
<tr>
<td>C38</td>
<td>C-WD(B,W)</td>
<td>E5</td>
<td>E(C) WD-(M,T)</td>
</tr>
<tr>
<td>C39</td>
<td>C-WD(B,W)</td>
<td>E5</td>
<td>E(C) WD-(M,T)</td>
</tr>
<tr>
<td>C40</td>
<td>C-WD(B,W)</td>
<td>E5</td>
<td>E(C) WD-(M,T)</td>
</tr>
</tbody>
</table>
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub-humid mid highlands
   1.1 Mapping Symbol: SH2
   1.2 Sub Zone: Tepid to cool seb-humid lakes and rift valleys
   1.3 Mapping Symbol: SH2-2
   1.4 Area (ha): 440,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Lakes and rift valleys
2.2 Altitude (m): 1400 - 2000

2.3 Soil
   a) Type: Tm, Ne, je, Re
   b) Moisture: US2, UD1, UD2
   c) Fertility: moderately fertile to fertile

2.4 Climate
   a) Mean annual rainfall (mm): 800 - 1600
   b) Mean annual PET (mm): 1300 - 1700
   c) Mean annual temperature: T3
   d) LGP: D2a-1, D2a-2, D2u-3, S1-15
   e) Rainfall variability (%): 20 - 45
   f) Drought probability: 0.3 - 0.4

2.5 Present Land use/cover type: 2.1, 2.2, 2.3, 9.1/2.3, 10.1a

2.6 Farming System: C5/C20, C6/C35, C22, C23, E10/E19

2.7 Crops
   a) Annuals: M, T, S, W
   b) Perennials: E, Ch

2.8 Livestock: C, G, S, D, M

2.9 Wildlife: Di, Bb, W

2.10 Forestry: A, Cov, C, F, Epc

3. Summary of Agricultural potential and constraints
   a) Potential: crop production
   b) Constraints: moisture stress, termite

4. Remark: highly suitable for mechanized farming if moisture stress is overcomed.
1. **MAJOR AGROECOLOGICAL ZONE**: Tepid to cool sub-humid mid highlands

1.1 Mapping Symbol: SH2
1.2 Sub Zone: Tepid to cool sub-humid plateau
1.3 Mapping Symbol: SH2-6
1.4 Area (ha): 1,248,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Plateau
2.2 Altitude (m): 2000 - 2800

2.3 Soil
   a) Type: Ao, Vp, I, Bv, Lc, Ne, Vc, Lo, Nd, Bd
   b) Moisture: US1, US2, UD1, UD2, UD3, AQ
   c) Fertility: moderate to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 900 - 2000
   b) Mean annual PET (mm): 1300 - 1600
   c) Mean annual temperature: T3 - T4
   d) LGP: D2a-1, D2u-2, S1-5 S1-10
   e) Rainfall variability (%): 15 - 35
   f) Drought probability: 0.1 - 0.4

2.5 Present Land use/cover type: 2.2, 2.3, 4.2/2.3, 5.1, 5.2, 8.2, 9.1, 9.1/2.3, 9.2, 10.2a, 12.0

2.6 Farming System: C7, C21, C22, C25, C26, C43, C50, C6/C35, C8/C24, C16/C41, C19/C45, E8/E14, E50/E60

2.7 Crops
   a) Annuals: T, W, S, M, Ba
   b) Perennials: E, Co, Ch, B, Ci, A

2.8 Livestock: C, S, G, D, H, M

2.9 Wildlife: Di, Wa, Sc

2.10 Forestry: Cov, A, F, C, Po, Jp, Olea, Ph Dv, Ce, Rx

3. Summary of Agricultural potential and constraints
   a) Potential: crop, livestock and forestry production
   b) Constraints: topography, shallow soil, soil erosion, deforestation, Enset disease

4. Remark:

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1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool sub humid mid highlands

1.1 Mapping Symbol: SH2
1.2 Sub Zone: Tepid to cool sub-humid mountains
1.3 Mapping Symbol: SH2-7
1.4 Area (ha): 6,664,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Mountain
2.2 Altitude (m): 1600 - 3200

2.3 Soil
   a) Type: Nd, Ao, I, Bd, Hh, Vp, Ne, Le, Be,
   b) Moisture: US1, US2, UD1, UD2, UD3, AQ
   c) Fertility: very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 700 - 2200
   b) Mean annual PET (mm): 1200 - 1700
   c) Mean annual temperature: T3 - T4
   d) LGP: D2i-2, D2i-3, D1a-3, D2a-3, Dsa/DS4, S1-5, S1-10, S1-11, D2a-1, S1-15
   e) Rainfall variability (%): 10 - 45
   f) Drought probability: 0.1 - 0.5

2.5 Present Land use/cover type: 2.1, 2.2, 2.3, 2.4, 2.4/4.3, 3.0, 4.1, 4.2, 4.3, 5.1, 5.2, 7.1, 8.1, 8.2, 9.1, 9.2, 9.2/9.3, 10.1a, 10.2b

2.6 Farming System: C6, C7, C16, C20, C21, C22, C6/C35, C8/C24, C16/C41, C41/C39, C42/C50, E2, 36, E9, E1/E15, E4/E17, E10/19, E13/18 P1, P2

2.7 Crops
   a) Annuals: M, T, Pu, S, Tu, FM
   b) Perennials: Co, Ch, B, E, Ci, Pa, Ma, Su

2.8 Livestock: C, S, H, M, D

2.9 Wildlife: Di, Bp, Se, Ab, Le, Cm, Vm

2.10 Forestry: As, Mf, Po, A, C, Cov, Po, Ha, Lea, Epc, F, Era, Pf, Fs, Fy, Avol, Va, Ce

3. Summary of Agricultural potential and constraints
   a) Potential: crop, livestock and forestry production
   b) Constraints: topography, shallow soil, stoniness, termite, low fertility, soil erosion, deforestation.

4. Remark: In some parts of this sub-zone mechanized farming is highly suitable.
   Unless conserved properly the topography is very fragile
1. **MAJOR AGROECOLOGICAL ZONE**: Cold to very cold sub-humid sub afro-alpine to afro-alpine

1.1 **Mapping Symbol**: SH3
1.2 **Sub Zone**: Cold to very cold sub-humid mountains
1.3 **Mapping Symbol**: SH3-7
1.4 **Area (ha)**: 532,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 **Physoigraphy**: Mountain
2.2 **Altitude (m)**: 2600 - 4300

2.3 **Soil**
   a) **Type**: Bh, Ao, Vc, Vp, I, Re
   b) **Moisture**: US1, US2, UD1, UD2
   c) **Fertility**: fertile to very fertile

2.4 **Climate**
   a) **Mean annual rainfall (mm)**: 700 - 1500
   b) **Mean annual PET (mm)**: 1200 - 1600
   c) **Mean annual temperature**: T4 - T6
   d) **LGP**: D2a-3, D2i-3, D2i-4, D2a/DS4, S1-11, S1-15, S1-16
   e) **Rainfall variability (%)**: 10 - 25
   f) **Drought probability**: 0.1 - 0.3

2.5 **Present Land use/cover type**: 2.2, 2.3, 3.0, 4.1, 4.2, 4.3, 5.1, 5.2, 7.1, 9.2

2.6 **Farming System**: C16/C41, C23, E10/E19, E13/E18

2.7 **Crops**
   a) **Annuals**: Pa, Ba, W, T
   b) **Perennials**: E, Ch

2.8 **Livestock**: C, S, O, M, H

2.9 **Wildlife**: Di, Wa, Bb, Li, Ab

2.10 **Forestry**: Jp, Ha, Po, Olea, Eva, Ek, Epc

3. **Summary of Agricultural potential and constraints**
   a) Potential: forestry and wildlife production
   b) Constraints: topography, shallow soil, stoniness, low temperature, poor infrastructure

4. **Remark:**
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm humid lowlands
1.1 Mapping Symbol: H1
1.2 Sub Zone: Hot to warm humid plains
1.3 Mapping Symbol: H1-1
1.4 Area (ha): 48,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plain
2.2 Altitude (m): 600 - 1400

2.3 Soil
   a) Type: Nd, Ao, Je, Bd, Z
   b) Moisture: UD1, UD2
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1500 - 2000
   b) Mean annual PET (mm): 1500 - 1550
   c) Mean annual temperature: T1 - T2
   d) LGP: S1-13
   e) Rainfall variability (%): 30 - 35
   f) Drought probability: 0.2 - 0.4

2.5 Present Land use/cover type: 5.1/7.3, 5.2, 7.3, 9.1, 9.3

2.6 Farming System: C6, S1

2.7 Crops
   a) Annuals: C, S, M, Tu
   b) Perennials: Ma, Su, Pa, B, Co

2.8 Livestock: C, G, D, Ca, S

2.9 Wildlife: Li, E, B, Le, Cr, Br

2.10 Forestry: Pcy, vd, Ba, A, Era, To, Zsc, Sk, Cov

3. Summary of Agricultural potential and constraints
   a) Potential: forestry and wildlife production, park and tourism development
   b) Constraints: forest fire, malaria, deforestation, stetse infestation

4. Remark: Irrigated mechanized farming is very feasible in some areas of this sub-zone
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm humid lowlands
   1.1 Mapping Symbol: H1
   1.2 Sub Zone: Hot to warm humid lakes and rift valleys
   1.3 Mapping Symbol: H1-2
   1.4 Area (ha): 28,000

2. CHARACTERISTICS OF THE SUB-ZONE
   2.1 Physoigraphy: Lakes and rift valleys
   2.2 Altitude (m): 1200 - 2000
   2.3 Soil
      a) Type: Nd, Vc
      b) Moisture: UD2
      c) Fertility: fertile to very fertile
   2.4 Climate
      a) Mean annual rainfall (mm): 1200 - 1500
      b) Mean annual PET (mm): 1525 - 1550
      c) Mean annual temperature: T2
      d) LGP:D2a/DS1
      e) Rainfall variability (%): 25 - 35
      f) Drought probability: 0.4 - 0.5
   2.5 Present Land use/cover type: 2.1, 8.2
   2.6 Farming System: C6/C35
   2.7 Crops
      a) Annuals: S, M, C, Sun, Tu
      b) Perennials: B, Pa
   2.8 Livestock: C, G, S, D
   2.9 Wildlife: Cr, Bz, H, D, Wa
   2.10 Forestry: A, Cor, Ba, F, Mo

3. Summary of Agricultural potential and constraints
   a) Potential: mechanized irrigation farming
   b) Constraints: workability (drainage), shallow soil, stoniness

4. Remark: flat topography and perennial river in the surrounding makes it very feasible for irrigation mechanized farming.
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm humid lowlands

1.1 Mapping Symbol: H1
1.2 Sub Zone: Hot to warm humid mountains
1.3 Mapping Symbol: H1-7
1.4 Area (ha): 940,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physiography: Maintain
2.2 Altitude (m): 800 - 2200

2.3 Soil
   a) Type: Nd, Vp, Bd, Ao, Je
   b) Moisture: XR2, XR3, US2, UD1, UD2
   c) Fertility: very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 500 - 2000
   b) Mean annual PET (mm): 1350 - 1600
   c) Mean annual temperature: T2 - T3
   d) LGP: D1a-2, D2a/DS1, S1-12, S1-13
   e) Rainfall variability (%): 15-40
   f) Drought probability: 0.1 - 0.5

2.5 Present Land use/cover type: 2.3, 2.4, 4.2, 4.3, 5.1, 5.2/7.3, 5.2, 6.0, 7.1, 7.3, 9.1, 9.2, 9.2/9.3, 9.3, 10.1b 9.3/2.3

2.6 Farming System: C5/E12, C6, C6/C35, C7, C9/C30, S1, S2, E6

2.7 Crops
   a) Annuals: M, S, FM, Sun, Sp, Tu
   b) Perennials: Co, Ch, E, B, Pa, Ma, Li, Su

2.8 Livestock: C, S, G, D, H, M

2.9 Wildlife: B, E, Dw, Cm, Sc, Le, Ab, Wa, Bp, Gk

2.10 Forestry: Ca/Br/As/Ang/ Ca/Ole/Pf/Schi/A/ Ds/ Ph/F/C/ Cov

3. Summary of Agricultural potential and constraints
   a) Potential: Crop, livestock, forestry and wildlife production
   b) Constraints: topography, landslide

4. Remark: In some areas of this sub-zone mechnized farming is feasible. The Tepi Coffee Development project is situated in this sub-zone
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool humid mid highlands

1.1 Mapping Symbol: H2
1.2 Sub Zone: Tepid to cool humid lakes and rift valleys
1.3 Mapping Symbol: H2-2
1.4 Area (ha): 28,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Lakes and rift valleys
2.2 Altitude (m): 1600 - 2000

2.3 Soil
   a) Type: Nd, Ao, Qc, I
   b) Moisture: UD1
   c) Fertility: poor to moderately fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1200 - 1400
   b) Mean annual PET (mm): 1350 - 1600
   c) Mean annual temperature: T3
   d) LGP: D2a/DS1
   e) Rainfall variability (%): 35-37
   f) Drought probability: 0.5

2.5 Present Land use/cover type: 8.2/2.3

2.6 Farming System: C6/C35

2.7 Crops
   a) Annuals: S, M, C, Sun, W, Ba
   b) Perennials: Su, Ba, Pa, Co

2.8 Livestock: C, G, S, D

2.9 Wildlife: Wa, Di, Sc

2.10 Forestry: Cpr, Mo, Ba, A, F, C, As, Ds, Ola

3. Summary of Agricultural potential and constraints
   a) Potential: forestry production
   b) Constraints: topography, shallow soil, stoniness, low fertility

4. Remark: Soil and water conservation, works should be taken immediately in this sub-zone. If crop production is to be undertaken it should be on conservation based development approach.
1. MAJOR AGROECOLOGICAL ZONE: Tepid to cool humid mid highland

1.1 Mapping Symbol: H2
1.2 Sub Zone: Tepid to cool humid plateau
1.3 Mapping Symbol: H2-6
1.4 Area (ha): 64,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physoigraphy: Plateau
2.2 Altitude (m): 1400 - 3000

2.3 Soil
   a) Type: Lc, Hh, Vp, Be, Re
   b) Moisture: US2, UD1
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 900 - 2000
   b) Mean annual PET (mm): 1300 - 1500
   c) Mean annual temperature: T3 - T4
   d) LGP: D2u-1, D2a/i, S1-12
   e) Rainfall variability (%): 15 - 30
   f) Drought probability: 0.3 - 0.5

2.5 Present Land use/cover type: 2.1, 2.2, 8.2, 9.1

2.6 Farming System: C15, C21, C16/C41, C42, C43, C47

2.7 Crops
   a) Annuals: W, B, T
   b) Perennials: Ch, E

2.8 Livestock: S, C, M, H, D

2.9 Wildlife: Sc, Ab, Le, Bb, Cm

2.10 Forestry: Pp, Po, Ola, A, F, Ha

3. Summary of Agricultural potential and constraints
   a) Potential: Crop, livestock, and forestry production
   b) Constraints: topography, shallow soil, land scarcity, shortage of fuel wood.

4. Remark: The agricultural area located nearby Addis Ababa city is subject to reduction, in the long-run due to the expansion of the city.
1. **MAJOR AGROECOLOGICAL ZONE:** Tepid to cool humid mid highlands

1.1 Mapping Symbol:H2

1.2 Sub Zone: Tepid to cool humid mountains

1.3 Mapping Symbol:H2-7

1.4 Area (ha):2,704,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Mountain

2.2 Altitude (m):2000 - 32000

2.3 Soil
   a) Type: Nd, Je, Ne, Ao, Vp, Bd, I, Bh, Ck, Hh, Be
   b) Moisture: US1, US2, UD1, UD2, UD3
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 700 - 2200
   b) Mean annual PET (mm): 1200 - 1700
   c) Mean annual temperature: T3 - T4
   d) LGP:D1a-1,D1a-2, D2a/DS3, D2a/DS1, S1-12, S1-13
   e) Rainfall variability (%): 10-45
   f) Drought probability: 0.1 - 0.5

2.5 Present Land use/cover type: 2.1,2.2,2.3,2.4,4.2,4.3,4.3/2.4,5.1, 5.2, 7.1,7.3,8.2,8.2/2.3,9.1,9.2,9.3,9.2/2.3,10.1a

2.6 Farming System: C6/C35, C4/C36,C7,C16,C16/C41,C17,C23, C41/C39,C42/C50,E1/E5, E4/E17, E6,P1,P2,C5/E12,E13/E18

2.7 Crops
   a) Annuals: M, S, FM, Sun, Sp, Tu
   b) Perennials: Co, Ch, E, B, Pa, Ma, Li, Su

2.8 Livestock: C,S,G,D,H,M

2.9 Wildlife: E,Dw, Cm, Bp, Br, Sc, Wa, Ab, Le Gk, Ra, Vm, Li

2.10 Forestry: Ane,As, Alo, Ap, Ar, Pf, Sy, Sch, Ek, Cor,C,Mo,Erd,Ep,A,Po,F,Pa,Ha, Jp, Ola, Ph, Er, Hr, Fa, Ca, Trg, Da

3. Summary of Agricultural potential and constraints
   a) Potential: Crop, livestock, forestry production
   b) Constraints: topography, shallow soil depth, stoniness, workability, shorgage of firewood, encroachment, deforestation

4. Remark: Some areas of this sub-zone is highly feasible for mechanized farming.
1. **MAJOR AGROECOLOGICAL ZONE**: Cold to very cold humid sub-afroalpine to afro-alpine

   1.1 Mapping Symbol: H3
   1.2 Sub Zone: Cold to very cold mountains
   1.3 Mapping Symbol: H3-7
   1.4 Area (ha): 604,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: Mountain

2.2 Altitude (m): 3000 - 4200

2.3 Soil  
   - a) Type: Nd, Ao, Lc, Vp, I, Re, Bh  
   - b) Moisture: US2, UD1, UD2  
   - c) Fertility: moderately fertile to fertile

2.4 Climate  
   - a) Mean annual rainfall (mm): 900 - 1800  
   - b) Mean annual PET (mm): 800 - 1200  
   - c) Mean annual temperature: T5 - T6  
   - d) LGP: D1a-2, D2a/DS3, S1-3, S1-13  
   - e) Rainfall variability (%): 10 - 25  
   - f) Drought probability: 0.1 - 0.3

2.5 Present Land use/cover type: 2.2, 2.3, 3.0, 4.2, 4.3, 5.1, 5.2, 5.2, 7.1

2.6 Farming System: C5/E12, C16/C41, C23, C42, C50, E6

2.7 Crops  
   - a) Annuals: B, W, Pu  
   - b) Perennials:

2.8 Livestock: C, S, G, H, M, D

2.9 Wildlife: Wa, Mn, Di, Aw, Ks, Mb, Le, C, J, Bb, H

2.10 Forestry: Er, Hr, Ha, Sch, Lob

3. Summary of Agricultural potential and constraints  
   - a) Potential: forestry and wildlife production, tourism development  
   - b) Constraints: low temperature, topography, shallow soil depth, stoniness, rock outcrops, wind erosion

4. Remark: In some parts of this sub-zone highland crop production is highly feasible.
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm pe-humid low lands
1.1 Mapping Symbol: ph1
1.2 Sub Zone: Hot to warm per humid mountains and plateau
1.3 Mapping Symbol: Ph1-5
1.4 Area (ha): 72,000

2. CHARACTERISTICS OF THE SUB-ZONE

2.1 Physiography: Mountains and plateau
2.2 Altitude (m): 800 - 1200

2.3 Soil
   a) Type: Je, Be
   b) Moisture: UD1, UD2
   c) Fertility: very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1100 - 1500
   b) Mean annual PET (mm): 1300 - 1450
   c) Mean annual temperature: T2
   d) LGP: D2a/DS2
   e) Rainfall variability (%): 25 - 35
   f) Drought probability: 0.2 - 0.4

2.5 Present Land use/cover type: 4.3, 5.1, 5.2, 9.1, 9.2, 9.3

2.6 Farming System: S2

2.7 Crops
   a) Annuals: S, M
   b) Perennials: Co, Ch, E, Ma, B, Pa, Su

2.8 Livestock: C, G, S, D

2.9 Wildlife: Di, B, Gk, Lk, Gg, Wb, Li, Le

2.10 Forestry: A, Ba, Era, Cor, Ola, F, C

3. Summary of Agricultural potential and constraints
   a) Potential: Crop, livestock, forestry and wildlife production
   b) Constraints: topography, deforestation, encroachment

4. Remark:
1. MAJOR AGROECOLOGICAL ZONE: Hot to warm per-humor lowlands
1.1 Mapping Symbol: Ph1
1.2 Sub Zone: Hot to warm per-humid mountains
1.3 Mapping Symbol: Ph1-7
1.4 Area (ha): 416,000

2. CHARACTERISTICS OF THE SUB-ZONE
2.1 Physiography: Mountain
2.2 Altitude (m): 1000 - 2000
2.3 Soil a) Type: Lc, Nd, Be, Ao, Z, Qc, Re
   b) Moisture: US1, UD2, UD3
   c) Fertility: fertile to very fertile
2.4 Climate a) Mean annual rainfall (mm): 1100 - 2200
   b) Mean annual PET (mm): 1300 - 1500
   c) Mean annual temperature: T1 - T2
   d) LGP: D2a/DS2, S1-14
   e) Rainfall variability (%): 15 - 35
   f) Drought probability: 0.2 - 0.4
2.5 Present Land use/cover type: 2.2, 2.4, 2.4/4.3, 4.2, 4.3 5.2, 7.3, 9.1, 9.3
2.6 Farming System: C5/E12, S1, S2, S3
2.7 Crops a) Annuals: M, S, Tu
   b) Perennials: Co, Ch, E, B, Pa, Ma, Ci, Su
2.8 Livestock: C, S, G, D
2.9 Wildlife: E, Dw, Cm, Sc, Wa, Bp, Le
2.10 Forestry: As, Ang, Ca, Ola, Pf, Sch, A, Ds, Ph, F, C, Cov

3. Summary of Agricultural potential and constraints
   a) Potential: Crop, livestock, forestry and wildlife production
   b) Constraints: topography, landslide, deforestation and encroachment

4. Remark:
1. **MAJOR AGROECOLOGICAL ZONE**: Tepid to cool per-humid mid highlands

1.1 Mapping Symbol:Ph2
1.2 Sub Zone: Tepit to cool per-humid mountains
1.3 Mapping Symbol:Ph2-7
1.4 Area (ha): 468,000

2. **CHARACTERISTICS OF THE SUB-ZONE**

2.1 Physoigraphy: mountain
2.2 Altitude (m): 1000 - 2800

2.3 Soil
   a) Type: Ao, Nd, Lc, I
   b) Moisture: UD1, UD2, UD3
   c) Fertility: fertile to very fertile

2.4 Climate
   a) Mean annual rainfall (mm): 1100 - 2200
   b) Mean annual PET (mm): 1350 - 1500
   c) Mean annual temperature: T3
   d) LGP: D2a/DS2, S1-14
   e) Rainfall variability (%): 15 - 35
   f) Drought probability: 0.2 - 0.3

2.5 Present Land use/cover type: 2.1, 2.4, 4.3/2.4, 4.2, 4.3, 5.2, 9.3

2.6 Farming System: C5/E12, S2, S3

2.7 Crops
   a) Annuals: M, S, Tu
   b) Perennials: E, Co, Ch, E, B, Pa, Ma, Su, Ci

2.8 Livestock: C, S, G, D, H, M

2.9 Wildlife: B, Gk, Lk, Li, Di, Gg, Wb, Le

2.10 Forestry: Era, Mf, F, Ca, Cov, Av, Pa, C, Sch

3. Summary of Agricultural potential and constraints
   a) Potential: Crop and livestock production
   b) Constraints: topography, shallow soil, stoniness, deforestation, encroachment.

4. Remark: Most of the land in this sub-zone has been changed to agriculture (crop husbandry).
9. CONCLUDING REMARKS

The presently identified AEZs:

a) reveal the qualities, potentials and constraints of the agricultural resources to help plan studies at different levels;
b) give general indications for delineating areas requiring resource conservation programmes for the agricultural lands, forest areas, degraded lands, areas of tourist attraction, and natural vegetation and wildlife areas;
c) indicate areas requiring agricultural intensification or expansion;
d) helps to appropriate input and land use objectives (levels of irrigation requirements);
e) help to evaluate the potentials of the zones for perennials, or annuals and/or livestock production system;
f) guide researchers and climatologists as to where to establish centers and stations from which results could be extrapolated to areas with similar resource endowment;
g) the present classification is largely based on macro-level information and does not take care of variations fully as they relate to micro-environmental characteristics. This can be solved only through detail studies;
h) initiate interest for further research work;
i) diversities in climate, vegetation, soils, crop/livestock patterns and farming systems within ecological zones reveal fragility of the ecosystems which are demanding special treatment as far as resource management and utilizations are concerned;
j) the work will be refined as more and reliable data and feed-back will be available;
SOIL UNITS

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## THERMAL ZONE CLASSES

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THE LENGTH OF THE GROWING PERIOD

EXPLANATION

The growing period counted in days, is the period during a year when rainfall exceeds one full PET, soil moisture storage is built up. In this case, the amount by which rainfall exceeds PET, up to maximum of 10mm, is assumed to be soil moisture storage. The number of days required to evapotranspire the soil moisture is counted as part of the growing period. In addition any time interval during the period when water is available but temperatures are too low for plant growth as may happen at high altitudes is excluded.

The growing period in normal (solid green lines) when it has a time interval when rainfall exceeds one full PET. It is intermediate (dashed green lines) when the rainfall remains between one half and one full PET. The calculation of the growing period is based on a simple water balance model comparing rainfall with PET (calculated according to Penman’s 1984 formula).

NOTES: 1. To save space, following abbreviations are commonly used:

- DGP: Dependable growing period
- MGP: Median growing period
- OEPM: Optimal earliest planting month
- DSC: Drought-sensitive crops
- DRC: Drought-resistance crops
- PET: Potential evapotranspiration

2. Where the term DSC is used or the term DRC is not used, it is understood that the quality of the growing period is such that the full water requirement of a crop can be met. This growing period regime could be assumed non-limiting in terms of water availability.

Where the term DRC is explicitly used, it is understood that the quality of the growing period is such that the full water requirements of a crop cannot be met, but that the crop, if drought-resistant, is likely to survive and to produce a yield, albeit smaller than under the previous growing period regime. If the crop is drought-sensitive, it is expected to be severely affected by the water shortages inherent to this growing period regime.

Zone symbol | Zone characteristics
--- | ---

1. AREAS WITHOUT SIGNIFICANT GROWING PERIOD

N0  No growing period from rainfall that is adequate to meet in most years a major fraction of the water requirements of drought-resistant very short-maturing crops. Extremely high consumptive water use (annual PET: 2700 – 3000m).
N1  As previous zone, but lower annual PET (2300 – 2500mm)
N2  As previous zone, but lower annual PET (2000 - 2200mm)
N3  As previous zone, but lower annual PET (1900 – 2000mm)
N4  As previous zone, but lower annual PET (1600 – 1900mm)

2. AREAS WITH A SINGLE GROWING PERIOD

2.1 Areas in which the growing period is inadequate to meet in most years the full water requirements of very short-maturing crops.

SO-2 DGP and MGP for DSC are negligible; DGP for DRC is about 8 weeks MGP is 2.5 months. OEPM is June(July); growing period onset is fairly reliable; growing period duration is not responsive to soil moisture storage capacity.

SO-3 DGP and MGP for DSC are negligible; DGP for DRC is about 8 weeks and MGP is about 3 months; OEPM is (June-July); growing period onset is reliable; growing period duration is not responsive to soil moisture storage capacity.

SO-4 Comparable characteristics as for previous zone but with intrazonal variability.

2.2 Areas in which the growing period is adequate to meet in most years the full water requirements of (very) short-maturing crops in many years but not most years.

SO-1 DGP is about 9-10 weeks; MGP is about 3 months; OEPM is (June-July); growing period onset is fairly reliable; growing period duration is slightly responsible to differences in soil moisture storage capacity.

2.3 Areas in which the growing period is adequate to meet the full water requirements of short-maturing crops in most years, but with a substantial risk that subnormal rainfall will result in serious yield reductions.
S1-1  DGP is about 2.5-3 months and MGP is 3-4 months according to soil moisture storage capacity; OEPM is June; growing period onset is reliable.

S1-2  DGP is about 3-4-5 months and MGP is 4-5.5 months according to soil moisture storage capacity; OEPM is June; growing period onset is reliable.

S1-6  No reference stations are available for this zone. Assumed levels of DGP (3-4 months) and of MGP 4-5.5 months) inferred from zonation studies in Sudan. Assumed OEPM is June and growing period onsets assumed reliable.

S1-8  DGP is about 3.5-4.5 months and MGP is 4.5 months according to soil moisture storage capacity; OEPM is June; growing period onset is reliable.

S1-9  DGP is about 3 months; MGP is 3.5-4 months; OEPM is June; growing period onset is reliable; growing period duration is not responsive to changes in soil moisture storage capacity.

S1-17 DGP is about 2.5-3 months; MGP is 3-4 months; OEPM is December; growing period onset is reliable; growing period duration is slightly responsive to changes in soil moisture storage capacity.

2.4 Growing period adequate to meet in most years the full water requirements of crops with medium cycle to maturity. Dry period too long for perennials.

S1-3  DGP is about 4.5-6 months and MGP is 5-7 months accordingly to soil moisture storage capacity; OEPM is May; growing period onset is reliable.

S1-4  DGP is about 5-7 months and MGP is 6-8 months according to soil moisture storage capacity; OEPM is May; growing period onset is reliable.

S1-7  DGP is about 5-6 months and MGP is 6-6.5 months according to soil moisture storage capacity; OEPM is May; growing period onset is reliable.

2.5 Growing period adequate to meet in most years the full water requirements of long-maturing crops. Usually adequate for most perennials.
is the most important and reliable. High spatial variability of growing periods.

3.2 Areas in which neither growing period is adequate for rainfed crop production is most years and the rainfall shortfalls can be supplemented by alternative water sources. Average rainfall conditions usually allow a short-maturing crop in the better growing season. Agricultural production can probably be stabilized by water conservation methods or by concentration in topographically favoured positions.

D3-1 The first DGP is about 2 months and starts in March/April at the earliest; the MGP is almost 3 months; the growing period onset is reliable. The second DGP is about 1 month and starts in September/November at the earliest; the MGP is almost 2 months; the reliability of the second growing period onset is lower.

3.3 Areas with double growing period, in which only one growing period can be considered adequate for rainfed crop production in most years. The secondary growing period, which could be the first or the second, is too unreliable for sustained crop production.

D11i-1 The first DGP is the most important; its length is about 2.5-3 months and starts in March at the earliest, the MGP is 3.5-4 months; the growing period onset is fairly reliable. The second DGP is only 4-5 weeks and starts in October/November at the earliest; the MGP is 7-9 weeks; the growing period onset is more reliable.

D11i-2 The first DGP is the most important; the length is about 2.5-3 months and starts in April at the earliest, the MGP is 3.5-4.5 months, the growing period onset is not reliable. The second DGP is only 1.5-4 weeks and starts in August at the earliest; the MGP is 14 weeks; the growing period onset is more reliable.

D11i-3 The first DGP is the most important; its length is about 4-5 months and starts in March at the earliest, the MGP is 4.5-9 months; the growing period onset is reliable. The second DGP is only 5-9 weeks and starts in October at the earliest; the MGP is 9-11 weeks; the growing period onset is also reliable.

D11i-4 The first DGP is the most important; its length is about 2.5 months and starts in April at the earliest; the MGP is 5.5-6.5 months; the growing period onset is fairly unreliable. The second DGP is 9-10 weeks and starts in August at the earliest, the MGP is 3-4 months; the growing period onset is reliable.
S1-5  DGP is about 6-8 months and MGP is 6.5-8.5 months according to soil moisture storage capacity; OEPM is May; growing period onset is reliable.

S1-10  DGP is about 5.5-7.5 months and MGP is 6.5-8.5 months according to soil moisture storage capacity; OEPM is April; growing period onset is reliable.

S1-11  DGP is about 6.5-8.5 months and MGP is 7-9.5 months according to soil moisture storage capacity; OEPM is April; growing period onset is reliable.

S1-12  DGP is about 7-9.5 months and MGP is 8-11 months according to soil moisture storage capacity; OEPM is April; growing period onset is reliable.

S1-15  DGP is about 6.5-7.5 months and MGP is 8-10 months according to soil moisture storage capacity; OEPM is March; growing period onset is fairly reliable.

2.6  Growing period adequate to meet in most years the full water requirements or long and very long maturing crops. Growing period well adapted for perennials but less suited to annual crops in view of increased risk of pests, diseases and lodging and difficulties in harvesting.

S1-13  DGP is about 8-11 months and MGP is 9-12 months according to soil moisture storage capacity; OEPM is March-April; growing period onset is reliable.

S1-14  DGP is about 9.5-11.5 months and MGP is 10-12 months according to soil moisture storage capacity; OEPM is March – April; growing period onset is reliable.

3.  AREAS WITH A DOUBLE GROWING PERIOD

3.1  Areas in which neither growing period is adequate for rainfed crop production in most years and the rainfall shortfalls are severe enough to necessitate supplementary irrigation.

D3-2  DGP for DSC negligible to both rainy seasons; DGP for DRC is 4 weeks with earliest onset in March and 8 weeks with earliest onset in July.

D3-3  Comparable growing period lengths for DRC as in zone D3-2 but later and less reliable onsets for both growing periods. First growing period
D2i-1 The second DGP is the most important; its length is about 3-4.5 months and it starts in July at the earliest, the MGP is 3.5-5.5 months; the growing period onset is reliable. The first DGP is 7-8 weeks and starts in February/March at the earliest, the MGP is 3-4 months; the growing period onset is unreliable.

D2i-2 The second DGP is the most important; its length is about 2.5-3 months and it starts in July/August at the earliest; the MGP is 3.5 months; the growing period onset is reliable. The first DGP is 7 weeks and starts in February/March at the earliest; the MGP is 3 months; the growing period onset is very unreliable.

D2i-3 The second DGP is the most important; its length is about 3-4 months and it starts in June at the earliest; the MGP is 4-5 months; the growing period onset is fairly reliable. The first DGP is about 2 months and starts in March at the earliest; the MGP is about 4-5 months; the growing period onset is reliable. The growing period onset is very unreliable.

D2i-4 The second DGP is the most important; its length is about 3.5-4 months and it starts in June at the earliest; the MGP is 4-5 months; the growing period onset is reliable. The first DGP is about 2 months and starts in February at the earliest; the MGP is 4-4.5 months; the growing period onset is very unreliable.

3.4 Areas in which both growing periods are adequate for crop production in most years, but in which double cropping is jeopardized by the unreliable onset of the first growing period.

D2u-1 The second growing period is the most important; the DGP is 5-6.5 months and the earliest start is in May; the MGP is 5-7 months; the growing period onset is reliable. The first growing period

D2a-u The first growing period starts in February/March at the earliest, has a reliable onset and allows a short-maturing crop of 3-months cycle. The second growing period starts in June/July at the earliest has a reliable onset and usually allows a 3-month duration crop. Area with considerable variation in growing period conditions. Double cropping may be hampered by end-season drought in some parts of the zone. The MGP is 5.5 - 6.5 months.

D2a-1 The first growing period allows a first short maturing crop of 3 month cycle, planted in February/March at the earliest followed by a second crop, planted in July at the earliest, with according to soil moisture storage capacity, 3.5-5.5 month cycle. The MGP is 9-10 months.
3.5 Areas in which both growing periods are adequate for production in most years. The first growing period is the most important. The spacing between the two growing periods is such that harvesting problems are less likely than in region 2.5 but that supplementary irrigation to region 2.5 but the supplementary irrigation to bridge the two growing periods is less feasible.

D1a-1 The first growing period allows a first short maturig crop of 3 month cycle planted in March at the earliest, followed by second crop with 3-month cycle planted, according to locality, in July to September at the earliest. For both growing periods the onsets are reliable.

D1a-2 The first growing period starts in March at the earliest, the second one in July/August at the earliest. For both growing periods the onsets are reliable. At high moisture storage capacity levels the two growing periods merge into a single growing period. Perennials can bridge the gap between the two rainy seasons and MGP of 9-11 months is available.

D1a-3 The first growing period starts in March at the earliest, the second one in August/September at the earliest. Double cropping is possible by growing a first crop of 4-4.5 month duration, followed by a second crop of 3-month duration. For both growing periods the onsets are reliable. Perennials can bridge the gap between the two rainy seasons and have a MGP of 7-9 months available.

3.7 Area in which both growing periods are adequate for rainfed crop production in most years. Includes areas in which the two growing periods are adequate for rainfed crop production in most years. Includes areas in which the two growing periods merge into a single long growing period.

D2a/DS1 The first growing period starts in March at the earliest, the second one in July/August at the earliest. Both growing periods have reliable onsets. At low levels of soil moisture storage capacity two short-maturing crops with 3-month cycle each can be grown. At higher levels the two growing periods merge into a single DGP of 7-9.5 months. For perennials an MGP of 9-11 months is available.

D2a/DS2 At low levels of soil moisture storage capacity a first short-maturing crop of 3 month cycle, planted in February at the earliest, can be followed by a second longer-maturing crop of 5-7 months duration planted in June at the earliest. At higher levels of moisture storage capacity the two growing periods merge in which case a DGP of 11-12 months may be available.

D2a/DS3 The first growing period starts in February at the earliest and has a
fairly unreliable onset. The second growing period starts in May/June at the earliest and the onset is reliable. Where the two growing periods do not merge a first 3-month duration crop could be followed by a second 3.5-5 month duration crop could be followed by a second 3.5-5 month duration crop. Where the two growing periods merge, a single DGP of 7-8 months is available. For perennials a DGP of 7.5-10 months would be available.

D2a/DS4 The first growing period starts, according to locality, in February-April, the second one in June/July. Both growing period onsets are reliable where the two growing periods do not merge, a first 3-month duration crop could be followed by a second 3.5-4.5 month duration crop. Where the two growing periods do merge a single DGP of 7-9 months may be available. For perennials an MGP of 5.5-7.5 months is available in areas where the growing periods do not merge, and an MGP of 6.5 – 10.5 months in areas with merging growing periods.
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LIVESTOCK

Camel = Ca
Cattle = C
Donkey = D
Goat = G
Horse = H
Mule = M
Sheep = S
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<td>Guinea fowl</td>
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<td>Hamadhyas baboon</td>
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<td>Hyena spp</td>
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<td>Klipspringer</td>
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<td>Leéwe hart beast</td>
<td>(Lh)</td>
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<td>Animal</td>
<td>Abbreviation</td>
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<td>Leopard</td>
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<td>Lesser kudu</td>
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<td>Lion</td>
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<tr>
<td>Menelik’s bushbuck</td>
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<td>Mongoose</td>
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<td>Mountain nyala</td>
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<td>Mountain reedbuck</td>
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<td>Nile Lechwe</td>
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<td>Nubian Giraffe (Ng)</td>
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<td>Oryx</td>
<td>(Or)</td>
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<td>Rael</td>
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<td>Simen Fox</td>
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<td>Sommerings gazelle</td>
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<td>Spotted hyena</td>
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<td>Strese mann’s bush cros</td>
<td>(Sbc)</td>
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<tr>
<td>Striped hyena</td>
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<td>Swayne’s harte beast</td>
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<td>Tiag (Topi)</td>
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<td>Tora heartbeast</td>
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<td>Tortoise</td>
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<td>Vervet monkey</td>
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<td>Walia Ibex</td>
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<td>Warthog</td>
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<tr>
<td>Water buck (common)</td>
<td>(Wb)</td>
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<tr>
<td>White eared kob</td>
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<tr>
<td>White tailed swallow</td>
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<td>Wild ass</td>
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<tr>
<td>Zebra</td>
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</table>
INDIGENOUS TREE SPECIES
Acacia spp. (A)
Acacia nilotica (An)
Acacia senegal (Asg)
Acacia seyal (Asy)
Adansonia digitata (Ad)
Albizia schimperana (As)
Allophylus abyssinicus (Alo)
Aningeria adolfi-friedericii (Anj)
Aningeria altissima (Ang)
Anogissus leiocarquus (An)
Apodaytes dimidiata (Ap)
Arundinaria alpina (Ar)
Arundo donux (Ard)
Avena Sativa (Av)
Balonites aegyptica (Ba)
Borassus aethiopum (Bo)
Boswellia bovanensis (Bb)
Boswellia papyrifera (Bp)
Calatropis procera (Cp)
Carissa edulis (ce)
Celtis africanana (ca)
Cembriflum mollue (Cm)
Commiphera spp. (Com)
Cordia africana (Cor)
Croton macrostachyus (C)
Dichrostachys cinrea (Dyc)
Diospyros abyssinica (Da)
Dodonia viscosa (Dv)
Dombeya torrida (Dt)
Dracaena steudneri (Ds)
Ehretia cymosa (Ec)
Ekebergia capensis (Ek)
Entada abyssinica (Et)
Euclea schimperi (Es)
Euphorbia abyssinica (Ep)
Euphorbia condelabrum (Epc)
Euphorbia tirucalli (Ept)
Erica orborea (Er)
Erythrina abyssinica (Era)
Erythrina brucei (Erb)
Fagaropsis angolensis (Fa)
Ficus spp. ((F)
Ficus sur (Fs)
Ficus sycomorus (Fsy)
Ficus vasta (Fv)
Gardenia lutea (Gl)
Grewia bicolor (Gb)
Grewia ferruginea (Gf)
Hagenia abyssinica (Ha)
Hypericum revolutum (Hr)
Juniperus procera (Jp)
Lannea fruticosa (Lf)
Lobelia rhynchopetalum (Lob)
Manilkara butugi (Mb)
Maytenus senegalensis (Ms)
Maytenus spp. (M)
Milletia ferruginea (Mf)
Moringa oleifera (Mo)
Olea africana (Ola)
Olea capensis (Olc)
Olea welwitchii (Olw)
Oxytenanthera abyssinica (Ox)
Parkinsonia aculatea (Pk)
Phoenix reclinata (Ph)
Puiostigma thonningii (Pti)
Podocarpus gracilior (Po)
Polyscias fulva (Pf)
Prunus africana (Pr)
Pterocarpus lucens (Pt)
Pygeum africanum (Pa)
Rumex nervosus (Rx)
Salix subserrata (S)
Schefflera abyssinica (Sch)
Securidaca longipedunculata (Sl)
Sterculia africana (St)
Stereospermum kunthianum (Sk)
Strychnos innocua (Si)
Syzygium guineense (Sy)
Tamarindus indica (Ti)
Tamarix aphylla (Ta)
Terminalia brownii (Tb)
Terminalia glauceshens (Tq)
Terminalia macropetra (TM)
Trema guineensis (Trg)
Vernonia amygdalina (Va)
Vitex doniana (Vd)
Ximenia americana (Xa)
Zyzyphus mucronata (Zm)
Zyzyphus spina-christi (Zsc)
REFERENCES


Farm Management hand Book of Kenya.

