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BACKGROUND REPORT:

Four Ethiopias: A Regional Characterization

***Assessing Ethiopia's Growth Potential and
Development Obstacles***

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POVERTY REDUCTION AND ECONOMIC MANAGEMENT 2
COUNTRY DEPARTMENT FOR ETHIOPIA
AFRICA REGION

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Executive Summary

Despite Ethiopia's vast resources of land, water and labour, it is one of the poorest countries in the world, unable to use its huge resources effectively to prevent famine, reduce poverty, and support its rapidly increasing population. Its important growth potential is not being realized, due to a combination of natural factors and self-reinforcing dynamics that impose a subsistence orientation and impede economic growth. These dynamics relate to a variety of structural factors that need to be transformed if Ethiopia's economy is to be enabled to grow and contribute to development and poverty reduction.

Ethiopia's growth is constrained by a subsistence- oriented economy, based on rainfed agriculture and extremely vulnerable to an erratic rainfall regime, the impacts of severe and protracted environmental degradation, and shortages of arable land in the highlands where the population is concentrated. These problems are further exacerbated by critically low levels of human and physical infrastructure.

Ethiopia has an area of some 1.13 million sq kms, with a population estimated at 69.127 million (2002), increasing by some 2.9 percent per annum. It comprises a high central plateau, the 'Highlands', from 1,500 to 2500 meters above sea-level (masl), covering about 43 percent of the country, and surrounded by lowlands on all sides.

Ethiopia's topography, multiple climates, current environmental status, and demography, along with its development history and infrastructure, underlie its principal economic burdens and endowments. Examination from these perspectives makes it possible to divide the country into four distinct regions or 'four Ethiopias,' with differing levels of development and growth potential. This is done through a regrouping of administrative zones based on the spatial distribution of a wide range of burdens and endowments.

The assessment of development status, potential and opportunities for growth is based upon the examination of 51 indicators in all of the country's administrative zones. These are used to identify development level and areas of growth potential, where increased public investment in specific geographic and development areas, might make an optimal contribution to economic growth. This has led to the present classification, regrouping the country's administrative zones into four socio-economic/development regions, providing four different spatial perspectives of Ethiopia, its problems and potentials.

In view of Ethiopia's overwhelmingly agricultural economy, the initial focus is on agricultural potential and risk. However; examination of 51 indicators across administrative zones also draws attention to the significant geographical diversity within and among the zones comprising the four socio-economic regions. These regions are described as:

- Ethiopia One, the largely high risk-low potential eastern highlands with low-rainfall, land shortages and high vulnerability, but with a large surplus of labor that needs to be put to productive use through non-farm employment, urbanization, and enhanced labor mobility.

- Ethiopia Two, a mainly low-risk-medium potential Ethiopia, largely in the western highlands, but also including areas of Arrsi and North Shewa with higher rainfall and more arable land, and both surplus labor and significant potential for increased production. It particularly needs investment in water infrastructure to develop irrigation and provide hydroelectric power for non-farm livelihoods.
- Ethiopia Three; the high risk-medium potential Ethiopia, with possibilities for growth in agriculture, livestock and off-farm employment, in some zones of the western highlands, as well as in lowland zones, with considerable potential for irrigated farming. The risks include drought, malaria and tsetse fly in some zones. Sustainable growth requires investment in water infrastructure and risk mitigation.
- Ethiopia Four comprises the high risk- high regions of the humid and sub-humid western lowlands, and the dry, southern and eastern lowlands. It also includes the largely highland East Wellega zone, combining medium potential low risk highlands, together with large areas of high potential - high risk in its extensive lowland river valleys that cut through the high plateau.
 - The western lowlands are part of a sparsely-populated region of some 196,000 sq kms, large areas of which, large areas are suitable for rainfed mechanized agriculture, as well as irrigated multi-seasonal farming with some 1.7m ha of irrigable land, but no significant irrigation infrastructure. The region also has high potential for commercial agriculture based on rainfed production of valuable crops that could provide the raw material basis for development of processing industries, if supported by public investment in infrastructure, irrigation, tsetse fly eradication, and human and animal health measures.
 - The dry eastern and southern lowlands, with some 1.5 million ha of irrigable land, have significant potential for irrigated farming and commercial livestock raising. Livestock production for the domestic and export markets can provide an important source of growth when approached on a commercial basis and provided appropriate basic infrastructure and public goods, such as human and animal health infrastructure, and water for irrigation and forage production.

The development of water infrastructure is an imperative for effective and sustainable economic growth in Ethiopia. Multi-purpose water infrastructure for irrigation and hydropower is essential to realize the potential of the country's main resources: land, water and surplus labor, and enable sustainable agricultural and industrial growth. Investment in malaria control, tsetse eradication, and basic infrastructure can also open up large lowland areas suitable for rainfed commercial farming. Investment in irrigation and animal health infrastructure in the eastern lowlands can enable realization of the region's high potential for commercial livestock production and irrigated cropping. But, this requires initially, large public investment that takes account of the imperative of rapid growth and the realities that may constrain it, and stimulates the even more important contribution of private investment.

1. Introduction

Despite Ethiopia's vast resources of land, water and labor, it remains among the poorest countries in Africa, and the world. It has been unable to use its huge resources effectively to prevent famine, reduce poverty, and support its rapidly increasing population. The country has important growth potential but this potential is not being realized, due to a combination of natural and other factors, including self-reinforcing dynamics that impose a subsistence orientation and impede economic growth. These dynamics relate to a variety of structural factors that need to be transformed if Ethiopia's economy is to be enabled to grow and contribute to development and poverty reduction.

The impediments include a subsistence level and orientated economy, based on rainfed agriculture in the context of an erratic rainfall regime and extremely vulnerable to weather fluctuations. They include a lack of available arable land and other basic factors of production. This is further exacerbated by critically low levels of development of human and physical infrastructure in areas ranging from nutrition, adult literacy and primary school enrolment to road density and market access.

Ethiopia's development and growth are constrained by a severe lack of capital stock in terms of basic physical and human infrastructure. Its extremely low levels of literacy and health care constitute a major burden, with serious implications for growth. Rates of health care are extremely low and malaria is a significant health problem with serious development/economic implications, as 73 percent of the total area is exposed to malaria, and 53 percent of the population vulnerable to it.¹ Primary and secondary school enrolment rates are very low. Net primary enrolment in rural schools is only 28 percent.²

Ethiopia lacks energy and communication infrastructure with only 13 percent of the population having access to electricity, and nine telephones per 1000 population, of which only six are operational. Overall road density is only 30.76 kms/1000 kms. Most of the population lives more than a half-day walk from the nearest road, and in many rural areas, the principal means of transporting goods is through human portage or use of pack animals.

Ethiopia covers some 1.13 million square kilometers of the Horn of Africa, with a population estimated at 69.127 million (2002) and 84.45 percent rural. Its current population, the second largest in Sub-Saharan Africa estimated at over 70 million (2003) and increasing by some 2.9 percent per annum.³ The country comprises a high central plateau, the 'Highlands', ranging from 1,500 to 2500 meters above sea level (masl), with several peaks rising up as high as 4,600 masl. The Highlands cover some 43 percent of the total area, divided by the Great Rift Valley, running from southwest to northeast, and surrounded by lowlands on all sides.

¹ Ethiopia:CEM Database. Except where otherwise stated, the source of all data used herein is the database and background papers developed for the Ethiopia Country Economic Memorandum (See Appendix 1).

² FDRE: Sustainable Development and Poverty Reduction Program (Ethiopia's PRSP), p13, cited in Ethiopia: Rural Development Policy Note

³ UNICEF, "The State of the World's Children 2004," UNICEF, New York, 2003

The highlands contain nearly 85 percent of the population, 95 percent of the cultivated land and 80 percent of the country's 35 million cattle, part of Sub-Saharan Africa's largest livestock population. Among others the cattle population are a vital part of Ethiopia's ox-plow cultivation-based agricultural production system.⁴

Due to a more favorable climate with higher rainfall, Ethiopian agriculture developed mainly in the Highlands, with a system of rainfed mixed farming, using crop rotation and fallowing to maintain soil fertility. This worked well when the population was much smaller, household plots, much larger and there was adequate arable land relative to population size. But vast increases in population size over the past half-century, together with land degradation, has made the system increasingly less viable. This is exacerbated by the country's highly variable rainfall and vulnerability to frequent drought episodes.

With a population increasing at an estimated 2.9 percent a year, the number of food insecure districts and of food insecure households within them, is rapidly expanding. In the 1940s, with probably one third of its present population, Ethiopia managed to survive, albeit with difficulty, and widespread poverty. Today, using much the same production methods, but with three times the population size and extensive land degradation, this is no longer viable.

With nearly 85 percent of its population concentrated in the land-short and over-crowded Highlands, Ethiopia needs to develop its land and water resources in the lowland half of the country, still largely underused due to the prevalence of human and animal diseases, such as malaria and trypanosomiasis. These can be overcome, as has been done elsewhere, if the necessary health infrastructure and policies are put in place.

The Western Lowlands that slope to the borders of Sudan, contain millions of hectares of potentially arable and generally receive sufficient annual rainfall for at least one major crop per year. There is also high potential for irrigated farming, but this region remains sparsely populated, due to the prevalence of malaria and tropical diseases not found in the Highlands. The lowlands to the east, southeast and south are largely semi-arid with average annual rainfall of below 600mm.⁵ They have little potential for limited potential for rainfed crop production, but considerable potential for commercial livestock production and irrigated agriculture. Little attention has so far been given to developing the vast irrigation potential of these lowland regions.⁶

Across Ethiopia's diverse topography and multiple climatic zones, water availability is a key growth and development issue. Water resource constraints are central to Ethiopia's poverty, low levels of agricultural productivity and stalled development. It has abundant water resources and the run-off from its highlands fills the major rivers of the Horn of Africa. But it is unable to satisfy its minimum water requirements for agricultural production and economic growth due to an erratic rainfall regime and lack of the

⁴ FDRE, Ministry of Agriculture: "The Main Features and Issues Related to the Ethiopian Domestic Biomass Energy Sector," Woody Biomass Inventory and Strategic Planning Project, Addis Ababa, June 2003.

necessary water infrastructure to provide adequate water when and where it is needed. Multi-purpose water infrastructure for irrigation and hydropower is essential to sustainable agricultural and industrial growth and economic development in Ethiopia.

Ethiopia's topography, multiple climates, current environmental status, and demography, along with its development history and infrastructure, underlie its principal economic burdens and endowments. Examination from these perspectives makes it possible to divide the country into four distinct regions, or 'four Ethiopias,' with very different levels of development and growth potential.

The regrouping of Ethiopia's administrative zones is based on examination of the spatial distribution of a range of 51 selected factors and characteristics, burdens and endowments, used as indicators of development level and potential, across all of the country's administrative zones. These are used to identify areas of growth potential, where increased public investment might make an optimal contribution to economic growth, and regroup the zones into four socio-economic/development regions, comprising four "Ethiopias," or perspectives of Ethiopia and its problems and potentials.

2. Background

Ethiopia appears to be in a stalled development process in which it is failing to pull ahead of demographic growth. To emerge from this situation that might lead towards a poverty trap, the country needs to achieve a much higher and more sustained rate of economic growth than it has thus far experienced. To do so it needs to assess its development potentials and effectively address the constraints that prevent their realization.

Ethiopia has three principal resources. First is the land that supports its mainly agriculture based economy. The second is water, which Ethiopia has in abundance, but due to its erratic rainfall regime, often does not have at the right place and time to support its agricultural production. To make optimal use of this resource will require substantial increases in Ethiopia's water storage capacity and hydropower production. The third main resource is the country abundant labor, much of which is unemployed or underemployed, and concentrated in the rural highlands, where due to shortages of land and water, it cannot be put to optimal use, the mobility of this key resource needs to be enhanced, through urbanization, as well as both temporary and permanent migration. Achieving sustainable economic growth will require bringing these three resources together and integrating them in ways that enable their optimal use for Ethiopia's development.

Ethiopia starts from a very low base with many constraints in terms of topography, climate, human development and physical infrastructure capital stocks. It must contend with low levels of education, health and energy, frequent climatic shocks from an erratic rainfall regime, and severe lacks of transport infrastructure, storage and marketing facilities.

Ethiopia's rugged topography is itself a major constraint. It consists of a high central plateau, divided by the Rift Valley and surrounded by semi-arid and arid lowlands. The country is further sub-divided by a dozen major river valleys, running down from the

highlands that divide the country into different regions, isolated both from the center and among themselves. At a lower level, the divisions continue, resulting in inadequate physical linkages between rural and urban areas and within the rural sector. In this context, transport is difficult and costly, constraining trade and market access, and weakening economic integration at local, regional and national levels.

Ethiopia's economy is based on agriculture. This sector is responsible for more than 90 percent of exports, 85 percent of employment, and 55 percent of GDP.⁷ The export sector mainly comprises coffee, chat, oilseeds, pulses, livestock products and increasingly, horticultural products. The importance of coffee, the country's main export has diminished radically over the past five years, with collapsing coffee prices on international markets, leading to reduction in domestic production, and a reduction in the value of coffee exports from US\$420 million to US\$160 million.⁸

Despite the importance of the agriculture sector, its potential remains largely untapped. Less than a quarter of the potentially arable land is under crops. Agricultural production is largely on a subsistence scale, with 96 percent of cropped land cultivated by small-scale farmers, responsible for 90 percent of all agricultural production through mainly low-input, low-yield, rain-fed farming.⁹ This draws attention to the need to both increase productivity and commercialise farming by linking today's subsistence farmers to the national economy through trade.

The central problem is that this is a low-input, low-value subsistence-oriented, rainfed agriculture. It is dependent on a highly erratic rainfall regime and vulnerable to frequent weather fluctuations and drought episodes that often lead to failure. Ninety-six percent of cropped land is cultivated by small-scale, mainly subsistence farmers with low outputs and rare, if any surpluses.

The sector is based on some 10 million household farms, which produce over 95 percent of agricultural output. They are constrained by, among others, severe land shortages. The average household landholding is about one hectare.¹⁰ However, a large and increasing proportion of farm households in the highlands (20-25 percent) cultivate less than 0.5ha of land. This is often insufficient to feed an average rural family for a full year, even with adequate rainfall. They lack significant savings and have little capacity to make the investments needed to achieve any significant increase in yields.

The outcome is poverty. Ethiopia ranks 168 (out of 172 countries) in the Human Development Index, an assessment combining life expectancy, adult literacy, primary school enrolment rate and per-capita income. Ethiopia has one of the highest illiteracy rates in Africa, including 52 percent of adult males and 68 percent of adult females. Infant mortality is 97/1000. Average food intake is reported to be 1,840 calories per day,

⁷ Degu et al (2000), cited in Ethiopia: Trade and Transformation Challenges , V.2, Annex, Agriculture and Trade (Draft), July 8,2003,p5.

⁸ Ethiopia: Trade and Transformation Challenges , V.2, Annex, Agriculture and Trade (Draft), July, 2003.

⁹ Kuma 2002, cited in Ethiopia: Trade and Transformation Challenges , V.2, Annex, Agriculture and Trade (Draft), July 8,2003.

¹⁰ Deininger et al, "Tenure Security and Land Related Investment Evidence from Ethiopia," World Bank Working Paper, 2003, p12.

or about 17 percent below the average for Sub-Saharan Africa. Child malnutrition is widespread, with 47 percent of children under five significantly underweight. Moderate to severe wasting is reported among 11 percent of under-five children and moderate to severe stunting affects 52 percent.

Some four to five million people, 5.7%-7.1% percent of the population are chronic food insecure and require food aid from year to year on an ongoing basis. An additional six to seven million 8.5%-10% more are transitionally food insecure, and require food aid, when the rains fail or under-produce.

Overall poverty decreased in the 1990s, but it now appears that agricultural growth is failing to keep pace with population increase. Agricultural GDP expanded only slowly over the past decade and has suffered from large periodic weather shocks, variations in rainfall that have led to severe fluctuations in agricultural production. Between 1992/93 2002/03, agricultural growth averaged about 1.5 percent per year, with sharp variations in between, increasing up to 15 percent in a particularly good year and declining as much as 12 percent in a drought year like 200/03.¹¹ Excluding the drought year of 2002/03, the average growth estimate would have reached 2.3 percent per year, still less than population growth. The slow aggregate growth, however, masks the regional variation in performance, with the high potential and more food secure regions showing a relatively better trend.

The majority of the rural poor depend on agriculture or agriculture-related activities for their livelihoods. They often lack adequate resources in terms of land, oxen and farm inputs to increase their productivity. They are often the most vulnerable to drought and famine and the most likely to descend into destitution due to weather fluctuations. Many such households affected by drought shocks have lost key productive assets, or had to sell them to survive. In this context agricultural growth needs raising labor productivity, now less than one-fifth the average for Sub-Saharan Africa. It also needs diversification of income sources by producing higher value products, adding value through agro-processing and increasing opportunities for non-farm employment. In particular the orientation of agriculture has to shift from subsistence to commercial farming.

This will require changes in policy and patterns of public investment to address problems of poor market integration and lack of infrastructure. It will entail putting in place better infrastructure (e.g., roads, markets, irrigation, communication) and development of rural towns to serve as growth centers. Empirical evidence suggests a high rate of return to investment in rural roads by reducing transport costs and providing better access to markets. A more vibrant agriculture with better linkages to towns, markets and industry would spur rural non-farm activities, which are currently very limited but can be an important source of rural income growth and diversification.

Thus far, rural growth is constrained by, among others, lack of investment and private sector engagement in the development process in rural areas. This in turn, is linked to a poorly developed rural market system and the failure to develop significant off-farm,

¹¹ The growth estimate for the period 1992-93 to 2001-02, excluding the 2002-03 drought, is 2.3% which is still below the current population growth rate.

non-agricultural livelihoods in Ethiopia's rural areas. Other constraints include the lack of rural roads and other infrastructure, bureaucratic obstacles to trade and the absence of an effective legal framework to ensure the protection of contractual rights.

A key requirement for Ethiopia to emerge from its existing situation of stalled economic growth is to increase productivity, shift farming out of its subsistence mode, commercialise it and encourage diversification, by linking today's subsistence farmers to the national economy through trade. The lack of such linkages is a significant obstacle to rural growth. The constraints to realising this include the current subsistence focus of crop production, as well as lack of roads, leading to limited and therefore, costly access to transport and markets.

Rural markets tend to be informal, unregulated, and constrained by weak market linkages and lack of rural infrastructure. Most farmers live more than a half-days walk from the nearest road, and road density is among the lowest in the region. There is also a severe lack of institutional infrastructure that can facilitate farmers' links to markets and the overall economy. Traders, cooperatives, farmers' organizations and other local institutions that might be expected to contribute to market functioning, tend to be weak or absent.

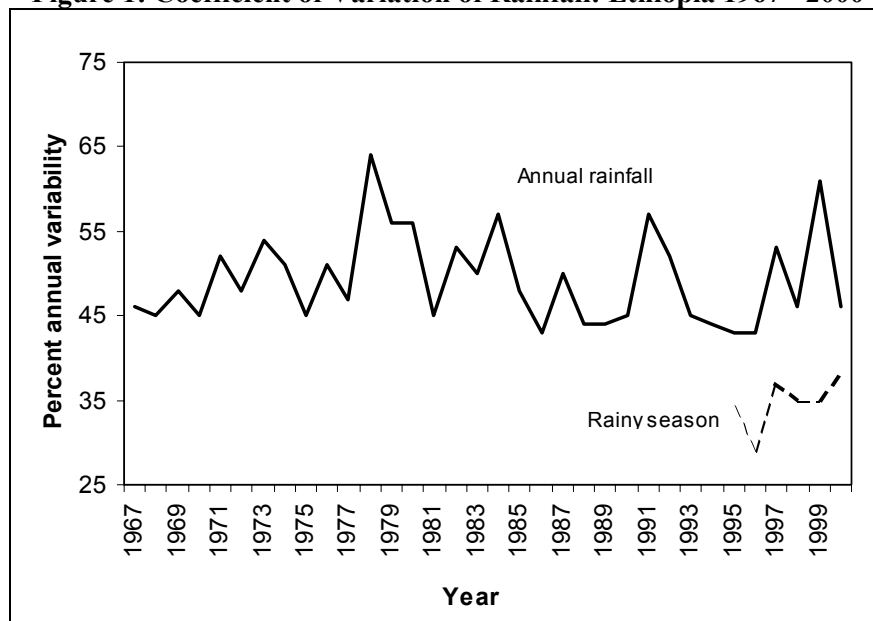
These weaknesses contribute to the subsistence orientation of the Ethiopian rural economy and constrain its growth. The nascent private sector of the pre-Derg period was devastated by the 'Socialist' oriented military regime, and is yet to regain its momentum. Private sector growth is constrained by a legacy of monopoly practices as well as weak infrastructure, limited human skills, poor access to land and finance, government bureaucracy and high taxation.

Most of Ethiopia's agriculture is based on cereal production in the highlands where most of the population lives. Due to this, most public investment has been focused on the highlands and most policies influenced by the perspectives and requirements of the highlands. This has often contributed to inadequate attention to some of the country's most valuable resources.

Agricultural productivity is generally low, linked to fluctuations in rainfall, and constrained by a subsistence orientation. The high probability of drought is a significant factor in the risk aversion behaviour of rural households.¹² Measures of variability (calculated over the 33 years between 1967-2000) across time and space show that, in any given year actual rainfall can deviate from the long-term average for an area by up to 50% (Figure 5). This suggests that even when the overall average rainfall may appear “normal”, many areas may experience significantly higher or lower than expected rainfall

¹² The highly variable and unequal distribution of rainfall implies that Ethiopia experiences pervasive drought risk. Between 1978 and 1994 alone, there were 15 droughts (and famines), with large numbers of households facing food and non-food consumption shortfalls during each year.

Figure 1: Coefficient of Variation of Rainfall: Ethiopia 1967 - 2000



Source: CSA data; World Bank staff estimates in *Ethiopia Risk and Vulnerability Assessment*, World Bank 2003 (draft).

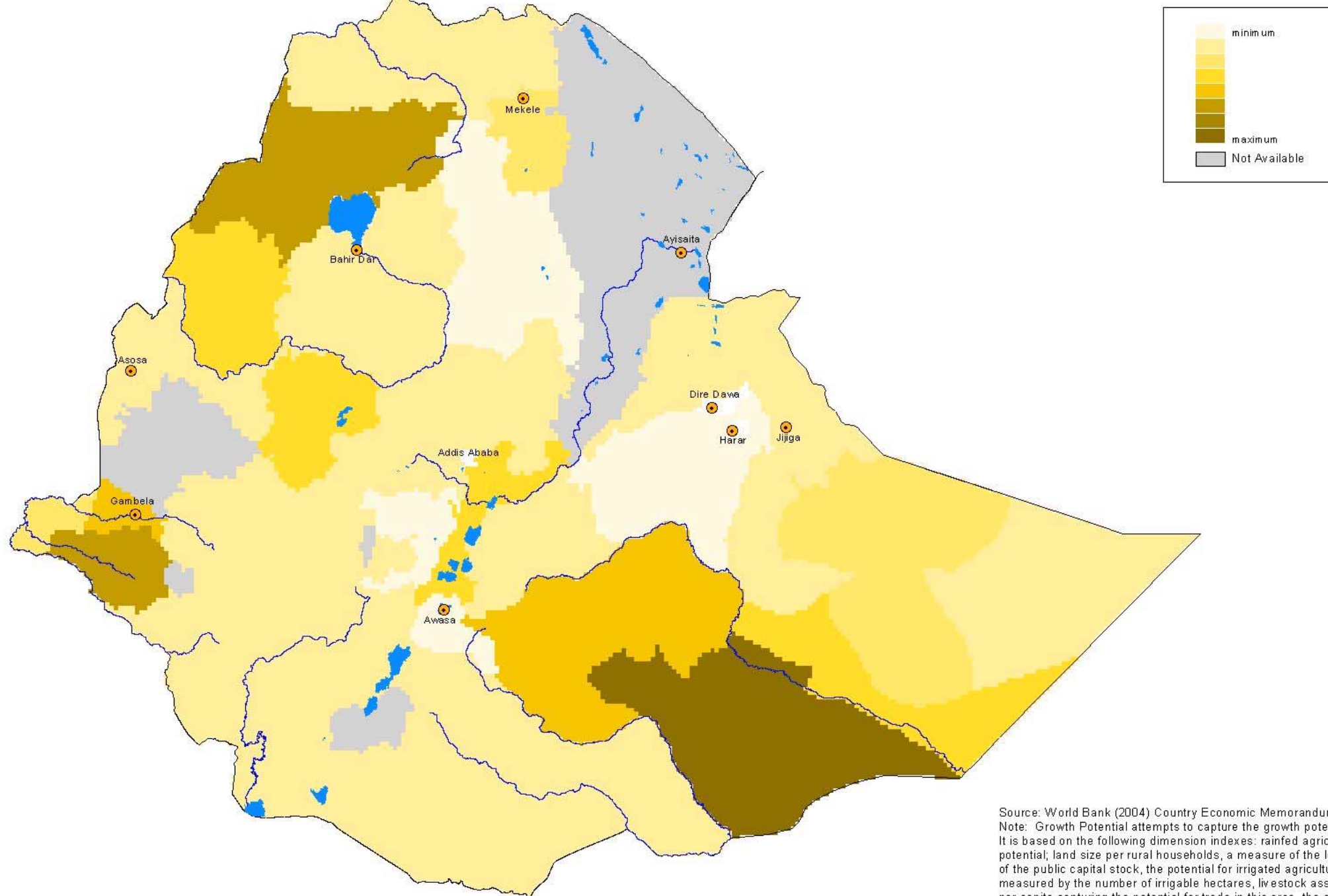
Water resource constraints are central to Ethiopia's poverty, low levels of agricultural productivity, and stalled development. As the above graph shows, rainfall has fluctuated from year to year. Agricultural growth has shown similar variability, reflecting its dependence on climate, particularly its linkage to rainfall. While the country has abundant water resources, it is unable to satisfy its minimum requirements for agricultural production and economic growth. This is due to the erratic nature of its rainfall and to lack of the necessary water infrastructure to use the country's water resources to provide adequate water when and where it is needed. Multi-purpose water infrastructure for irrigation and hydropower is essential to sustainable agricultural and industrial growth and economic development in Ethiopia.

2.1 Four Ethiopias

Ethiopia's diversity is a key source of both potential and vulnerability. Its diverse topographic and climatic features, agro-ecological zones, and degrees of access to land and reliable water sources, reflect its different levels of potential and limitations. From the perspective of spatial characteristics, endowments and developmental obstacles, there are four Ethiopia's, each separated from the others by topographical divisions, ecological conditions, and differing levels of vulnerability and potential.

Ethiopia's topography, multiple climates, current environmental status, and demography, along with its development history and infrastructure, underlie its principal economic burdens and endowments. Examination from these perspectives makes it possible to divide the country into four distinct regions with very different levels of development and growth potential. These comprise the 'four Ethiopias,' to be examined below.

ETHIOPIA — Growth Potential



Source: World Bank (2004) Country Economic Memorandum
 Note: Growth Potential attempts to capture the growth potential. It is based on the following dimension indexes: rainfed agriculture potential; land size per rural households, a measure of the level of the public capital stock, the potential for irrigated agriculture measured by the number of irrigable hectares, livestock asset per capita capturing the potential for trade in this area, the share of the active population employed in non-farm activities-a measure of the intensity of existing rural-urban linkages.

2.2 Methodology

The regrouping of Ethiopia's administrative zones is based on the spatial distribution of a wide range of factors and characteristics, burdens and endowments. These are used as indicators of development level and potential, and to identify areas of growth potential, where increased public investment in specific geographic and development areas, might make an optimal contribution to economic growth. The assessment of development status, potential and opportunities for growth is based upon the examination of 51 indicators in all of the country's administrative zones, and the classification of those zones into four socio-economic/development zones, comprising four different Ethiopias, or perspectives of Ethiopia and its problems and potentials. These are described as:

- Ethiopia One, the largely high risk-low potential eastern highlands with low-rainfall, land shortages and high vulnerability, but with a large surplus of labor that needs to be put to productive use through non-farm employment, urbanization, and enhanced labor mobility.
- Ethiopia Two, a mainly low-risk-medium potential Ethiopia, largely in the western highlands, but also including areas of Arssi and North Shewa with higher rainfall and more arable land, and both surplus labor and significant potential for increased production. It particularly needs investment in water infrastructure to develop irrigation and provide hydroelectric power for non-farm livelihoods.
- Ethiopia Three; the high risk-medium potential Ethiopia, with possibilities for growth in agriculture, livestock and off-farm employment, in some zones of the western highlands, as well as in lowland zones, with considerable potential for irrigated farming. The risks include drought, malaria and tsetse fly in some zones. Sustainable growth requires investment in water infrastructure and risk mitigation.
- Ethiopia Four comprises the high risk- high regions of the humid and sub-humid western lowlands, and the dry, southern and eastern lowlands. It also includes the largely highland East Wellega zone, combining medium potential with low risk in its highland parts, and large areas of high potential - high risk lands in its extensive lowland river valleys that cut through the high plateau.

Two of the four Ethiopias are found largely in the Highlands and reflect the significant differences that exist between the zones along the eastern escarpments, and the zones to the south and west. The main meher rains come from the passage of the moisture-laden southeasterly wind from the South Atlantic that rises over the western side of the plateau, depositing much of its moisture load before cooling and descending the eastern side. The eastern side experiences a 'rain shadow' effect and receives considerably less rain.

The central and southern reaches of the eastern highlands receive the Belg rains brought by the southeasterly winds from the Indian Ocean. But the zones along the northeastern face of the highlands have low average rainfall, limited agricultural potential, and severe shortages of arable land. Central Tigray and South Tigray Zones have an average 0.8ha per household, with 0.6 ha for East Tigray Zone. North Wollo and South Wollo Zones report an average of 0.6 ha per rural household. Across the Rift Valley on its eastern side in West Hararge, households had an average of 0.6 ha, and in East Hararge, 0.4 ha per rural household.

These figures include large numbers of households with less than 0.5 ha of land and little prospect of being able to grow enough food for their own subsistence. In East Tigray 40 percent of households, in Central Tigray, 31 percent of households and in South Tigray, 29 percent of households held less than 0.5 ha of land. In South Wollo, North Wollo and Wag Hemra zones, the respective figures were 49 percent, 38 percent and 20 percent, and in East Hararge and West Hararge, 50 percent and 34 percent respectively.

The southeastern face of the highlands to the west of the Rift Valley receives more rainfall, but it is also an area characterised by low potential and severe and increasing poverty, where population has far outpaced the region's limited potential at its current level of technology. Here, the staple crop switches from ox-plow based cereal cultivation to cultivation of the Ensete or false banana that is the traditional centerpiece of the southern highland diet. Ensete cultivation requires less land to support the same density of population, but here the level of population density is often two to three times higher than in the northeast

But there is yet another highland Ethiopia. It is more difficult to delineate geographically, and there are pockets of differing levels of potential but in some parts of the Rift Valley and parts of the western highlands, where rainfall is much higher and more dependable, there remain large areas with significant, though limited, potential for development.

Each of these four Ethiopias; the Highlands, divided by the great Rift Valley, the moist Western Lowlands, and dry Eastern Lowlands, reflects their shared context of dependency for survival and development, on the same three principal resources- land water and labor. For each of them water is central to development as a major source of potential and limiting factor, and the erratic nature of rainfall, an ever present risk. They also share a need for interchange and integration, within which, the comparative advantages of each can be put to optimal use in the context of a rural-based growth strategy. To achieve this, they need to capture and utilize their waters, and to do so; they must build the necessary water, road, health, and above all, policy infrastructures, to make this possible.

Despite their diversity and considerable resources, the four Ethiopias have been unable to effectively address their central problems of crushing poverty, exacerbated by recurrent drought, deteriorating terms of trade, and other economic and livelihood shocks. The country is beset by the convergence of a number of factors; the combination of rapid population growth, the inability of the land in many areas to food the entire rural population, the failure of towns and cities to grow, attract labor, and provide new livelihoods for the surplus rural population. This leads inexorably towards a slow deterioration of livelihoods that threatens crisis in the absence of new sources of growth. Much of Ethiopia's recent increases in agricultural production have been linked to temporary improvements in rainfall, or the expansion of cultivation into marginal lands. This in turn increases the variability of production, raising it temporarily, but with the likelihood of a future reduction with rapidly declining productivity of the marginal land. As is usual, improved rainfall has contributed to increased crop production. Some has also come from greater use of fertilizers and extension packages, but largely on crops like maize, with limited demand from the majority highland population, whose diet and culture are closely linked to injera, made from teff, the preferred local food-grain. A

sharp increase in maize production, together with imports of food aid, soon led to market collapse with heavy losses for many farmers who had invested their meager resources in inputs for this crop.

With or without fertilisers, the timely availability of adequate water remains a key factor for Ethiopia's almost entirely rainfed agriculture. If the country's erratic rains come late, end early, or diminish in volume, as is often the case, crops under-produce and sometimes fail entirely, leading to food shortages and increased poverty. The obvious answer is irrigation, but despite Ethiopia's considerable water resources, and the huge irrigation potential of several rivers running down from the central highlands, there is little development of the water infrastructure needed for irrigation.

The bottom line is increasingly, the fact that the highlands can no longer sustain their existing rural population. That population and its minimum requirements are rapidly expanding, but these are not matched by expanded production, nor by significant increases in productivity. This is clearly unsustainable and solutions must be found. One option that has been taken up is resettlement, but one whose problems should not be ignored.

Each of the four Ethiopias has important endowments with potential to complement those of the other two. Each also faces significant constraints that can be most effectively addressed through closer integration with the others in ways that take due advantage of the comparative advantages of each.

- Ethiopia One, the eastern low-rainfall, land deficit and high vulnerability face of the Highlands has a considerable surplus of labor that needs to be put to work.
- Ethiopia Two; the higher rainfall and more fertile reaches of the highlands, has both surplus labor and potential for increased production if the necessary infrastructure is made available.
- Ethiopia Three; includes medium potential zones of both highlands and lowlands, where medium levels of potential are accompanied by high risk factor.
- Ethiopia Four; includes zones of high potential and high risk, largely lying in the western, southern and eastern lowlands.
- The Western Lowlands, have vast expanses of land suitable for rainfed mechanised agriculture as well as irrigated farming if adequate measures are taken for tsetse fly eradication, malaria control, and roads to link the region with the national economy. Ethiopia Three has considerable potential for economic growth if supported by adequate public investment in infrastructure, irrigation, tsetse fly eradication, and human and animal health measures.
- The Eastern Lowlands, also have significant potential for irrigated farming and livestock raising, and important contribution to development and economic growth if the necessary public investment is made available in the areas of development of water resources, animal health, and transport infrastructure is made available.

Realization of the potential contribution of each of the four Ethiopias will depend upon the availability of adequate and appropriate investment. It needs initially public investment that takes full account of the imperative of rapid growth and the realities that may constrain it, and which stimulates the longer-term contribution of private investment.

3. Ethiopia One: The Low Potential – High Risk Eastern Highlands

Ethiopia One comprises the eastern, low potential side of the highland, much of it, lying along, or near, the eastern escarpments of the Rift Valley. It is divided into three areas. The first, in the north, includes the eastern, central and southern zones of Tigray Region, and the Wag Hemra, North Wello, South Wello, and Oromiya zones of the Amhara Region. The second area, in the southern highlands, comprises a group of zones and special districts lying along the same escarpment. The third, lying across the Rift Valley along another escarpment, jutting out to the east, includes the East and West Hararge zones.

A recent study of the three northeastern zones of the former Wello Province identifies the key problems shared by much of the northeastern highlands.¹³ This predominantly high altitude region includes steep gorges, dividing highland regions, and slopes leading down to lowland plains. Its topography and paucity of roads, creates difficult problems for the inhabitants in terms of inaccessibility and their lack of access to communities, towns and markets. It has too many people on too little land, much of it severely degraded. Its erratic and inadequate rainfall exacerbates these problems, leading to low agricultural productivity, declining availability of arable land, and low per-capita food production.

¹³ Stephen Devereaux, "Destitution in Ethiopia's Northeastern Highlands (Amhara Region), Save the Children UK.

Table 1: Ethiopia One: The Eastern Highlands Areas of Low Potential and High Risk

Zones	%Elec. Access	Road Density Km/ 1000 Sq. km	Irrigation Potential /Ha.	Size of Rural hsehd land- holding	Live- stock/ hsehd TLUs	Gross Primary Enrollment	Gross Secondary Enrollment	% non- farm Employment	% area Exposed to Malaria	% area Tsetse Affected	Drought Risk
N. Wello	6%	69.7	0	0.7	0.7	48%	10%	13.2%	27%	0%	577
S. Wello	13%	76.1	0	0.7	0.6	63%	12%	10.6%	45%	0%	557
Wag Hemra	5%	30.3	0	0.9	0.9	35%	5%	8.1%	100%	0%	622
Oromiya	5%	23.9	0	0.6	0.5	25%	3%	10.9%	100%	0%	565
W. Hararge	3%	39.6	13,536	0.7	0.5	53%	10%	13.0%	44%	0%	367
E. Hararge	9%	23.6	15,886	0.5	0.6	55%	8%	16.4%	92%	0%	372
Gurage	3%	95.4	0	0.5	0.2	79%	12%	18.9%	18%	38%	319
Kembata A.	2%	109.8	300	0.6	0.5	73%	23%	10.7%	74%	0%	320
Sidama	8%	137.4	0	0.3	0.5	68%	18%	15.4%	72%	0%	329

The Burdens

Geography

Ethiopia One has multiple burdens, beginning with geographical constraints. It lies along the eastern flank of the highlands. Ethiopia's main rains are brought by the southwesterly winds from the South Atlantic and rise across the western side of the plateau, and the uplands that divide it from the eastern side. They lose much of their moisture before cooling and descending the eastern escarpment, leaving the eastern highlands in a rain shadow. Covering some 98,342 sq kms, Ethiopia One has a population of some 15 million or about 21.6 percent of Ethiopia's total population, with a population density of 151 per sq km.

The population problem

Even four decades ago, the levels of human and infrastructure capital stocks, and the immediate factors of production, land and livestock availability were already extremely low. Subsequent progress has done little more than keep pace with population growth, and often, not even that. In the eastern highlands, average population density has reached 151/sq km, with unsustainable pressures on arable land. But urbanization remains extremely low at 8 percent, as compared to the still very low national average of 15.5 percent. The rural population cannot support itself by farming. Here, most households have an average household plot size of less than 0.6 ha of land, and many of them less than 0.5 ha. The total production of 'temporary crops,' which are mainly food crops, is only 1.1 quintals per capita, far less than minimum food requirements. Nevertheless, only 14 percent of the active population is employed in non-farm activities.

The shortage of arable land is a key factor, throughout most of the eastern highlands, with average household landholdings of only 0.6 ha. In the northeastern grain-dependent zones of Ethiopia One, average household landholdings are extremely low at 0.6 ha. Only Wag Hemra zone has average household landholdings of 0.9 ha. In all of these zones a large proportion of households cultivate less than two timad (0.5ha) of land, less than the minimum required to fulfill the minimum food needs of an average household for a year.¹⁴ Some 18.4 percent of households own no livestock, without which they lack the draught power to cultivate their land. Many such households rent out part of their land.¹⁵

The environmental trap: accelerating land degradation

The constraints and risks imposed by the region's low and erratic rainfall are central to its poor agricultural productivity, frequent crop failures and chronic poverty. These exacerbate a series of other problems including widespread land degradation often related to such factors as nutrient depletion due to lack of fallowing or return of crop residues to the soil, low levels of fertiliser use, and generally low levels of agricultural technology and inputs.

¹⁴ Stephen Devereaux, "Destitution in Ethiopia's Northeastern Highlands (Amhara Region), Save the Children UK.

¹⁵ *Ibid.*

Overall, Ethiopia One has some of the country's highest levels of soil erosion and soil nutrient depletion. Soil nutrient depletion, estimated at 26,300 mts/per annum, is equivalent to an opportunity loss of some 1,043,000 qtls of cereal production, or about 7.0 percent of the total cereal production of Ethiopia One.

The results of dependence on a declining and under-producing subsistence agriculture economy exacerbated by unreliable rainfall are manifested in widespread structural food deficits and associated structural dependence on food aid. The problems are made worse by farming systems that contribute to accelerating land degradation, decline in the productivity and availability of arable land, and the diminishing size of household plots linked to rapid population increase.

The highlands are affected by massive land degradation arising from deforestation and cultivation of steep slopes together with ineffective or inadequate watershed treatment, and uncontrolled grazing of livestock on steep watersheds. In some parts of the Ethiopia One, more than 50 percent of the land area is affected by soil erosion, with 25 percent being seriously eroded and four percent no longer productive.

Due to the high rates of soil erosion, the soil in many areas has been eroded down to depths of 20-30cm. This means that it is reaching the lower limits of productivity and has lost much of its capacity to retain moisture. Much of the land in the highlands has undergone drastic reductions in productivity over the past few decades, and much has been rendered more or less unproductive, through processes of degradation that are continuing and in many places accelerating.

The process is continuing with household plots shrinking below minimal livelihood levels, and pasture availability decreasing. Increasingly poor farmers are forced to feed crop residue to their livestock and use manure for fuel rather than fertilizer leading to further soil degradation and declining productivity.

The Amhara Region's Wag Hemra, North Wollo and South Wollo zones, the former Wollo Province, with a population of about 4,670,000, lie along the eastern face of the northern highlands. Leaving aside the town of Dessie, the only significant urban center in the three zones of the former Wollo, the remaining population amounts to some 4.5 million, of whom 90 percent are rural and largely dependent upon subsistence farming for their livelihood. The three zones depend on a bi-modal rainfall regime with cultivation in both meher and belg seasons. However, rainfall is erratic with frequent shocks and crop failures.

This clearly indicates their limited agricultural potential in the absence of some form of irrigation, and helps to explain a heavy reliance on food aid and migration, off-farm employment, which could make a significant contribution, is in very short supply. This appears to be related to the low level of urbanization, the wide dispersal of the rural population over large areas, the scarcity of local urban centers, and low levels of physical and human capital stocks.

Agricultural growth in the context of Ethiopia One has limited potential, but even to realize the existing potential, needs the intensification and commercialization of agriculture. But the effective intensification of agriculture in Ethiopia One, will require the increased use of farm inputs including irrigation. In the context of Ethiopia's erratic and unreliable rainfall regime, water - reliable water supply- is the most crucial factor in effective crop production.

It will also require more integrated markets to allow the growth of effective demand, putting in place better infrastructure (e.g., roads, markets, irrigation, communication) and development of rural towns to serve as growth centers. Empirical evidence suggests a high rate of return to investment in rural roads by reducing transport costs and providing better access to markets. A more vibrant agriculture with better linkages with town centers and industry, and increased availability of electric power, would also spur non-farm activities, such as crop processing, which are currently very limited but could be an important source of rural income growth and diversification.

The potential for this is limited and likely to be costly. The key challenges include:

- Severe shortages of arable land in large areas of the northern/central highlands with up to a third of households in some zones cultivating less than the minimum area needed for subsistence.
- Large sectors of the rural labor force unemployed/underemployed for much of the time.
- Low availability of off-farm employment opportunities.
- Low level of rural road and transportation access.

The subsistence farming trap

Water is the central issue; water availability where and when it is needed to prevent the loss of crops and ensure and enhance their growth. Without it there are few agricultural solutions for Ethiopia One. Temporary increases in rainfall have contributed to occasional recent improvement in crop production, as has increased use of fertilizers and extension packages in some areas. However, with or without fertilizers, the timely availability of adequate water remains the key factor for Ethiopia's farm production, particularly in the low rainfall, low productivity areas of the eastern highlands.

The obvious answer is irrigation, even supplementary irrigation to tide crops over periods of drought stress when rainfall is delayed or interrupted, or ends prematurely, could make a significant contribution to Ethiopia One's agricultural production and significantly reduce vulnerability in several areas of the eastern highlands. But, thus far there has been little development of the water infrastructure needed for irrigation, and inadequate serious study of the problems and opportunities involved.

The effective intensification of agriculture is often linked to the movement from subsistence farming to commercial agriculture, as is the effective and sustainable introduction of irrigation. There is little scope for large-scale irrigation in the eastern highlands, but where the priority goal is poverty-reduction in-situ for highland

subsistence farmers, through enabling them to become smallholder commercial farmers, then small-scale irrigation in combination with extensive watershed rehabilitation can be part of the solution, but one unlikely to have an early impact on wider issues of growth for acceleration of overall economic development.

Microdams can make a significant contribution, in some, but not all areas. But they need to be approached from the perspective of a means of expanding the cash economy of specific rural communities by providing increased cash earnings and employment opportunities, rather than as a means of enhancing subsistence farming. In view of the cost, they need to focus on growing high value crops for accessible markets, rather than staple grains. As such crops are likely to be perishable, and transport is costly, the appropriate sites for microdams are likely to be in close proximity to roads and market towns.

Ethiopia One offers little potential for agricultural based growth. Improved agricultural production may provide a temporary safety net, but little more than that. The future lies in acceleration of urbanization and non-farm employment, together with enhanced labor mobility, to provide productive employment for Ethiopia One's huge under-employed labor force.

Potential/Endowments

Ethiopia One's most important endowment is its surplus highly industrious, but often seriously under-employed labor force that needs to be encouraged and assisted to move to where employment and other opportunities are to be found. This will involve considerable migration to urban areas, and in particular to lowland regions that have much greater resources and development potential.

Sustainable migration will require significant investment in the potential areas of reception to provide the necessary physical and other infrastructure to enable the creation of livelihood opportunities for migrants. It will also need increased investment in training, enhancing the capacity of potential migrants to undertake non-agricultural employment, and stimulating the growth of rural towns and the informal sector as sources of non-agricultural livelihoods. The current efforts at development of the country's vast hydroelectric power potential can contribute significantly to this. An example may be seen in India, where the availability of cheap electricity has contributed to the growth of a large informal sector in rural areas and small towns, where it makes an important contribution to employment. Similarly, as in India, there is potential, if affordable electricity is available, for pump irrigation in some areas, from ground water sources, and small streams.

4. Ethiopia Two: The Medium Potential – Low Risk Western Highlands

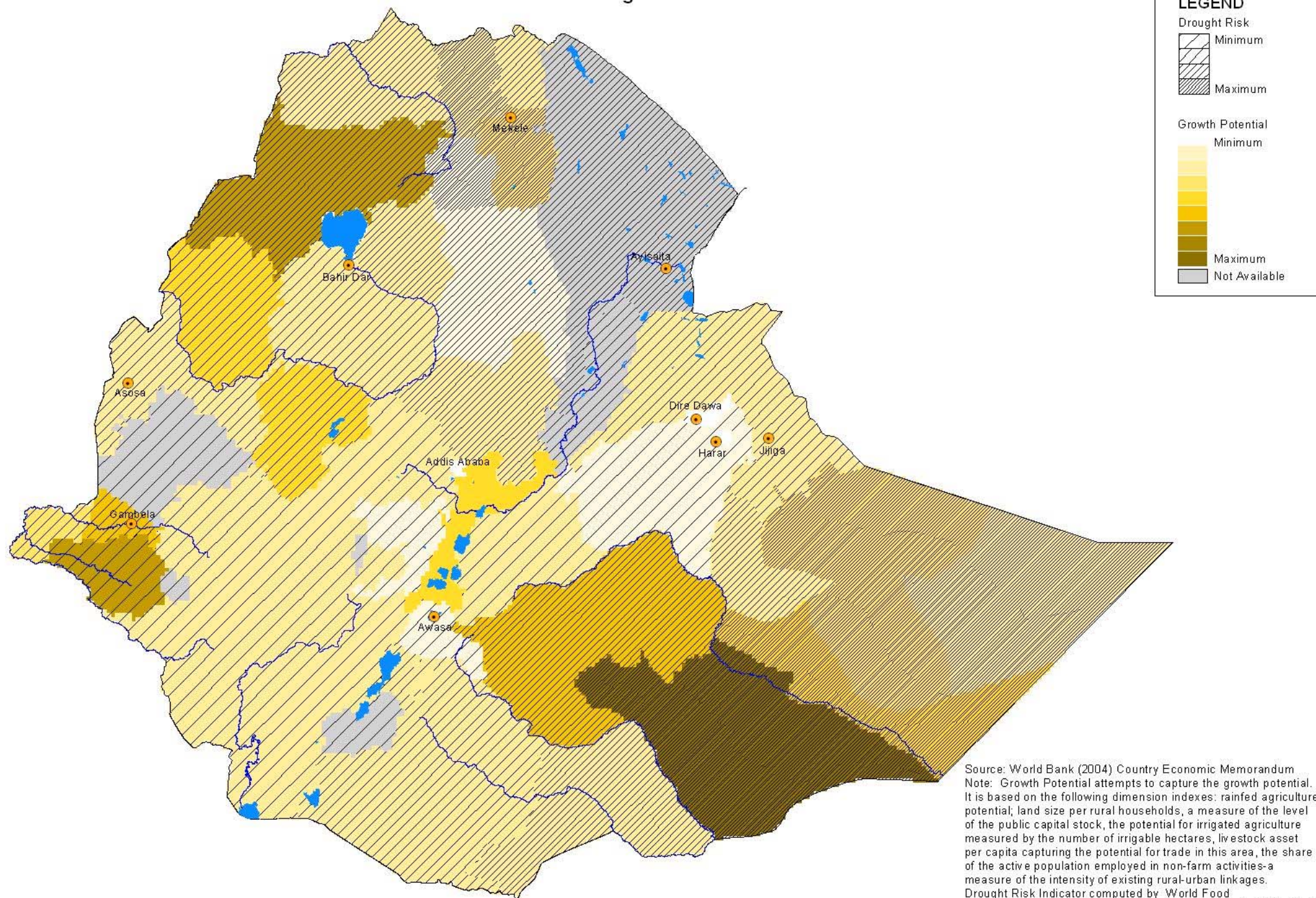
Ethiopia Two comprises a group of mainly low risk-medium potential zones lying mainly along the high rainfall, western slope of the highlands, including East and West Gojam, West Wellega, West Shewa, as well as the North Shewa and Arssi zones. These zones have generally have substantially higher rainfall than the eastern side of the plateau. They have also have more availability of arable land. The average size of household

landholdings at 1.1 ha is almost double the average for Ethiopia One. Its average per capita production of temporary (mainly food) crops is also double the average for Ethiopia One, and it has a higher level of ownership of livestock, a key component of the highland agricultural production system.

This reflects lower levels of vulnerability, and significantly higher agricultural potential in most of the western highland zones, as well as Arssi and North Shewa (R3). These are also zones with a significantly higher level of use of the available technology. Here, some 40 percent of the cropped areas use fertilisers, as against a much smaller proportion in Ethiopia One, and the intensity of fertiliser use, is almost double that of Ethiopia One. In these zones there is at least a moderate potential for growth, but this could be threatened by high and increasing levels of environmental degradation.

The agricultural potential is not of a magnitude to turn around Ethiopia's economy, but if supported through improvements in water resource development together with transport, market infrastructure, and policy improvements, could make significant contributions.

ETHIOPIA — Growth Potential and Drought Risk



Source: World Bank (2004) Country Economic Memorandum.
 Note: Growth Potential attempts to capture the growth potential. It is based on the following dimension indexes: rainfed agriculture potential; land size per rural households, a measure of the level of the public capital stock, the potential for irrigated agriculture measured by the number of irrigable hectares, livestock asset per capita capturing the potential for trade in this area, the share of the active population employed in non-farm activities—a measure of the intensity of existing rural-urban linkages. Drought Risk Indicator computed by World Food Programme/Vulnerability Analysis and Mapping Unit, Addis Ababa, Ethiopia, 2003.

Table 2: Ethiopia Two: Medium Potential – Low Risk Western and Arssi Highlands

Zones	%Elec. Access	Road Density Km/ 1000 Sq. km	Irrigation Potential /Ha.	Size of rural hsehd land- holding	Live- stock/ hsehd TLUs	Gross Primary Enrollment	Gross Secondary Enrollment	% non- farm Employment	% area Exposed to Malaria	% area Tsetse Affected	Drought Risk
S. Gonder	4%	66.1	41,472	1.0	0.6	49%	9%	14.0%	55%	0%	514
N. Shewa. 3	7%	55.0	26,474	1.1	0.8	62%	12%	14.9%	41%	0%	510
E. Gojam	6%	56.7	7,632	1.1	0.7	61%	11%	19.5%	40%	38%	454
W. Gojam	8%	24.2	105,224	1.1	0.6	66%	13%	11.4%	61%	30%	447
N. Shewa. 4	4%	41.4	0	1.2	0.9	48%	12%	15.7%	39%	14%	487
W.Shewa	9%	54.7	28,817	1.2	1.0	61%	19%	14.5%	21%	49%	372
Arssi	4%	45.0	9,944	1.2	1.1	84%	22%	16.5%	17%	0%	364

The Burdens

Geography

Most of the northern and central zones of the western highlands form part of the Nile Basin drainage system. These areas tend to have higher, though still erratic rainfall, than the eastern highlands, and less frequent and severe drought. If the rains come a few weeks late or end a few weeks early, crops are likely to fail or be much reduced. However, land shortages are less severe and the western highlands are characterised by larger household landholdings, and often, higher productivity, than in Ethiopia One. These medium potential-low risk, largely western highland zones are the source of almost 38 percent of Ethiopia's production of temporary (mainly food) crops. The areas comprising the current zones of West and East Gojam were long known as the 'bread basket' of Ethiopia.

The existing subsistence agriculture system of the Nile basin highlands has long been recognized as unsustainable, particularly in view of the accelerating population increases of the past generation. Land-use studies show that under present cropping practices, the sustainability of production cannot be guaranteed if fallow land, grazing and forest areas are reduced to a proportion of less than 1.7 ha for every hectare of cultivated land.¹⁶ One cultivated hectare can feed an average of 5 people (10 quintals of cereals).¹⁷ But the current size of household landholdings is often much smaller.

This increasingly means that the same small plots must be planted to grain year after year, leading to a rapid decline in productivity and increasing land degradation and soil erosion. With deforestation and soil erosion, the land loses its capacity to retain moisture. When it rains, most of the water runs off, taking considerable topsoil with it. What is retained in the soil is often insufficient to keep crops alive until the next rain, especially when there are serious gaps in rainfall at the start of the growing season.

The population trap

Like Ethiopia One, Ethiopia Two has a large and rapidly increasing population problem. The zones comprising Ethiopia Two's medium potential-low risk highlands have an overall population density ranging from 120 to 175/sq km., and shortages of arable land are increasing, with only 15 percent of the active population employed in non-farm activities. The combined effects of population growth, massive environmental degradation, leading to declining food production, and of recurrent drought, have worsened food insecurity and increased the vulnerability of a large proportion of rural households. This is linked to a variety of inter-related factors, including land shortage, environmental degradation, and the general un-reliability of rain-fed agriculture.

These are frequent sources of absolute poverty, which is about the basics; food, shelter and clothing; and access to clean water, health, education, and other social services. It is first of all about productivity and food insecurity, which is the face of absolute poverty.

¹⁶ BCEOM: Abbay Master Plan, Section II, Vol. V, August 1997.

¹⁷ BCEOM: Abbay Master Plan, Section II, Vol. V, August 1997.

Absolute poverty means a vicious circle of chronic malnutrition, poor health and sanitation, and poor housing. All of these combine to exacerbate poor productivity and give poverty a self-sustaining momentum of its own.

Most potentially arable land that is not already cultivated is actually marginal land and the economic or ecological costs of bringing it under cultivation, are often prohibitively high. Such marginal areas often require heavy investment in irrigation, modern technologies and conservation. This is one of the reasons that with expanding populations, per-capita cultivated land shows a significant decrease.¹⁸

There is still potential for growth and poverty reduction in large areas of the western highlands. But there is also the inescapable reality that with growing population pressure on land, extensive systems of cultivation are no longer sustainable. Large and rapidly increasing numbers of farming households cannot fulfill their basic needs from agriculture and soil erosion is rapidly destroying the limited land resources. The need is for more intensive agriculture with greater use of farm inputs, including irrigation.

The environmental trap: accelerating land degradation

Environmental degradation, land shortage and lack of water resource development, are among major causes of food insecurity and extreme poverty in some areas of the western highlands. Ethiopia Two is increasingly affected by soil erosion and degradation resulting from nutrient depletion. With increasing deforestation, there is increasing reliance on use of manure and crop residue for fuel, rather than soil enrichment. Biofuel consumption is 16,088,216 mts, with soil nutrient losses estimated at 50,574mts, representing an equivalent loss of 2,152,060qtls of cereal production.

Even large areas of the “bread basket” zones of East and West Gojam, are now at high risk from soil degradation. The rates of soil loss from cultivated land are reported to include some of the country's highest.¹⁹ These issues are all closely inter-related in a vicious and self-reinforcing circle, a rapidly accelerating downward spiral marked by increasing poverty, desperation, and migration.

In the western highlands, with high rainfall variability, without significant access to irrigation, and with almost total dependency on unpredictable rainfall, climatic shocks have a direct effect on the vulnerability of smallholder farmers. Limited access to reliable water for agricultural production restricts widespread adoption of high yielding varieties and makes fertilizer use risky.

The lack of adequate access to land and water, together with increasing environmental degradation, has led to permanent food deficits, chronic poverty and household food

¹⁸ Belay Tegene, “Population Pressure and Problems of Arable Land Degradation in the Ethiopian Highlands,” Paper prepared for Workshop on Integration of Population, Environment, Equitable and Sustainable Development Issues into the Curriculum of the Demographic Training and Research Center,” Addis Ababa University, Addis Ababa, Ethiopia 18-19 April, 1995.

¹⁹ Ethiopia: World Bank Rural Development Policy Note, Water Sector and Irrigation, April 2003.

insecurity in a large and growing proportion of farming communities across the Ethiopian highlands.

Infrastructure and connectivity constraints

Ethiopia Two's extremely low capital stock is a major development obstacle. The total length of its road network is just 5,628 kms, a road density of about 49 kms/1000 sq kms, or some 0.34kms/1000 population. Most of the inhabitants are isolated, living more than a half-day walk from the nearest road. Access to electricity and to communications is also very low, with only 9 percent of the population having access to electricity and only 2 operational telephone lines/1,000 population. The levels of human and physical infrastructure for health and education coverage are low. There are only 0.3 health professionals per 1000 population. Only about 50 percent of the population is immunized and 38 percent have access to health service coverage. Over half (53 percent) of the area is exposed to malaria and 46 percent of the population is vulnerable to malaria. The educational base is also low, with gross primary enrolment of about 61 percent and gross secondary enrolment around 15 percent.

Ethiopia Two has considerable irrigation potential, in excess of 219,00 ha of irrigable land, but little irrigation infrastructure. Only some 2,537 ha are under irrigation. Development of this potential could make an important contribution to growth.

Lack of urbanisation

One of the major problems of Ethiopia Two is its extremely low level of urbanisation at only 11 percent. As elsewhere in Ethiopia, the population is mainly rural and the rural population is widely scattered with an unusually low incidence of significant population concentrations. The lack of urbanization and the market opportunities that it would provide, contributes to the subsistence farming syndrome.

The key challenges of Ethiopia Two's economy include:

- Shortages of arable land
- Large sectors of the rural labor force unemployed/underemployed for much of the time.
- Low availability of off-farm employment opportunities.
- Low level of rural road and transportation access.
- The lack of adequate access to land and water, together with increasing environmental degradation,

The subsistence farming trap

More than 90 percent of the rural population of Ethiopia Two depends on mainly rain-fed subsistence agriculture using farming methods that tend to contribute to soil erosion and loss of soil productivity. This is unsustainable and has to be addressed through shifting to commercial farming. This requires intensification of the crop production system, including irrigation to ensure the reliable availability of water. Commercial farming involves investment, and therefore risk, but subsistence farmers have learned to be risk

averse, as they have little margin for error. To invest their meager resources in commercial production, they need to be sure of markets, but large infusions of poorly timed food aid, sometimes disrupts those markets. This strengthens the tendency to risk aversion and discourages investment in increasing production.

Potential

The western highlands benefit from substantially higher rainfall than the eastern side of the plateau. The average size of household landholdings is also higher, about 1.1ha or almost double the average for Ethiopia One. This is reflected in the level of production of temporary crops (mainly food), which is 2.2 quintals per capita, double the average 1.1 quintals per capita of Ethiopia One. The level of livestock ownership is also higher, with an average of 0.7 tropical livestock units (TLUs) per household, compared to 0.5 TLUs in Ethiopia One. In Ethiopia Two, 40 percent of the cropped areas uses fertilizers as compared to 33 percent in Ethiopia One, and the intensity of fertilizer use is higher with an average of 0.32 quintals per hectare, versus 0.17 quintals/hectare.

There are sustainable solutions to be found in the western highlands, but they need more intensive farming, soil and water conservation. In particular, they require the use of available water sources for irrigation to reduce dependency on marginal lands and development of hydroelectric power as a basis for non-agricultural livelihoods. Off-farm livelihoods are essential to support populations no longer able to survive from subsistence farming on their degraded lands and enable them use their labor resources to produce and contribute to economic growth.

Lack of water resource development, particularly for irrigation, is the most critical factor limiting agricultural productivity and growth in the Western Highlands and the restoration of food security in the Ethiopian Nile basin. The critical importance of irrigation is explained by international experts Abu-Zeid and Biswas, who stress that Prospects for sustainable increase in productivity of rain fed agriculture are limited and that most future agricultural growth will depend on expanded irrigation.

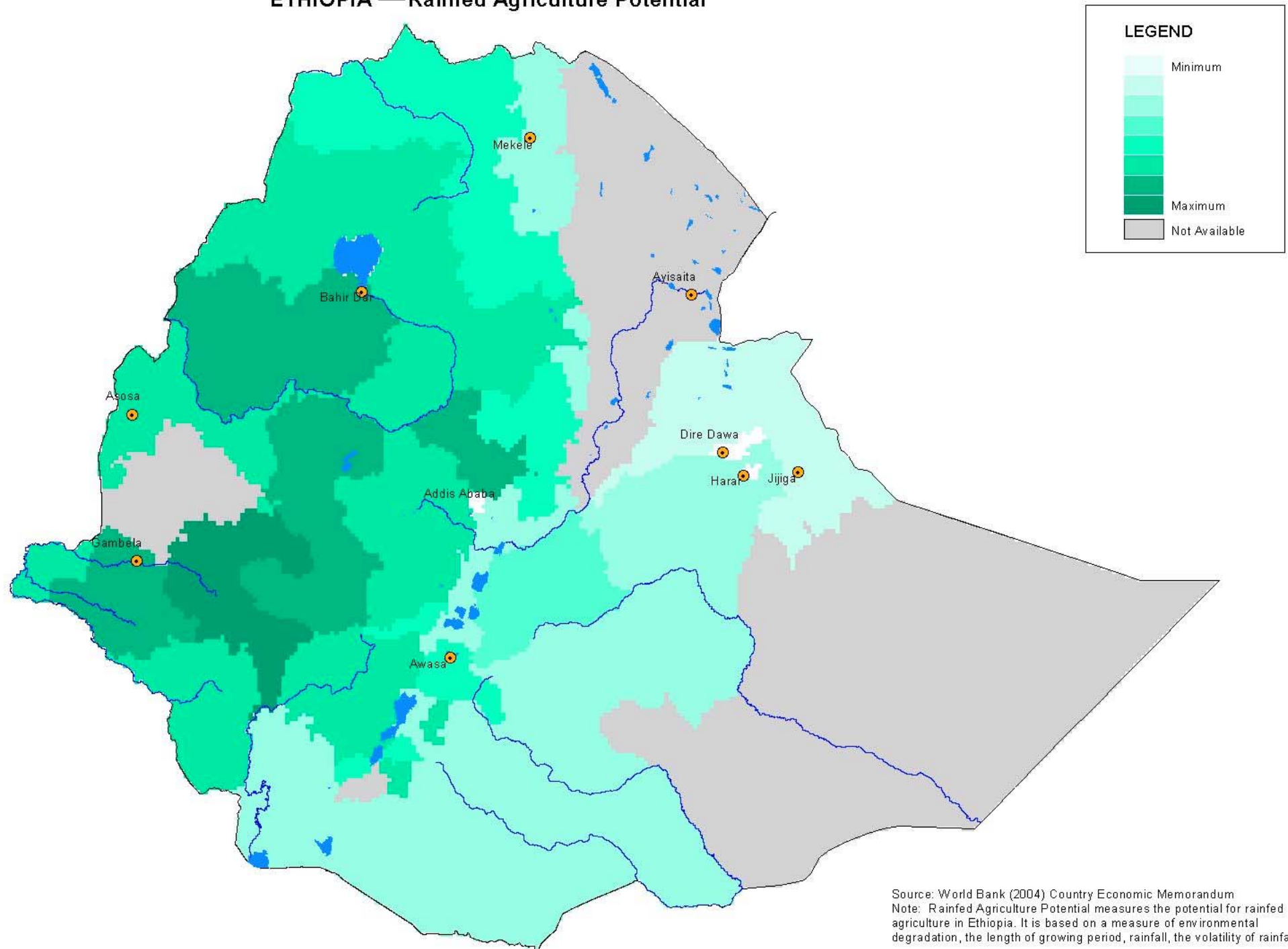
Nile Basin: Water Resources and Agricultural Development

“Not withstanding the fact that land is indispensable for agricultural production, it is water, rather than land which is a binding constraint. It is only when this water constraint is released that the other technical constraints such as nutrients and pesticides become important” (Abu-Zeid and Biswas, 1996). ⁱ²⁰

Reliable access to agricultural water is a fundamental condition to improving food security and achieving sustainable progress towards development objectives in Ethiopia Two. A more reliable access to water through investments in water management infrastructure could enable farmers to reduce the dangers of crop failure and risk of indebtedness from fertilizer purchase, thereby contributing to increased productivity. Secure water supply encourages investment in inputs to enhance productivity by diminishing the uncontrollable risk from erratic rainfall.

²⁰ Abu-Zeid, Mahmoud and Biswas, Asit K., *River Basin Planning and Management*, Calcutta, 1996, p13.

ETHIOPIA — Rainfed Agriculture Potential



Source: World Bank (2004) Country Economic Memorandum
Note: Rainfed Agriculture Potential measures the potential for rainfed agriculture in Ethiopia. It is based on a measure of environmental degradation, the length of growing period, rainfall, the volatility of rainfall.

Irrigation in the western highlands

Ethiopia Two, the western highlands, has adequate rainfall to improve its agricultural production, but most of this rainfall, either runs off or sinks into underground aquifers beyond the reach of growing crops, before it can be put to use. This is a problem that needs to be solved through development of water storage and irrigation.

Despite the recognised potential of irrigation, even supplemental irrigation at critical points in the growing cycle, to enhance crop production, and contribute to poverty reduction, food security and economic growth, little has been done about it. Irrigation in Ethiopia remains insignificant.

Reliable access to agricultural water is fundamental to progress towards achieving Ethiopia's agricultural development and poverty reduction objectives. Reliable access to water through investments in water management infrastructure puts a high premium on the use of productivity enhancing inputs, provides more flexibility, diversity, reliability, quantity and quality and capacity to meet market requirements. It can also enable farmers constrained by land shortages to produce more and also to capture higher seasonal prices. In addition, it reduces vulnerability related to rainfall variability and provides a more solid basis for policy reforms.

Irrigation potential is limited in the western highlands. Nevertheless, it exists on a significant scale. The opportunities for large-scale irrigation is considerably lower than in the lowlands, but such opportunities exist and need to be considered. The irrigation potential of Ethiopia Two is some 219,000 ha for large and medium scale irrigation, but also significant potential for small-scale irrigation in many areas.

For example, the proposed Megeche Scheme, near Lake Tana was designed to provide pump irrigation on 25,000 ha. The Megeche area is one of the few relatively flat and unbroken sites in the highlands that are conducive to large-scale surface irrigation.²¹ There are indications of considerable potential for development of pump irrigation in several areas of the western highlands, but the development of this potential on an economically viable basis is likely to require the availability of cheaper sources of power. As has been the case elsewhere, the development of cheap hydroelectric power could open the way to widespread development of pump irrigation.

A properly comprehensive approach to supporting investments in water management infrastructure should focus on the wide variety of environments that exist in Ethiopia. Supporting investments in small-scale water management requires providing stakeholders with a knowledge base that would aid them to understand which technologies are available and appropriate under specific local conditions, and empowering communities to make informed choices from among them. This would aid demand-driven rural development projects to be more effective in addressing real concerns, and it would increase the sustainability of their investments.

²¹ Waterbury, John, Yale University Press, New Haven and London, 2002, p.116.

From the perspectives of food security and poverty reduction, the construction of small dams and micro-dams makes sense in the highlands, but need to be carefully planned with particular attention to site assessment. There are cheaper irrigation technologies i.e. modern river diversions and traditional river diversions. But, taking into account the erratic nature of the rainfall regime, and the frequency of drought, there is a need to consider the importance of having the water available when and where it is required. For instance, many small rivers in the highlands will be at their lowest during the dry season and during drought episodes, when water is most needed. That might affect their capacity to effectively support river diversion projects. This draws attention to the importance of rainy season water storage to ensure dry season water availability, and the need for dams.

The development of small dams may be seen as a relatively expensive method of providing small-scale irrigation, compared to, for instance, modern river diversions. However it also has certain comparative advantages. The extreme variability of the rainfall regime makes small dams a more effective means of ensuring that water is available when required. During the dry season, and particularly during drought episodes, many small rivers may be at their lowest when needed for irrigation. While relatively more expensive, compared to some other sources of irrigation, dams may be more effective and economical in the longer term.

Nevertheless, small dams, if well planned and implemented can be economically viable long-term investments in rural communities with an operational life of 30 years or more. However, a key requirement under Ethiopian conditions is that the dams are established in "effectively protected watersheds." Other essential requirements include appropriate professional technical input in site selection and planning of dams to ensure the effective use of resources, and subsequent provision of irrigation extension, efficient scheme management, an effective marketing strategy and, means for, at least partial cost recovery." ²²

While dams are more expensive, they are also much more reliable, and often more effective, than 'water harvesting. A World Bank commissioned study on "Promotion of Small-Scale Irrigation in Food Insecure Woredas of Ethiopia" finds that while, a relative expensive solution, compared to 'water-harvesting' small dams and micro-dams, if well-planned and implemented, are economically viable in the longer term." ²³

The 15-year Ethiopia Water Sector Development Program (WSDP) proposes to develop 127,000 ha of small-scale irrigation, benefiting up to 503,000 farm households at a cost of US\$606m. Close to 85 percent is located in Amhara, Oromiya, Tigray and SNNPR.

²² Chris T. Annen, Promotion of Small-Scale Irrigation in Food Insecure Woredas of Ethiopia, 2nd Draft, Submitted to IDA, the World Bank, September 2001.

²³ Chris T. Annen, Promotion of Small-Scale Irrigation in Food Insecure Woredas of Ethiopia, 2nd Draft, Submitted to IDA, the World Bank, September 2001.

5. Ethiopia Three: The Medium Potential - High Risk Western/Southwestern Highlands and Lowlands

In the western highlands and elsewhere, there are some zones and pockets of zones with differing characteristics, and levels of potential and risk that differ from the zones around them. Some of these zones are regrouped together based upon shared characteristics of high risk and medium potential. These include the western highland Agew Awi Zone, and a set of zones in the high rainfall, southwestern highlands, including the major coffee-producing zones of Illubabor and Jimma, Jijiga in the east, and several lowland zones, such as Mirabawi, Asosa, Kamashi, South Omo, Borena, Liben, and Shinile. These areas represent a variety of sources of potential, including, among others, agriculture, livestock and off-farm employment.

Ethiopia Three has important sources of both potential and risk. These often vary significantly between and within zones. The resources include varying levels of agriculture, livestock potential, and sources of off-farm employment. This region includes zones such as Agew Awi in the western highlands and others such as Illubabor, Jimma and Keficho Shekicho in the fertile and high rainfall southwestern highlands, the source of a plethora of high quality coffee species, that if properly managed and marketed could find high price niches even in today's generally unfavourable coffee markets.

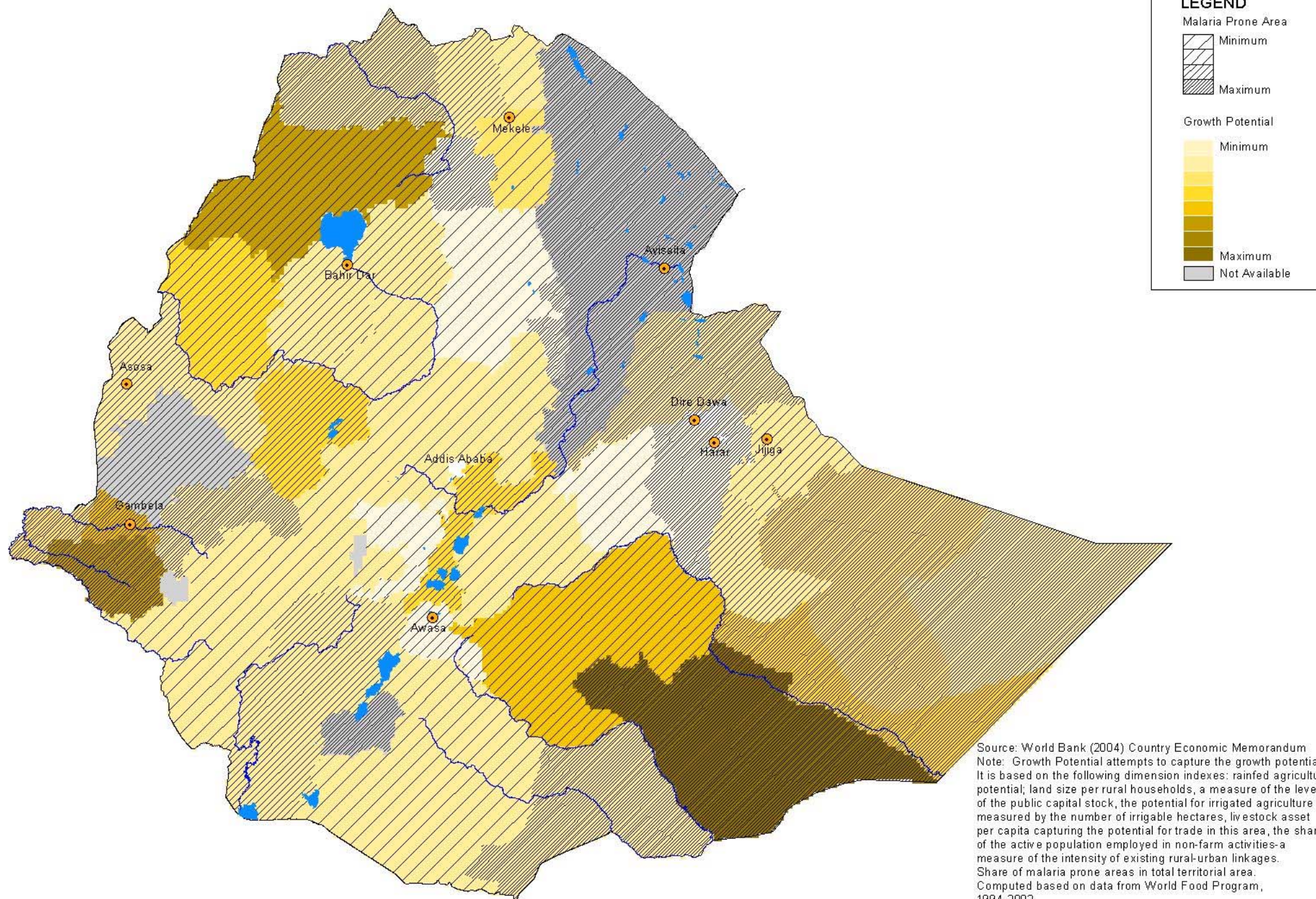
It also includes humid western lowland zones, such as Asosa and Kamashi, and dry lowland zones, including Mirabawi, South Omo, Borana and Liben. Most of these are affected by significant risks, including varying levels of drought risk. The lowland zones carry generally high levels of malaria risk, and large areas of the western and southwestern lowlands are infested with the trypanosomiasis-bearing tsetse fly.

Within the different highland and lowland categories, there exist several pockets of disparate geographic location and varying characteristics. These may differ among themselves, and between themselves and their immediate neighbours, but share the characteristics of medium potential and high risk. These zones are grouped together here as Ethiopia Three.

Table 3: Ethiopia Three: Medium Potential – High Risk Highlands and Lowlands

Zones	%Elec. Access	Road Density Km/ 1000 Sq. km	Irrigation Potential /Ha.	Size of Rural hsehd land-holding	Live-stock/ hsehd TLUs	Gross Primary Enrollment	Gross Secondary Enrollment	% non-farm Employment	% area Exposed to Malaria	% area Tsetse Affected	Drought Risk
Mirabawi	6%	23.3	93,129	1.0	1.3	55%	16%	19.9%	100%	0%	533
Mehakelegnaw	13%	29.0	0	0.8	0.8	74%	28%	17.0%	78%	0%	616
Misrakawi	9%	88.2	0	0.5	0.7	91%	35%	38.9%	n.a.	0%	573
Shinile	0%	17.3	0	1.2	1.4					0%	387
Jijiga	7%	30.5	17,707	1.3	1.0	21%	9%	28.2%	74%	0%	386
Fiq	0	0	12,351	1.5	1.2	18%	0%	28.2%	83%	83%	588
Jimma	9%	44.0	21,092	0.9	0.5	57%	12%	15.1%	29%	63%	298
Hadiya	6%	104.1	2,100	0.6	0.6	74%	21%	22.8%	43%	59%	318
Gedeo	11%	231.7	0	0.3	0.2	65%	17%	19.6%	40%	37%	342
Agew Awi	6%	39.6	13,536	1.2	0.5	72%	16%	13.6%	54%	76%	420
N. Omo	4%	36.4	32,922	0.4	0.4	67%	21%	29.7%	83%	28%	322
S. Omo	4%	22.7	54,670	0.4	1.5	37%	7%	11.5%	77%	61%	348
Asosa	9%	35.6	14,142	1.0	0.4	92%	16%	15.4	77%	100%	416
Kamashi	0%	21.2	26,595	1.2	0.3			15.4	85%	100%	387
Keficho Sh.	2%	38.4	100	0.7	0.4	72%	13%	17.1	34%	58%	324
Illubabor	9%	43.2	32,194	1.1	0.6	84%	23%	14.7%	94%	100%	296
Bench Maji	7%	15.5	21,050	0.3	0.5	81%	12%	15.7%	44%	54%	303
Borena	4%	27.5	123,594	0.5	0.6	53%	9%	14.4%	35%	0%	410
Liben	3%	12.6	80,290			23	0%	28.2%	100%	0%	571
Warder	1%	0	0			13	1%	28.2%	100%	0%	788

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The zones included here manifest a variety of potential and resources, including the high rainfall highland areas of the southwest, with a particular focus on permanent crops. These include multiple species of high quality coffee varieties, with significant potential to find niche markets for organic gourmet coffees. They also show potential in other areas of agriculture, livestock development and off-farm employment.

Ethiopia Three includes the western and southwestern zones of Agew Awi, Illubabor and Jimma, as well as Jijiga in the eastern highlands, and several lowland zones, including Mirabawi, with its history of large-scale mechanized farming, Asosa, Kamashi, and South Omo in the western lowlands; and Borena, Liben and Shinile in the south and east. These areas have considerable potential, but they also face high risks, such as malaria, drought, and in some zones, the tsetse fly-borne trypanosomiasis, an important risk for both farmers and their livestock.

The Mirabawi zone includes part of the 'Mazega' a fertile area that "trisects northeastern Ethiopia, Southwestern Eritrea and Eastern Sudan has been an important source of sorghum (grown for local and regional markets) and sesame (grown for export). Since mechanization began in the mid-1960s, commercial agriculture has historically stimulated significant regional trade and labor opportunities for migrant workers coming from food insecure parts of all three countries"²⁴

The potential of the region has already been established. The northwestern lowland plains have proven to be suitable for large-scale rainfed mechanised farming, particularly for such relatively drought-resistant crops as sorghum and sesame. Even without irrigation, these lowlands can usually, provide marketable surpluses of oil seeds, pulses, maize and sorghum. There is significant drought risk, but also high irrigation potential, as the zone has some 91,000 ha of potentially irrigable land. This demonstrates a potential that needs to be built upon and expanded.

6. Ethiopia Four: The High Potential - High Risk, Humid and Sub-Humid Western Lowlands and Dry Southern and Eastern Lowlands

Ethiopia Four focuses on areas that offer high potential for growth. These areas also present relatively high levels of risk. They include certain highland zones that combine high levels of potential and risk and contain important high potential river valleys, but are mainly located in the western, southern and eastern lowlands that comprise the country's lowland periphery. These two lowland regions have important, through significantly different sources of potential and risk.

Ethiopia Four includes the largely highland, high potential-high risk zones of Debubawi, East Wellege, and East Shewa; the zones of North Gondar, Metekel, and Zones One, Two and Three of Gambella Regional State in the western lowlands; and the Bale, Afder, Gode, Korahe and Deghabur zones in the eastern lowlands.

²⁴ Laura Hammond, "Obstacles to Regional Trade in the Horn of Africa: Borders, Markets and Production, February 2003.

The Western Lowlands

In the 1980s, studies carried out in areas of low population density in the western, southwestern, southern and southeastern lowlands showed that the tsetse-infected western lowlands offer the best potential for expanded agriculture, provided that the tsetse problem can be overcome. The Western Lowlands occupy nearly 200,000 sq kms, large areas of which are suitable for rainfed mechanised farming. There is also considerable potential for multi-seasonal irrigated crop production in its several river basins. This region offers considerable opportunity for commercial agriculture-based growth.

The Western Lowlands start below the western escarpment and extend down to the border with Sudan. They include the northwestern plains, covering an area of about 100,000 sq km, at elevations ranging from about 1300m in the east near the escarpment, to about 300-500m near the border with Sudan. The southern part of the western lowlands includes the zones comprising the Gambella Regional State and the Bench Maji and South Omo zones of the Southern Nations, Nationalities and Peoples' Regional State.

Table 4: Ethiopia Four: Key Areas of High Potential and High Risk

Zones	Elec. Access	Road Density Km/ 1000 Sq. km	Irrigation Potential Ha.	Size of rural hsehd land-holding	Live-stock/ hsehd TLUs	Gross Primary Enrollment	Gross Secondary Enrollment	% non-farm Employment	% area Exposed to Malaria	% area Tsetse Affected	Drought Risk
Debubawi	15%	80.2	93,120	0.8	0.9	64%	24%	34.5%	36%	0%	627
N. Gondar	7%	21.2	486,482	1.2	0.8	50%	13%	24.6%	62%	0%	506
E. Wellega	7%	38.5	223,258	1.2	0.8	71%	29%	20.7%	87%	71%	369
Metekel	8%	28.4	345,144	1.4	0.6	93%	25%	10%	68%	100%	433
E. Shewa	35%	29.2	35,731	1.4	0.7	66%	28%	31.8%	89%	0%	406
Bale	11%	11.4	414,584	1.0	1.0	66%	21%	19.5%	53%	0%	555
Gambela Z1	35%	151.9	265,903	0.2	0.0	130%	34%	31.0%	100%	100%	379
Gambela Z2	0%	36.6	341,362	0.5	1.4	133%	33%	31.0%	100%	100%	349
Gambela Z3	0%	17.4	38,219	0.2	1.0	95%	35%	31.0%	100%	100%	389
Afder	0%	8.3	725,178	0.6	3.1	12%	0%	28.2%	100%	0	660
Gode	2%	18.3	143,518	0.8	2.9	42%	3%	28.2%	100%	0%	726
Korahe	2%	6.1	6,543	0.7	2.4	18%	4%	28.2%	100%	0%	761
Deghabur	1%	10.3	13,418	1.5	1.5	23%	3%	28.2%	100%	0%	614

The Burdens

Geography

The high potential-high risk zones of the western lowlands have an area of about 93,000 sq kms with a population of some 3.1 million. The region is characterised by tropical lowlands with medium levels to high levels of rainfall. It has important agricultural potential, not so much for subsistence-oriented peasant farming as for larger-scale and higher-investment mechanised commercial cropping, and adding value to production by development of processing industries. The region contains millions of hectares of potentially arable land, suitable for rainfed single-season cropping, as well as large areas of potentially irrigable lands.

In brief, the western lowlands appear to have the type of potential needed to serve as the basis for rapid agricultural and economic growth and agricultural development-led industrialisation. Much of this region resembles the *sertao* of Brazil's Matto Grosso region that 25 years ago was covered with similar scrub bush, but is now covered with the soybean plantations that have made Brazil the world's leading producer of soybeans and soybean products.

Population density remains relatively low in the western lowlands, and is reflected in low levels of labor availability and market access. This is due, at least in part to the lack of basic infrastructure, and to the prevalence of malaria and other tropical diseases in much of the area. This draws attention to the prevailing risks, which mainly concern human and animal health and have proven key obstacles to settlement and development.

Human and animal health

Ethiopia Three has serious health problems. Malaria is prevalent over some 75 percent of the region and 66 percent of the population are vulnerable to it. There is also a high prevalence of trypanosomiasis, in many areas, spread by tsetse fly and dangerous to both people and their livestock. This has been a serious obstacle to settlement and development in the region. Settlers who are frequently or chronically ill from malaria or trypanosomiasis are unlikely to be able to develop the land, and move from a bare and precarious subsistence to commercial farming. The effective development of the western lowlands will, at a minimum, require the establishment of basic human and animal health infrastructure.

The Tsetse Problem: Trypanosomiasis

Trypanosomiasis affects nearly all large domestic animals, from cattle, goats and sheep, to donkeys and horses. It is endemic in the western lowlands, particularly in the higher rainfall areas most suitable for rainfed farming. This is a key constraint on peasant agriculture based on ox-plough cultivation. Without the use of oxen, they have little possibility of cultivating enough land to feed themselves, much less to produce a surplus. One study in Ethiopia's upper Didessa valley, following a tsetse control programme, found that the amount of land cultivated increased by over 380 percent, once the farmers were able to bring in draft oxen (FAO,1998).

The western lowlands and the major river valleys leading down to them from the highlands, have experienced a serious expansion of tsetse fly infestation over the past three or four decades. Several studies since mid-1966 have recorded the progress of tsetse fly expansion in the southern Rift Valley and the Omo and Abbay River systems, and the expansion of tsetse infestation from the lower valleys up the edge of the highlands. In the early 1970s in the upper Didessa Valley (East Wellega), human habitation and cultivation extended from the valley floor at 1400 masl to coffee plantations on higher ground near the valley walls.

The tsetse invasion eventually forced the retreat of the farming population from the upper Didessa Valley to the highlands above 2000 masl. Since then, the tsetse has gradually extended its domain from the former limits of about 1700masl, up to 2000masl.

The impacts of tsetse on farming and livestock raising included the almost total loss of all domestic livestock types. The immediate results were a drastic reduction in cultivated area due to the lack of work oxen, and a shift in cropping from teff, a high value crop requiring intensive cultivation, to mini-plots of maize based largely on hand cultivation. This led to severe drops in farmers' income and nutritional status and eventually to the abandonment of homesteads in many areas.

The history of the farmers of the Didessa Valley is also relevant to attempts before and after to resettle highland farmers in the western lowlands. Most such attempts were eventually defeated by the tsetse fly, drawing attention to the reality that peasant resettlement and ox plough based farming in the western lowlands, is unlikely to be sustainable without serious action towards tsetse control and eradication.

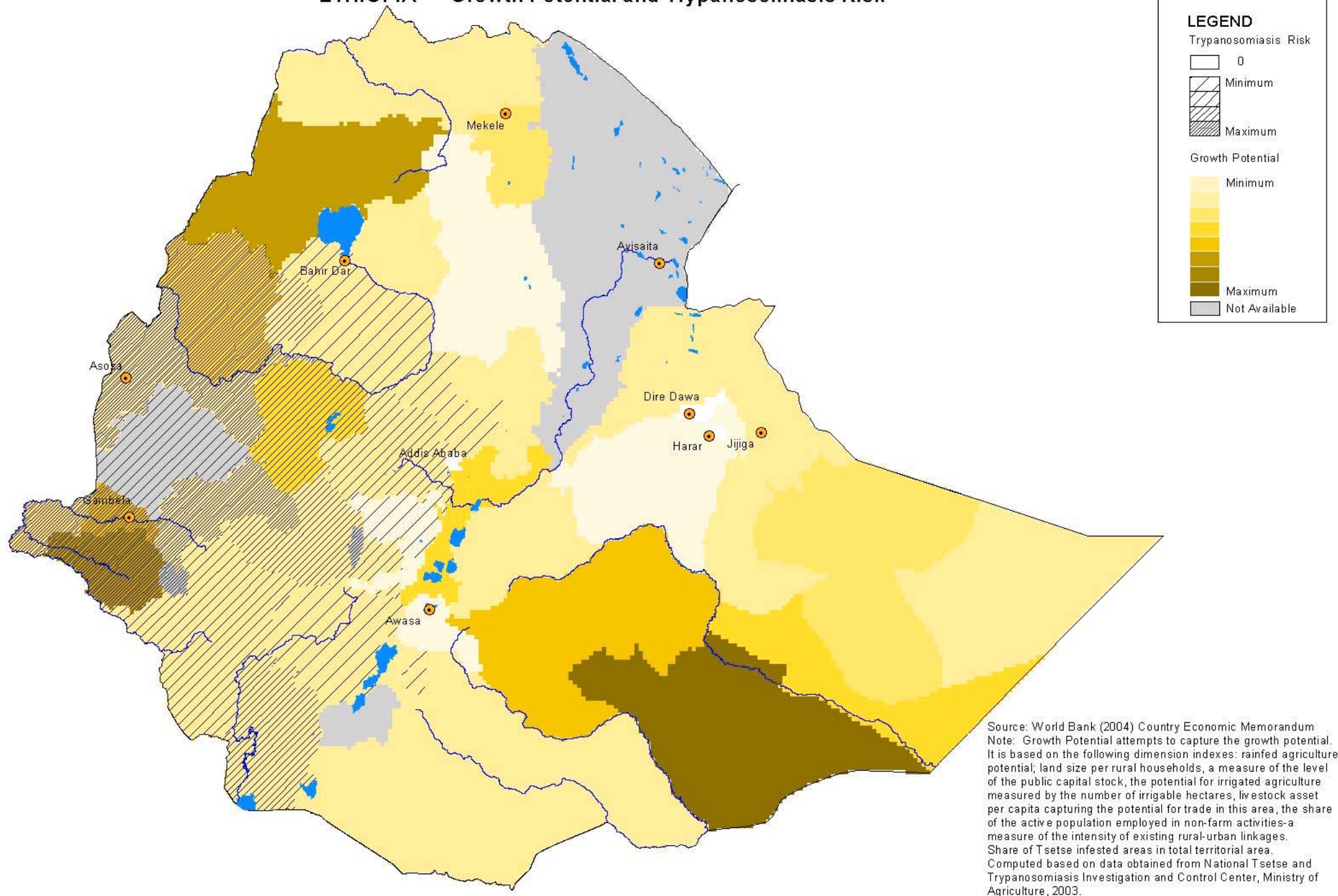
Potential/endowments

The western lowlands of North Gonder and Metekel zones extending down to the Sudanese border, comprise thousands of square kilometers of relatively flat alluvial plains suitable for rainfed mechanised agriculture and for irrigated multi-seasonal farming. North Gonder and Metekel, together with the lowland valleys of the neighboring East Wellega zone, contain nearly one million ha of irrigable land, but no significant irrigation infrastructure. However, even without irrigation, these lowlands can provide marketable surpluses of sorghum, sesame, pulses and other valuable crops, and provide the raw material basis for development of processing industries.

Development of the high-potential zones of the western lowlands, including their irrigation potential, is vital to sustainable agricultural growth in Ethiopia. Resettlement is increasingly an issue in low potential areas of Ethiopia and is seen as having significant potential for easing existing problems of food insecurity and chronic poverty. However, effective resettlement will require considerable investment in risk mitigation.

The principal obstacle to resettlement in the lowlands is the prevalence of tropical diseases unknown in the highlands, especially trypanosomiasis, a tsetse fly-borne disease, forms of which, affect, disable, and often kill, livestock as well as humans. Due to this, the oxplow-based production system of the highlands is not viable in most of the

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western lowlands. The experience, mentioned below, of the displacement of farmers in the Didessa Valley, by the expansion of tsetse fly, draws attention to the imperative of effective tsetse fly eradication as a prerequisite for resettlement in the western lowlands.

The tsetse problem can be overcome, but it requires a policy decision supported by significant investment. The tsetse problem can be overcome, but not on a piecemeal basis if it is to be sustainable. During the colonial period in many areas of eastern and southern Africa, tsetse and trypanosomiasis were controlled over large areas. The colonial regimes recognised the benefits of tsetse fly control to advancing their economic interests. Tsetse control programmes began to deteriorate in several countries in the years following independence, with poor governance and economic decline leading to neglect of both human and animal health programmes, including tsetse fly control. The result was a huge and continuing resurgence of the problem.

Tsetse Fly Eradication

There are two principal approaches to tsetse fly control. One is large-scale tsetse fly eradication. The other is through small-scale community-based control measures. Many farmers who have remained in tsetse-infested areas, have done so through use of trypanocidal drugs to keep their livestock alive. However the drugs to treat trypanosomiasis cost more than poor farmers can afford and the use of drugs to protect their livestock from it on a long term basis is even more unaffordable and unsustainable. The relatively high recurrent cost of these drugs, continuing high level of livestock loss, and recognition that drug therapy is palliative, rather than a long term solution to trypanosomiasis, draws attention to the imperative of tsetse control.

The most common vector control efforts, other than large-scale spraying of tsetse infested areas and common breeding places, include the use of traps and targets coated with insecticide, and animals coated with insecticide. These have proven effective in clearing small areas as pilot projects using community based labor. This is interesting as a social experiment, but its sustainability is questionable for several reasons. The first being that once the initial community enthusiasm loses its momentum and community efforts are relaxed, farmers become less likely to the tsetse move back into the cleared area from neighboring uncleared areas.

This makes small scale community-based tsetse eradication alone, unlikely to make the necessary impact. Effective tsetse eradication will need to be undertaken on a much larger scale. To be effective and sustainable, tsetse eradication will need to be undertaken over large areas, using all available methods, and followed up on a consistent basis throughout the tsetse-infested areas of the western lowlands and the tsetse infested valleys leading down into the western lowlands. This needs to be done over wide areas to limit immediate re-infestation and needs to utilise paid and supervised labor to ensure implementation.

To be effective, tsetse eradication must be seen as a public good, and implemented as such, by government to ensure that the necessary actions are taken. These would include the air and ground spraying of heavily infested areas; provision of free spray-on/pour-on insecticide preparations for cattle serving as mobile baits; preparation and placement of

large numbers of simple insecticide-treated traps, and the employment of a person in each community to periodically service the traps by replacing the odorant baits. This should be followed up with the extended use of the Sterile Insect Technique, and periodic surveillance in order to be able to react promptly to future incursions. It is vital to necessary to making the western lowlands tenable for sustainable resettlement and agricultural development, and able to contribute to Ethiopia's economic growth.

FTCA experts draw attention to the risk that if large scale tsetse control is implemented and the area under operation is not colonised at the same pace, tsetse flies from some pockets or from adjacent valleys can re-colonize the area. But the step by step process envisaged would take some five years for the first phase to clear a relatively small area of 5,500 sq km in the upper Didessa Valley,²⁵ with subsequent phases likely to be equally long-term, while tsetse infestation is expanding.

However, in view of the current plans for large-scale resettlement in the western lowlands, this should no longer be an issue. To the contrary, it draws attention to the urgency of the need for accelerated large-scale tsetse control measures as vital support to the resettlement programme.

Tsetse control in the western lowlands and river valleys will contribute substantially to the enhancement of national food security and to improvement of the quality of life of the rural population through increased and sustainable cropping and livestock production in the currently tsetse infected areas. This will require significant investment in large-scale tsetse eradication. There is already a considerable history of successful rain-fed mechanised commercial farming in the medium potential northern areas of the western lowlands, around Setit-Humera, where rainfall is significantly lower, than in the zones considered here.

Irrigation Potential

There is also considerable potential for irrigated multi-seasonal cultivation of a much wider range of crops in the lower river basins of the western lowlands. These include the lower basins of several rivers in the region, such as the Tekezze, Angereb, Guang, Rahad and Dinder rivers in the northwest, as well as the Didessa, Dabus, Guder, Bashile, Jama, Muger, the Beles and other Blue Nile tributaries, and the Blue Nile, itself.²⁶ and the Blue Nile itself. The total irrigable area, in terms of potential for development of large and medium scale irrigation, is some 1.687,650 ha. The development of this irrigation potential could allow multi-seasonal cropping over large areas, and provide surpluses for both export and development of processing industries.

²⁵ FITCA project document, "Farming in Tsetse Control Areas of Eastern Africa: Ethiopia National Component," Project No. 7 ACP ET086, Addendum to the Financing Agreements, p37

²⁶ Towards Conflict Prevention in the Nile Basin," Proceedings of the Vth Nile 2002 Conference, February 24-28, 1997, Addis Ababa, p.496).

Primary processing of major local products could add value to them, provide employment and help to initiate growth in the region. This can save on transport costs, provide local jobs, and the opportunity for further processing and addition of value for example through extraction of cottonseed oil and sesame, and production and sale of the oilseed cake as a valuable component of livestock feed. These could be significant areas for private sector investment and growth that could also promote agricultural development in the region.

A revival of private, mechanized farming in the lowlands could generate surpluses of oil seeds, maize and sorghum. Even today, these northern lowlands produce sesame crops that are marketed in the Sudan. It is probable that such crops are marketed in the Sudan due to transport and other problems that make their marketing in Ethiopia problematic. To make good economic sense, development in the western lowlands needs to be supported by a good road system, and robust markets.

Infrastructure and connectivity constraints

Sustainable growth in the western lowlands will require significant investment in physical and human infrastructure, including water infrastructure for hydroelectric power, and where possible, irrigation. In most of the area, there is a general lack of roads and transport, water resource, energy, and communication infrastructure. This is further reflected in the lack of urban centres, health, education, commercial, and other infrastructure, including the infrastructures and activities that could give rise to non-farm employment.

The Dry Eastern and Southern Lowlands

The high potential zones of Ethiopia Four's eastern lowlands center on the mainly dry, pastoral lowlands of the southeast. These comprise the Bale Zone of Oromiya Regional State, and the Afder, Gode, Korahe and Deghabur zones of the Somali Regional State. These zones include an area of 676,154 sq kms, with a population of 3,024,000, 14.7 percent of which is urban, with about 24 percent employed in non-farm activities. The mean annual rainfall varies from about 690mm in Bale zone to 194mm in Gode zone. The population is mainly pastoral or agro-pastoral.

These zones are dry, but have significant potential, particularly for commercial livestock production, as well as some 1.3m ha of irrigable land in the main river valleys. To realize this potential will require investment to develop the region's water resources and its livestock sector.

The Burdens

Geography

The eastern side of Ethiopia Four comprises mainly semi-arid and arid lowlands, with low and erratic rainfall, mainly dependent on the low-yielding Belg rains brought from the Indian Ocean to Somalia and eastern Ethiopia by the southeasterly winds. Much of the area is highly drought-prone.

The eastern lowlands are sparsely populated, with a population density of around 16/sq km. Most of the area has limited potential for crop production, except through irrigation in the river basins, but thus far, development of irrigation is insignificant. The urban population is just under 15 percent of the total and about 24 percent of the active population is employed in non-farm activities.

Infrastructure and connectivity constraints

In the eastern lowlands of Ethiopia Four, the levels of physical and human infrastructure are particularly low. Road density ranges from 6.1 km/1000 sq kms, in Korahe Zone to 18.3 kms/1000 sq kms in Gode Zone, but many of the rural roads are barely more than tracks. Only 5 percent of the population has access to electricity, with 1.0 operational telephone lines per 1000 population. Health care access is particularly low, and most of the area is exposed to malaria. Both gross primary and secondary enrolment are extremely low.

Potential/endowments

The dry pastoral lowlands of eastern and southern Ethiopia have limited potential for crop production, except through irrigation in the river basins. However, there is considerable potential for irrigation for both crop production and commercial livestock production. Ethiopia Four has some 1.591 million ha of irrigable land, of which only about 51,000 ha are thus far under irrigation.

Livestock are a key component of the livelihood of the rural poor, and particularly so, in the eastern lowlands. But Ethiopia's livestock production has been stagnant over much of the past three decades, with human population increasing by as much as 2.5 percent a year as compared to an average increase of only about 1.0 percent per year in the livestock population. During the same period, milk production increased by only 1.5 percent per year, and meat production by only 0.9 percent per year.²⁷

Livestock are the largest source of cash income for rural households, and their most important marketable commodity. They serve as a vehicle for savings and investment where banks are perceived as inaccessible and unreliable, and fulfill various social functions. MEDAC (1998), estimates the contribution of the livestock sector at respectively 35 percent of agricultural GDP and 15 percent of total GDP. The livestock sector provides multiple functions and as one of the major sources of cash could be a key engine of rural growth. Increased exports of live animals, meat and leather products could be the main driver of such growth.²⁸

Livestock sector growth has been constrained by several factors, the most important being the natural resource base, disease prevalence leading to high morbidity and

²⁷ Diagnostic Trade Integration Study, V.2, Ethiopia: Trade and Transformation Challenges, Annex 9, Livestock and Meat (Draft), July, 2003

²⁸ *Ibid.*

mortality rates, and poor transport systems.²⁹ Nevertheless, this sector has considerable importance for both the domestic and export economies. It has multiple functions and could be an important engine of rural growth.

Livestock can provide an important source of growth, when approached on a commercial rather than subsistence basis, and provided with basic infrastructure needs, such as animal health infrastructure, water for forage production, and transport and marketing infrastructure. A recent study suggests that the combined "formal" and "informal" livestock exports could equal the export value of the coffee sector.³⁰

The formal exports of Ethiopia's livestock and livestock products are estimated at between US\$50 million and US\$80 million per year. This amounts to 9-21 percent of agricultural exports, and 8-17 percent of total exports. The livestock sector therefore, is second to coffee in exports.³¹ However, besides these formal, (legal) exports, there is also a large 'informal' export of live animals to the Middle East, mainly via Somaliland/Somalia. The DTI Study (2003) estimates the 'informal' exports of livestock at about US\$70 million per year. It further estimates that "formal and informal exports combined would bring the livestock sector about at par in export value with the coffee sector."³²

The coffee sector has increasingly serious problems that do not raise hopes for rapid growth in the near future. Livestock, however is a sector with considerable potential for growth if the key constraints are overcome and could help fill the earnings gap left by the decline of the coffee market. This can be achieved through appropriate investment and policy action.

The Middle East offers important market opportunities for export of Ethiopian meat and live animals. This is an area in which Ethiopia has considerable proven comparative advantage in terms of consumer preference. This is linked to, among others (breed, etc., the Somali blackhead sheep for example, a major product of eastern Ethiopia, are a favorite of the Middle East market), proximity to the market, and ability to provide chilled, rather than frozen meat, in smaller shipments tailored to importer demands. To take full advantage of this requires more attention to animal health, especially as the health requirements for this market are tightening.³³

In this respect, Ethiopia has huge resources in the form of Africa's largest livestock population, including about 35 million heads of cattle, 24 million sheep and 18 million goats (FAO, 2002) as well as seven million horses and donkeys, one million camels and 50 million chickens. The livestock sector involves to varying degrees, some five million households or about 25 million people. It is the main source of power (oxen) to cultivate about 70 percent of the estimated 10million ha of land under cultivation. It also produces

²⁹ *Ibid.*

³¹ *Ibid.*

³² Diagnostic Trade Integration Study, V.2, Ethiopia: Trade and Transformation Challenges, Annex 9, Livestock and Meat (Draft), July 2003.

³³ *Ibid.*

about one million tons of milk and 450,000 tons of meat and provides large quantities of manure, needed for fertiliser, but increasingly used for domestic fuel.

The highland areas of the country are often livestock-deficit in terms of cattle, due to high needs in terms of demand for plow oxen, as well as beef. Large numbers of cattle are supplied to highland areas from pastoral and agro-pastoral areas. These areas are also a main source of supply for export abattoirs at Debre Zeit, Mojo and Metahara. There is also an important cross-border livestock trade with neighboring countries, which often re-export livestock to the Gulf countries.

Of the country's livestock resources, some 20 percent of the cattle, 73 percent of goats and 100 percent of camels are produced in the lowland pastoral areas. Numerically, a rough estimate suggests a figure of about 7 million cattle, 6 million sheep, some 13 million goats and about 1 million camels.³⁴ The relatively lower proportion of cattle in the lowlands is related to the higher needs of cattle in terms of availability of grazing and water which limits their range of movement, and the scarcity of these resources in many dry lowland areas.

There are important constraints that need to be addressed at the infrastructural and policy levels. These include a weakened natural resource base following recurrent droughts, and the need to provide adequate fodder for livestock production and prevention of mass livestock losses during periods of drought. Likewise it is essential to address the prevalence of livestock disease, leading to high rates of livestock mortality and morbidity, and limiting market access; and poor marketing and transport systems that lead to high losses.

Enhancing livestock production and preventing livestock loss

The most important constraint is of course the resource base. As grazing is the most important source of livestock feed in Ethiopia, the livestock sector is highly dependent on rainfall and therefore, vulnerable to drought. This is particularly so for the lowlands where there is also less availability of crop residue, the country's second most important source of livestock feed. According to the DTIS (July, 2003) the "limited and highly variable resource base", and its inability in most years to provide sufficient feed for the national herd, is probably the most important constraint to growth in the livestock sector. According to the study, the feed balance between good and bad year years, shows a 35 percent deficit in normal years and a 70 percent deficit in drought years.³⁵

This is a problem that needs to be addressed in the context of water resource development in the major river basins of the eastern and southern lowlands, the source of much of the country's exportable livestock. Particular attention should be given to the Gennale-Dawa, Shabelle and Awash basins, where there is considerable potential for irrigated

³⁴ Belachew Hurrisa, Head, Market Research and Promotion Department, Livestock Marketing Authority, "Livestock Marketing and Pastoralism," paper presented at the Third National Conference on Pastoralism and Development, Pastoral Forum Ethiopia (PFE), Addis Ababa, 23-24 December 2003,

³⁵ Diagnostic Trade Integration Study, V.2, Ethiopia: Trade and Transformation Challenges, Annex 9, Livestock and Meat (Draft), July, 2003.

commercial farming and fodder production. As in many other countries, irrigated farming could produce large quantities of crop residues suitable for dry season livestock feed. This would help to sustain livestock during drought episodes, and prevent large-scale losses of valuable livestock. Irrigated fodder production would also open the way to large-scale commercial livestock production under controllable sanitary conditions, enabling better access to export markets.

Every major drought leads to loss of hundreds of thousands of livestock and weakens and reduces the quality of hundreds of thousands more, particularly in the dry lowland pastoral zones that lack alternative sources of livestock feed. Protracted and recurrent droughts, and these are increasingly common, often lead to large-scale loss of livestock, the mass impoverishment of pastoralists, and frequently to famine.

The Shinile Zone of Somali region has a population of about 338,000 people with about 2 million head of livestock. The drought of the year 2000 killed about 40 percent of the livestock population of Shinile Zone.³⁶ By 2002 the drought had killed 37 percent of the total livestock population of the Afar Region and Shinile Zone of SNRS.³⁷ Similarly huge losses have been reported in other zones of the nine zone Somali Regional State, and the Borena Zone of the Oromiya Regional State.

These losses represent an enormous and unnecessary loss of capital to what, in terms of growth potential, is one of the more promising sectors of the economy. It also severely constrains Ethiopia's potential to develop its livestock sector, which if properly developed, on a commercial basis, with better infrastructural and policy support, could make an important contribution to economic growth. The value of drought-related livestock losses over the past decade of recurrent droughts is difficult to quantify in the absence of more reliable data, than is presently available. Nevertheless, extrapolating from what exists from various sources, it would appear to be far greater than the costs of addressing structural problems underlying the extreme vulnerability to disastrous levels of livestock loss arising from drought-related causes.

According to some estimates of livestock loss during the 1999-2000 drought in eastern and southern Ethiopia, herd size declined by up to 80 percent in the Oromiya and Somali regions, and by 45 to 50 percent in the Afar and SNNP regions.³⁸ In the Borena zone of region, average household herd size reportedly declined from 92 head per household in 1980-81 to 58 head per household in 1996 (Mulat Demeke, 2004). The year 2000 drought situation reportedly led to the loss of 40 percent of the livestock population of over 2 million in the Shinile Zone of Somali Region.

Accurate figures on the cash value of Ethiopia's livestock losses over the past decade are not available. It is clear however, that large numbers of livestock have been lost. Taking into account official estimates of the livestock population of the Somali Regional State in

³⁶ FDRE: Ministry of Agriculture: Contingency Plan for Afar Regional State and Shinile Zone of SNRS, Agricultural Interventions (Draft), November 2002, Addis Ababa.

³⁷ FDRE: Ministry of Agriculture: Contingency Plan for Afar Regional State and Shinile Zone of SNRS, Agricultural Interventions (Draft), November 2002, Addis Ababa, p2.

³⁸ Webb, Patrick, J. von Braun and Yishac Yohannes, "Famine in Ethiopia: Policy Implications of Policy Failures at National and Household Levels," Research Report 92, IFPRI, 1992.

a survey published in April 2001, and various rough estimates of the minimum numbers of livestock lost in the context of drought situations over the past decade, a very rough estimate might suggest a figure of up to two million heads of cattle, and large numbers of small stock. The value of these, suggests figures far greater than the cost of preventing such losses through development of water resources and irrigated forage to mitigate the impacts of recurrent drought.

Drought cannot be prevented, but its impacts can be diminished through appropriate investment and development actions. Much of the livestock loss associated with recurrent drought can be prevented through suitable measures in terms of policy and infrastructure. Achieving this will require significant investment in irrigation, transport, animal health and marketing infrastructure. The cost of such investment should be balanced against the value of the livestock losses that it can be expected to prevent, based on the losses associated with recurrent drought over the past decade.

In this respect it is useful to consider existing export capacity. At present, the country's average annual marketable production capacity is estimated at about 1.1 million head of cattle, 2.1 million head of sheep, 5 million head of goats, and 70,000 head of camels. Based on this, and deducting domestic demand and breeding stock requirements, the Livestock Marketing Authority estimates that there is an export potential of some 404,000 head of cattle or 44,400 tons of beef and veal; 700,000 heads of sheep or 7,000 tons of lamb and mutton; 1,800,000 goats or 16,200 tons of goat meat; and 23,000 camels or 4,800 tons of camel meat.³⁹

In terms of productivity, the off-take rates are low at only eight percent per year for cattle, 40 percent for sheep and 35 percent for goats. In the case of cattle it is particularly low, about 53 percent of the rate for Senegal and about 40 percent of that for Kenya.⁴⁰ This is partly, but only partly due, to the extensive use of cattle for traction in Ethiopian agriculture. But these rates can be increased in the lowland context.

As with the agrarian sector, the livestock sector in Ethiopia is largely subsistence-oriented, but this is to a significant degree linked to problems of marketing and the lack of appropriate market infrastructure and ready access to market information. The pastoral livestock sector is also amenable to commercialisation, where favourable terms of trade are found. The best evidence of this has been seen in the huge numbers of Ethiopian produced livestock informally exported via the Somaliland port of Berbera, prior to the Saudi ban on live imports from the region.

The sector is also highly dependent upon and vulnerable to the fluctuations of a particularly low and erratic rainfall regime. This is characterised by increasingly frequent and severe droughts leading to massive livestock losses, destitution of pastoral populations, and related famine situations. From an economic perspective it involves a

³⁹ Belachew Hurrisa, Head, Market Research and Promotion Department, Livestock Marketing Authority, "Livestock Marketing and Pastoralism," paper presented at the Third National Conference on Pastoralism and Development, Pastoral Forum Ethiopia (PFE), Addis Ababa, 23-24 December 2003,

⁴⁰ Diagnostic Trade Integration Study, V.2, Ethiopia: Trade and Transformation Challenges, Annex 9, Livestock and Meat (Draft) July 2003.

huge, unaffordable, and ultimately unnecessary loss of valuable resources in a sector with enormous economic potential.

The problems of agricultural growth and food security in pastoral areas needs to be seen in the context of the overall development of the pastoral economy.¹ In view of the erratic, low and unreliable rainfall regime and the experience of frequent drought in the eastern and southern lowlands, sustainable pastoral development aimed at growth, needs to be linked to the availability of surface or underground water. This can enable irrigated farming and production of forage for enhanced livestock production and prevention of livestock losses during drought episodes.

The sustainable development of the livestock and agricultural production potential of the eastern lowlands needs to be linked to multi-purpose development of the water resources of the principal river basins of the region. These include the Awash, still only partially developed. They also include the Shebelle Basin (irrigation potential 160,000 ha) and the Gennale-Dawa-Juba Basin (irrigation potential, 885,000 ha). Multi-purpose water resource development in this basin would enable large-scale irrigation, for crop production and increased livestock development, as well as hydroelectric power production and flood control. The availability of affordable hydropower could also open the way to agro-processing, and encourage development of the southeast.

Ethiopia has the necessary water resources, but they are neglected. The net irrigation potential of the Shebelle and Gennale basins alone exceeds 800,000 ha, several times the country's existing irrigated area. In Ethiopia, irrigation remains an extremely rare and neglected sector, but this is no longer affordable. In the few areas where irrigation is effectively practiced, it has been able to increase productivity substantially over that of un-irrigated land.

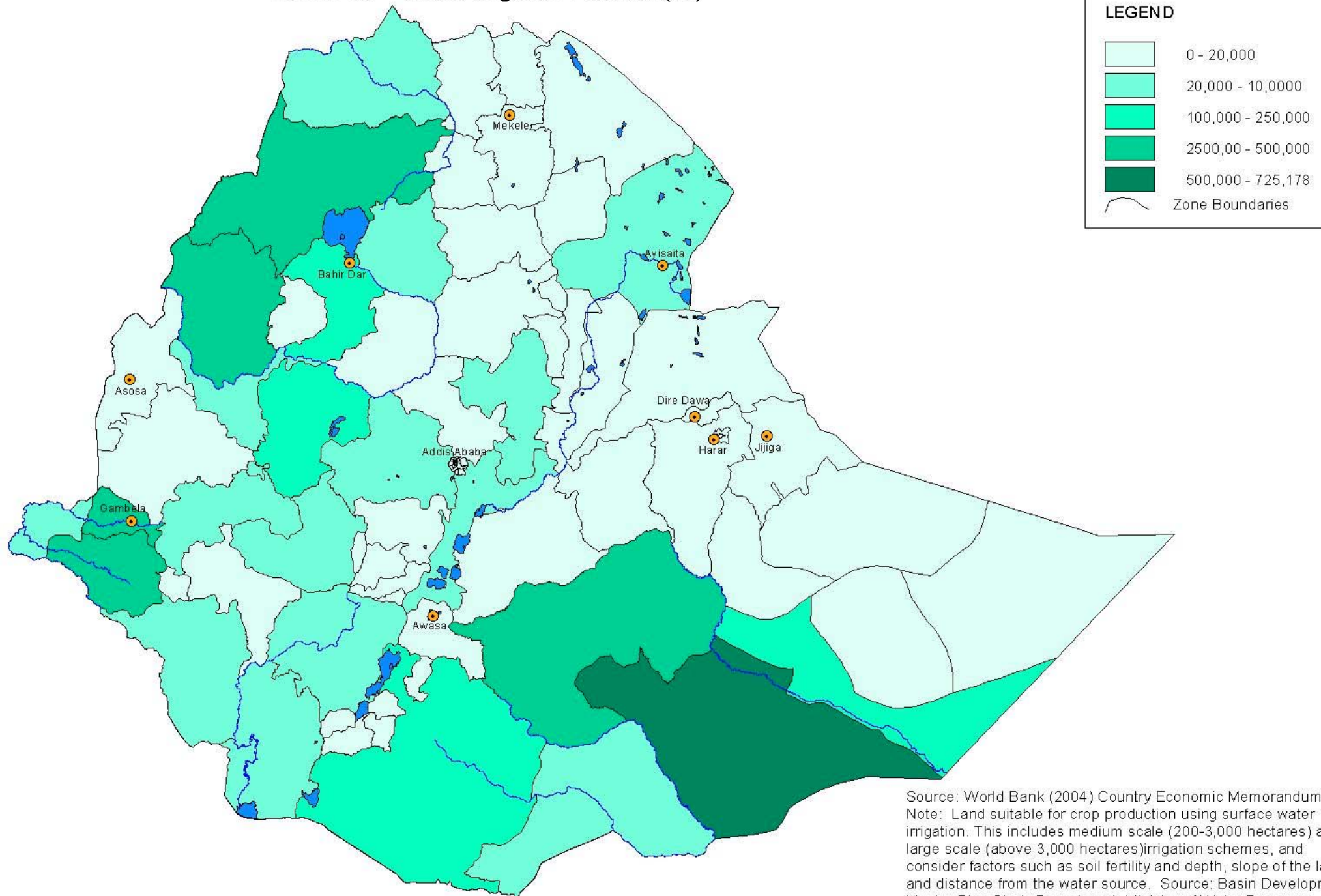
Investment policy for the southeastern lowlands needs to take account of the particular opportunities offered by the southeastern river valleys. Overall it needs to think in terms of multi-purpose water resource development, including development of an irrigated, higher-intensity agriculture and livestock production supported by market access (roads), and early development of at least basic processing industries to add value to primary production.

Multi-purpose water resource development for irrigated agriculture and livestock production can provide an important window of opportunity in the form of surplus agricultural and livestock output. Multi-purpose dams for production of hydropower for export and domestic use, as well as irrigated agriculture and livestock production and processing, can provide the key mechanisms needed to enable and accelerate economic growth in Ethiopia's southeastern lowlands.

The prevailing topography here includes broad, relatively flat and unbroken areas that are suitable for large-scale (and more cost-effective irrigation). The low population density and different tenure systems can allow more opportunity for large-scale agriculture and potential for commercial farming and livestock production. There is an abundance of

¹ SDPRP; Section 5.2.1

ETHIOPIA— Gross Irrigation Potential (ha)



Source: World Bank (2004) Country Economic Memorandum
 Note: Land suitable for crop production using surface water irrigation. This includes medium scale (200-3,000 hectares) and large scale (above 3,000 hectares) irrigation schemes, and consider factors such as soil fertility and depth, slope of the land and distance from the water source. Source: Basin Development Master Plan Study Department, Ministry of Water Resource and Development, 2003.

potentially productive land that can benefit from irrigation at lower per hectare costs than in the highlands.

Multi-purpose dams with production of affordable hydropower, will also open new opportunities for irrigation. In some dry land areas with good market access and potential to grow and effectively market high value crops, pump irrigation using rivers, or groundwater will be viable. This however, needs to be carefully assessed on a location-specific basis.

Water resource development in the southeastern river basins is an imperative for the effective use of their land and labor resources. Water resource development encompassing development of the hydropower resources of the main river basins and irrigation to enable effective use of the land and labor resources, can make a major contribution to the optimal development and growth of Ethiopia's livestock sector. When combined with the necessary road infrastructure to promote growth in the eastern lowlands and integrate that growth into the national economy, it can serve as an important motor for the economy at regional and eventually, national levels.

Investment here will contribute to creation of important regional centres of processing, production and growth that will provide productive employment for significant sectors of the under-employed and unemployed population. This will help to increase the contribution of these labor resources to the national economy through integration of former pastoralists who have lost their livelihoods in earlier droughts. It will also contribute to economic diversification in the southeast, and eventually towards increasing the size, productivity and diversity of the domestic market and the national economy;

The key element is the adding of value to the existing resources. For example, the provision of irrigation can enable large increases in crop and livestock production. The production of hydropower will provide the opportunity to add value to agricultural production through processing, providing employment to the labor force and creation of an additional resource for export.

Animal Health

Investment in animal health is also an important need to enable the country to make more effective use of its pastoral resources. Improved animal health, and the capacity to provided certification of animal health, is critical to the growth of the livestock sector on a commercial and export oriented basis.

Livestock diseases are also an important constraint to both livestock production and to access to international markets. The "list A" diseases of the World Animal Health Organisation (OIE) are particularly important both from the perspective of production and that of international market access. These include Rinderpest, a virus disease which has apparently been eliminated from Ethiopia, Foot and Mouth Disease, Rift Valley Disease (RVF), thus far not reported in Ethiopia, although it has occurred in neighboring countries; and others such as Contagious Bovine Pleuropneumonia, Peste de Petits Ruminants, Sheep and Goat pox and Blue Tongue.

The country's animal health infrastructure is extremely weak and over-stretched and the coverage is poor. Control of "List A" diseases is a federal responsibility with services provided free of charge, and control of "List B" diseases is provided by regional governments at subsidized prices. Despite the existing services, vaccination coverage remains low with only 5-15 percent of cattle being vaccinated each year against such diseases as Anthrax and CBPP. An important need to enable Ethiopia to take better advantage of its livestock potential is for strengthening of its animal health coverage.

The establishment of a broader veterinary network with increased animal health coverage might be assisted through creation of a better enabling environment for establishment of private veterinary service delivery systems.

Ethiopia's livestock sector is both critical to the livelihoods of millions of rural poor and represents important opportunities for external trade. There are important external market opportunities for Ethiopian livestock, meat, leather and leather products. To ensure access to these markets requires action to improve sanitary control and infrastructure and simplify administrative requirements.

As sanitary requirements in the Middle East and other markets are tightening, it is important to ensure a closer veterinary network at field level, and an adequate quarantine system. This will require zoning according to OIE and WTO guidelines and establishment of disease-free zones. To ensure market access, Ethiopia needs to be able to guarantee the health status of its live animal or meat exports. The Ethiopian Ministry of Agriculture reportedly estimates the costs of the necessary studies and the establishment of the zones at US\$29 million.⁴²

Ethiopia Four lives largely from livestock and will continue to do so. But it can do so much better through appropriate investment in its land and water resources, and the infrastructure necessary to enhance and obtain the best value from its livestock production for both domestic and export markets. Irrigation will also enable the region to grow more of the grain that comprises half or more of its diet, or grow higher value crops and livestock for sale to finance the purchase of grain, as well as other needs. Irrigated agriculture and livestock raising in Ethiopia Four can make a key contribution to the country's economic growth.

7. Conclusions and Recommendations: Ethiopia's Investment Choices

Growth in Ethiopia depends upon the effective development of the country's three principal resources. The land that supports its mainly agricultural economy, but is often in short supply in the highlands where four fifths of its population live; an abundance of water, but which, due to erratic rainfall and lack of water storage infrastructure, is often lacking when and where needed to support its agricultural production. The third resource

⁴² Diagnostic Trade Integration Study, V.2, Ethiopia: Trade and Transformation Challenges, Annex 9, Livestock and Meat (Draft), July, 2003.

is abundant labor, but concentrated mainly in the highlands, where due to shortages of land, water, and affordable energy, is often under employed.

To achieve sustainable economic growth, Ethiopia must bring these three resources together and integrate them in ways that enable their optimal use to accelerate economic growth. This is constrained by, among others, low levels of human development and physical capital stocks. Starting from a very low base, the country must contend with poor levels of education, health and energy, frequent drought shocks, and severe lacks of transport infrastructure, storage and marketing facilities.

Ethiopia's economy is based on agriculture, which accounts for more than 90 percent of exports, 85 percent of employment and 55 percent of GDP. But, its potential is largely untapped. Low-input, low-value, rain-fed subsistence farming accounts for 90 percent of all agricultural production. Due to high variability of rainfall, outputs are low and surpluses rare, providing little basis for accumulation, savings, investment, or growth.

The high probability of drought orients the behaviour risk aversion and subsistence, rather than investment and growth. Growth requires the intensification and commercialization of agriculture, a basic prerequisite of which is the reliable availability of water.

The imperative of water resource development

If agriculture is to work for Ethiopia, provide surpluses, and enable capital accumulation leading towards industrialization, it must have reliable access to water for irrigation and energy. Ethiopia's highlands receive abundant water, but it runs off quickly and is lost. The development of water infrastructure for water storage, irrigation, and hydroelectric power production is therefore an imperative for sustainable economic growth in the Ethiopian context.

Overall, Ethiopia has nearly four million ha of irrigable land.⁴³ The major opportunities for irrigation are in the main river valleys, which have a net irrigation potential of some 2.6 million hectares of land. Water resource development encompassing irrigation of land resources in Ethiopia's principal river basins and development of the hydroelectric power resources, are key prerequisites to enabling the effective use and development of its abundant labor resources. These, when combined with the necessary road infrastructure to integrate Ethiopia's river basins into the national economy, can serve as the essential motor for the economy.

From the growth acceleration perspective, investment in the development of Ethiopia's water resources needs to be given a high priority. Investment in multi-purpose water storage infrastructure for irrigation and hydroelectric power development, can enable large increases in crop and livestock production, while hydropower production can contribute to growth by providing cheap energy for processing and adding value to

⁴³ FDRE, *Executive Summary, Water Sector Development Program*, Vol. 1, Ministry of Water Resources, Addis Ababa, October 2002.

agricultural production, and as an additional resource for export to energy-deficit countries in the region.

Ethiopia's agriculture, like its population and its infrastructure, is largely concentrated in the highlands. The area of land now under cultivation amounts to about 10 million hectares, mainly in the highlands where there is a severe deficit of arable land. The imperative of accelerated economic growth requires that the country develop its land and water resources in the lowlands that occupy more than half of its total area.

Investment in the western lowlands: important potential for agricultural growth

Overall, the highlands are no longer capable of supporting their current population on a sustainable basis, and still less capable of significant contribution to the country's rapid and sustainable economic growth. This draws attention to the importance of development of the sparsely populated western lowlands that contain millions of hectares of potentially arable land, suitable for rainfed single-season cropping. The western lowlands of Ethiopia Four also contain nearly one million ha of irrigable lands, with potential for irrigated multi-season cropping.

In brief, this region has the type of potential needed to serve as the basis for rapid agricultural and economic growth and agricultural development-led industrialisation. It is a region of important agricultural potential, particularly for not so much for subsistence-oriented peasant farming as for larger-scale and higher-investment mechanised commercial cropping, and adding value to the produce by development of processing industries. Development of commercial agriculture in these lowland areas, and the major river valleys leading down to them, can provide a major source of growth.

In particular, the northern, medium to high rainfall zones of the western lowlands, with an area of over 100,000 sq kms, includes millions of hectares of extensive, flat plains, suitable for large-scale mechanized agriculture. These lowlands offer great potential, along with considerable risk. To achieve the potential, Ethiopia must also mitigate the risks. Both are interrelated, and require substantial investment, but also offer substantial rewards.

The risks are well known, but they are also manageable, in Ethiopia, as elsewhere, through, among others, well-planned strategic investment in human and animal primary health infrastructure and preventive measures. For the western lowlands of Ethiopia Four, with the exception of North Gondar, this must include significant investment in large-scale tsetse fly eradication.

The western lowlands are subject to important human and animal health risks, which is why they are sparsely populated. The risks include malaria, and in several areas, the prevalence of tsetse fly-borne trypanosomiasis, which weakens and kills livestock and thereby severely constrains the practice of oxplow cultivation. Nevertheless, these are risks that can be managed through appropriate investment in malaria control and tsetse fly eradication. This could require large-scale targeted aerial spraying of the types of

areas where the different species of tsetse tend to concentrate and breed, to be followed up on the ground by other proven methods of tsetse eradication.⁴⁴

The eastern lowlands: irrigation and livestock - an important potential for growth

The dry pastoral lowlands of eastern and southern Ethiopia lack potential for rainfed crop production, but there is considerable potential for irrigation for both crop production and commercial livestock production. The eastern lowlands contain some 1.5 million ha of irrigable land, of which only about 51,000 ha are thus far under irrigation.

Commercial livestock production can offer an important source of growth, when provided with basic infrastructure needs, including water for forage production, and animal health, transport and marketing infrastructure. A recent study suggests that the combined "formal" and "informal" livestock exports could equal the export value of the coffee sector.

Livestock comprise a key livelihood component with considerable importance for both the domestic and export economies, and could be an important engine of rural growth. The sector's growth has been constrained by several factors, the most important being the natural resource base, disease prevalence, and poor transport and market infrastructure.

In this respect, a major risk is recurrent drought, leading to large livestock losses. For instance, a survey in 2001 reported drought losses of some 80,000 heads of cattle in the Shinile of the Somali Regional State, representing about 35 percent of the total cattle population of the Shinile zone. Figures were not available for other zones of the Somali Regional State, but the percent of loss was expected to be as high or higher than in Shinile. At a rough estimate based on the region's estimated livestock population of some 3.8 million heads of cattle, and 20 million other livestock, total losses could represent a value of up to USD100m.

Such losses can be prevented, and the livestock production capacity in the eastern lowlands can be substantially increased through development of the region's river basins for irrigated forage and water supply. It has been estimated that the value of drought-related livestock losses over the past decade, could be sufficient to develop water resources to prevent such losses and achieve other development to stimulate growth in the sector.

Ethiopia needs development of multi-purpose dams in strategic locations for irrigation and hydropower, with linkages to urbanization and employment generation. Dams are

⁴⁴ The East African Desert Locust Control Organisation (DCLO), which includes Ethiopia, is well equipped for targeted aerial spraying. Other methods which need to be accelerated and expanded include use of sterile insect technology, and the extensive production and use of odour-baited, insecticide-impregnated traps and targets, together with provision to farmers of pour-on insecticide formulations for treatment of cattle as mobile baits. These need to be undertaken as an investment for the public good as part of a large-scale tsetse eradication effort, as effective tsetse eradication needs wide coverage to achieve a substantial and sustainable reduction in tsetse prevalence. Where farmers and communities may not be prepared to cover the costs of insecticide preparations, etc. over the time required to achieve the desired impact, this can leave gaps in coverage, allowing for rapid resurgence of the problem.

costly, but current literature is often ill informed or disputed as to the unit cost of dams. Some estimates are based on developed country costs, rather than taking full account of the costs of other countries, such as China, India or Turkey. In considering the cost of investment, those factors need to be taken into account.

Ethiopia's water resource development needs are very large, financial resources are limited, and there are various constraints that may necessitate a phasing of water infrastructure development. In view of this, it might be appropriate to suggest priorities for development of multi-purpose water infrastructure for irrigation and hydroelectric power production in basins where constraints are likely to be fewer. These might include:

- The Omo Basin, where there is considerable irrigable land and potential for development of hydropower export to power-deficit neighbouring countries, who are increasingly facing dependency on more costly oil-generated power. Surplus power could also be used for affordable pump irrigation in areas beyond the reach of gravity irrigation.
- The Dawa-Gennale Basin, which has over 200,000 ha of irrigable land in the Dawa part of the basin (Borena and Liben in Ethiopia Three) and over 725,000 ha of irrigable land on the Gennale in Ethiopia Four (Afdar Zone). Multi-purpose water infrastructure in this basin could enable development of nearly one million ha of irrigable land for commercial crop and livestock production, hydroelectric power production and export, and well as control of the floods that from time to time devastate the lower reaches of the basin.
- The Shabelle Basin contains more than 160,000 ha of irrigable land. Multi-purpose water infrastructure on the Shabelle for irrigation and hydropower would enable accelerated growth based on irrigated commercial crop and livestock production and export, as well as hydroelectric power export to power-deficit countries in the region. A further important consideration would be flood control.

A conducive and coherent policy framework, particularly as concerns public investment and promotion of private investment, is central to Ethiopia's development and economic growth. Current policy recognises the need to commercialise agriculture. But achieving this will require other policy measures that effectively support this goal. These include policies on large-scale investment in multi-purpose water infrastructure for irrigation to increase agricultural production and hydropower to provide energy for processing it, as well as energy for export to neighboring countries with energy deficits, and high energy costs; and policies to encourage private sector participation in the development of commercial agriculture. Particular needs include policies aimed at the accelerated development of road and transport infrastructure and market access in high potential zones, to open up such areas for irrigation and commercial agriculture, and integrate them with the rest of the national economy.