Chapter 1

Key Issues for the Sustainable Development of Smallholder Agriculture in the East African Highlands

Frank Place, John Pender, and Simeon Ehui

This book includes a series of studies of income strategies, land use, and agricultural dynamics and their impacts on welfare and natural resources in the highlands of Ethiopia, Kenya, and Uganda. There are several reasons for focusing on the highlands. First, the complex problems of severe poverty, low productivity, and poor natural resource management seem to be the rule rather than the exception. This is critical because the highlands support the majority of rural populations in the region. Second, within the highlands are some of the most densely populated areas in all of Africa. Thus, what happens in the highlands may provide pertinent insights for what is likely to happen as population density increases and agriculture intensifies in the rest of Africa in the future. Third, the highlands also contain a wide variety of agro-climatic conditions, from the semi-arid Tigray landscape to the lush humid highlands of Mt. Kenya, and vastly different market opportunities. The varying population density, agricultural potential, and market access conditions are representative of the variation found elsewhere in Africa. And finally, within the highlands are not only many areas beset by problems of poverty and low productivity but some real successes where farmers invest in agriculture and improved resource management and generate significant profits. Therefore, it is possible to understand how different conditions tend to lead to different evolution or intensification processes as well as which factors have been most critical in enabling some communities and farmers to prosper.

Despite the favorable climate and natural resource base that describes a sizable portion of the land area in East Africa, the region continues to languish with low rates of economic growth and high rates of poverty. The World Bank estimates per capita national income to be $100 in Ethiopia, $360 in Kenya, and $250 in Uganda in 2002 (World Bank 2003). Relative to other countries, that places Ethiopia among the most impoverished nations in the world. Similarly, the percentage of population undernourished in 1995 was 50 percent in Ethiopia, 40 percent in Kenya, and about 28 percent in Uganda (FAO 1999). For Kenya, this current situation reflects a stagnation or even deterioration during the late 1990s and early 2000s. Kenya's macroeconomy was hampered by a withdrawal of International Monetary Fund (IMF) support and complete lack of foreign direct investment. Overall, the Ethiopian economy has grown at a pace of 6 percent per annum over the past decade (Federal Democratic Republic of Ethiopia 2002), but this is tempered by periodic droughts and investment resources being diverted to the Eritrean war in the late 1990s. Moreover, the per capita income and poverty figures remind us just how far the economy has to go to bring forth significant poverty reduction. Noticeable improvements have taken place in Uganda, with average GDP growth rates of around 6 percent during the 1990s. However, this has not led to widespread employment generation or agricultural growth, and rural poverty rates are estimated to have increased from 37 to 42 percent from 1999 to 2002, after falling from 1992 to 1999 (Republic of Uganda 2003).

Agriculture continues to be the main livelihood for the populations of these countries. It is most important in Ethiopia, where 85 percent of the work force is engaged in agriculture and produces about 45 percent of the total gross domestic product (Demeke and Abebe 2003). In Uganda and Kenya, the percentage of agricultural labor to total labor is 80 percent and 75 percent, respectively (FAO 2004). In these two countries, however, the industrial and service sectors are relatively more developed and account for more than two-thirds of the value added in the economy. As in the rest of Africa, the poor of East Africa are overwhelmingly rural.

Although the highland areas of these countries include the most favorable agricultural production areas, they are also characterized by disappointingly high rates of poverty. Most of Ethiopia's population resides in the highlands, and, as will be seen below, much of the highland areas are not of high agricultural potential. In Kenya, there are stark contrasts in terms of poverty severity across the highlands. Rates are relatively low in the central highlands, near Nairobi, but the western Kenya highland districts (e.g., Vihiga, Kakamega, Kisii) are among the worst in terms of percentage of the population in poverty and incidence of disease (Repub-

lic of Kenya 2003). Already high poverty has been exacerbated by civil strife in parts of the Ethiopian and Ugandan highlands. One of the reasons for high rates of poverty is the extreme population density. The East African highlands contain the most densely populated rural areas in Africa, resulting in small landholdings. Another reason has to do with difficulties of transportation and communication because the rugged and difficult terrain in highland areas greatly increases the costs of establishing a dense road network.

Sadly, nonagricultural employment opportunities are not growing rapidly enough (imperceptible change in some areas) to provide the engine for a viable poverty reduction strategy for the short to medium term. Growth in the agricultural sector where most of the work force is located is a must for poverty reduction. For the countries as a whole, and for the highlands in particular, agricultural growth must be through intensification of production because there are no additional productive lands to be brought under cultivation. But intensification is not an easy task, as witnessed by the recent trends in smallholder communities of shrinking average farm sizes, low investment in agriculture, stagnant crop productivity, and visible signs of degrading resources. In fact, there are signs that the opposite is occurring in large areas of the highlands, where high rates of soil erosion and nutrient mining in many locations and farming systems have been reported (Bagoora 1988; Hurni 1988; Stoorvogel and Smaling 1990; Böjo and Cassells 1995; Tukahirwa 1996; Braun et al. 1997; Smaling, Nandwa, and Janssen 1997; Elias, Morse, and Belshaw 1998; Van den Bosch et al. 1998; Wortmann and Kaizzi 1998; Shepherd and Walsh 2002; Lesschen, Stoorvogel, and Smaling 2003; Nkonya et al. 2004, 2005b). Yet there is enormous potential for the highlands to be the food baskets for the region and beyond.

There are some successes to be sure, such as smallholder dairy and cash crop production in the central Kenya highlands (Minot and Ngigi 2004; Ngigi 2004). There, relatively high levels of investment in agriculture take place, a large number of profitable agricultural enterprises are adopted, a vibrant nonfarm economy has developed, natural resource management has improved, and poverty rates are low by regional standards. It is important to better understand the nature and causes of the nexus of problems that characterize the highlands as well as the ways in which successes have occurred. As will be seen throughout this book, there is no single type of problem or solution that dominates across the highlands. Rather there are different combinations of problems that result from numerous localized differences in terms of physical, climatic, ethnic, demographic, and economic factors. This means the identification of effective poverty reduction strategies requires attention to the prevailing circumstances, problems, and opportunities.

Key Objectives and Contributions of the Book

Objectives of This Book

The main objectives of the book are:

1. to identify different development pathways[1] that may be attractive for communities under different economic, political, agro-ecological, market, and demographic contexts;

2. to identify promising technological options that can catalyze or propel these development pathways; and

3. to identify the supporting policies and institutions that can lead to more effective management of community and household resources directly and through technological change.

Contributions of This Book

In support of the objectives, the chapters undertake empirical analysis of the following main research issues:

1. the factors determining comparative advantages of different income strategies, such as agricultural potential, access to markets and roads, and population pressure, and the impacts of these factors on agriculture, land management, and outcomes such as agricultural production, household income, and land degradation;

2. the impacts of income strategies on farmers' agricultural and land management practices and outcomes;

3. the impacts of agricultural and land management practices on outcomes; and

4. the impacts of numerous policy relevant factors—such as technical assistance programs, credit, education, local organizations, and land tenure arrangements—on agricultural and land management practices and outcomes.

This is not the first book to address these issues. Previous books have looked at agricultural intensification processes (Vosti and Reardon 1997; Lee and Barrett 2000), natural resource management, and agricultural technology (Sanders, Ramaswamy, and Shapiro 1995; Barrett, Place, and Aboud 2002). In general, the rele-

vant existing literature comprises case studies that focus on analyses of household behavior in a small number of villages. When synthesized, they are able to provide insights into the importance of meso- and macro-level variables in shaping agricultural processes, but because they were not designed to do so, their comparative strength remains in assessing the importance of household-level factors. Even here, there are some gaps in that the case studies have often emphasized a subset of decisions undertaken by households, for example, technology adoption or soil management. There have been some recent studies focusing on specific factors affecting natural resource management, such as property rights and land tenure (e.g., Otsuka and Place 2001b) and the ability to attain collective action (e.g., Meinzen-Dick et al. 2002), but these have tended to have a more narrow focus.

This book provides evidence about how the different problems of poverty, low productivity, and natural resource degradation are linked to one another at household and community (or meso) scales. It also shows how the particular set of local problems and other conditions will lead to distinct comparative advantages. Such comparative advantages further tend to influence the types of income strategies and development pathways pursued by communities and the households within them. The studies attempt to show how decisions on income strategies, land management, and technology adoption are linked as well as how they impact on welfare and natural resources.

The book also recognizes that important conditioning factors or driving forces manifest themselves at the landscape or community level as well as at the household or individual level. That is, some communities, by virtue of their remoteness, may be poorer and have fewer growth opportunities than other more favorably located communities. But even in favorable communities, some households will lack sufficient skills or resources with which to seize available opportunities. Likewise, there are some households in unfavorable areas that are able to invest in agriculture and break out of poverty cycles. Attention to these distinctions permeates throughout the problem and intervention analyses in the book.

The studies in the book are designed to tackle these issues. They cover wide areas of the highlands with both meso- and micro-level data. Hence, important variations in climate, market access, population pressure, land tenure systems, and cultural practices have been purposefully included in data sets and analyzed. In addition, quantitative analyses have been applied to assess the strength of tendencies across varied sites as well as within sites sharing particular conditions. Within the context of agriculture and natural resource management interventions, the studies in this book also look broadly at a range of technical, institutional, and policy interventions. Indeed, other strengths of the book are its focus on exploring synergies and tradeoffs among different interventions in order to address complex problems

as well as the need to alter sets of interventions to tackle diverse problem domains in different parts of the highlands.

Description of the East African Highlands

In this section, we describe some of the important features of the highlands and the national economic and political context in which highland households operate. These correspond first to conditioning factors, that is, those factors that are beyond the control of households, communities, and other decisionmakers and are largely fixed over time, such as altitude, rainfall, and soil type. A second set corresponds to what we call "driving forces," which are those variables that do change over time and may be influenced by decisionmakers. These include population growth and density, market access, and a host of government institutions and policies. We also provide brief descriptions of the distinguishing features of the agricultural and natural resource sectors. At the end, a few remarks are made about what we consider to be the key lessons from the description—some similarities, key differences, and what are likely to be the important variables that drive different income strategies and development pathways in the highlands that are to be explored in more detail in the following chapters. Chapter 2 will then examine these same factors in the framework of a conceptual model from which key hypotheses on cause–effect relationships may be formulated.

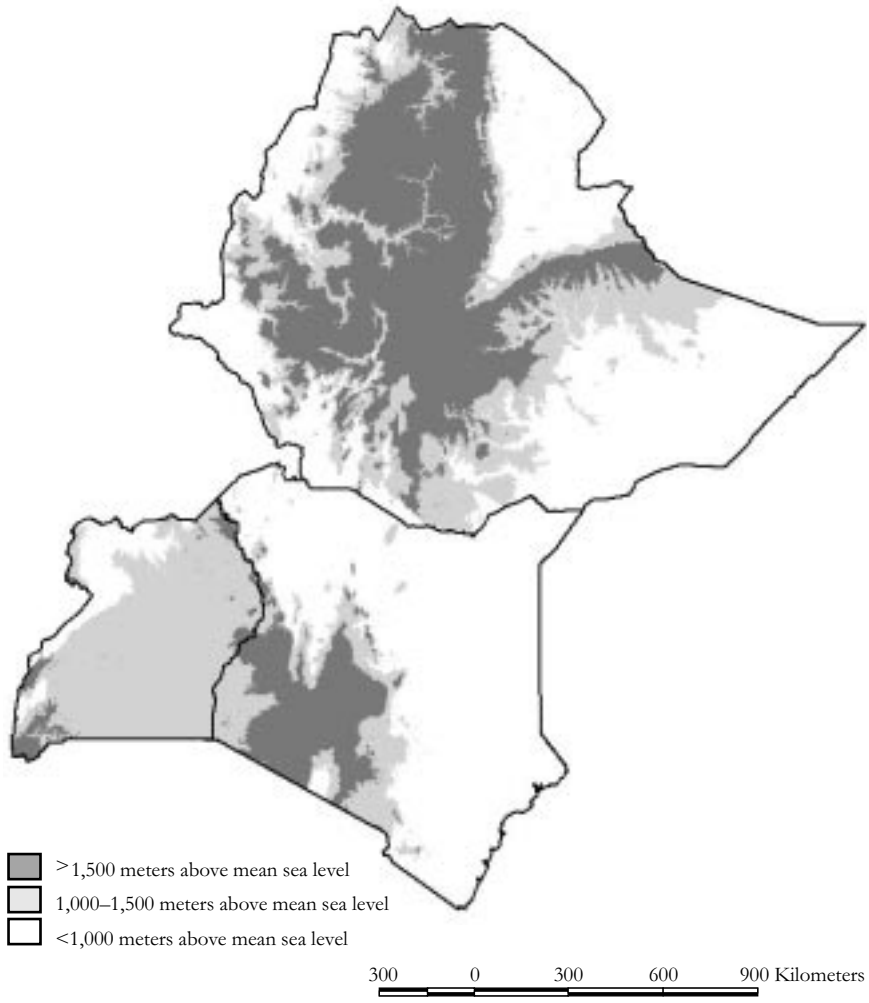
The Geography of the East African Highlands

Altitude and topography. The highlands constitute a large share of land in East Africa (consisting of Ethiopia, Kenya, Uganda, Rwanda, Burundi, and Northern Tanzania). Defined at 1,200 meters above sea level, the highlands comprise about 23 percent of the land area but are home to an even larger share of the population, 53 percent. The highlands are particularly important in Ethiopia, where they comprise 40 percent of the land area and as much as 81 percent of the population (Hoekstra and Corbett 1995; Alumira and Awiti 2000). In Kenya over half of the population resides in highland areas. Figure 1.1 shows the areas of Ethiopia, Kenya, and Uganda that are above 1,000 and 1,500 meters, respectively.

Another feature of the highlands is the wide variation in topography, often within small geographic areas. Common landscapes include hilltops, steep and moderately sloping land, relatively flat plateaus, and valley bottoms, both narrow and wide. Sloping areas represent the most fragile lands in the highlands, as they are highly susceptible to erosion, especially because intense rainfall events are common.

The topography leads to two important characteristics for farming. The first is that the climate can change dramatically within several kilometers as a result of the

Figure 1.1 Elevation map of the highlands of Ethiopia, Kenya, and Uganda



Source: Prepared by Meshack Nyabenge, World Agroforestry Centre.

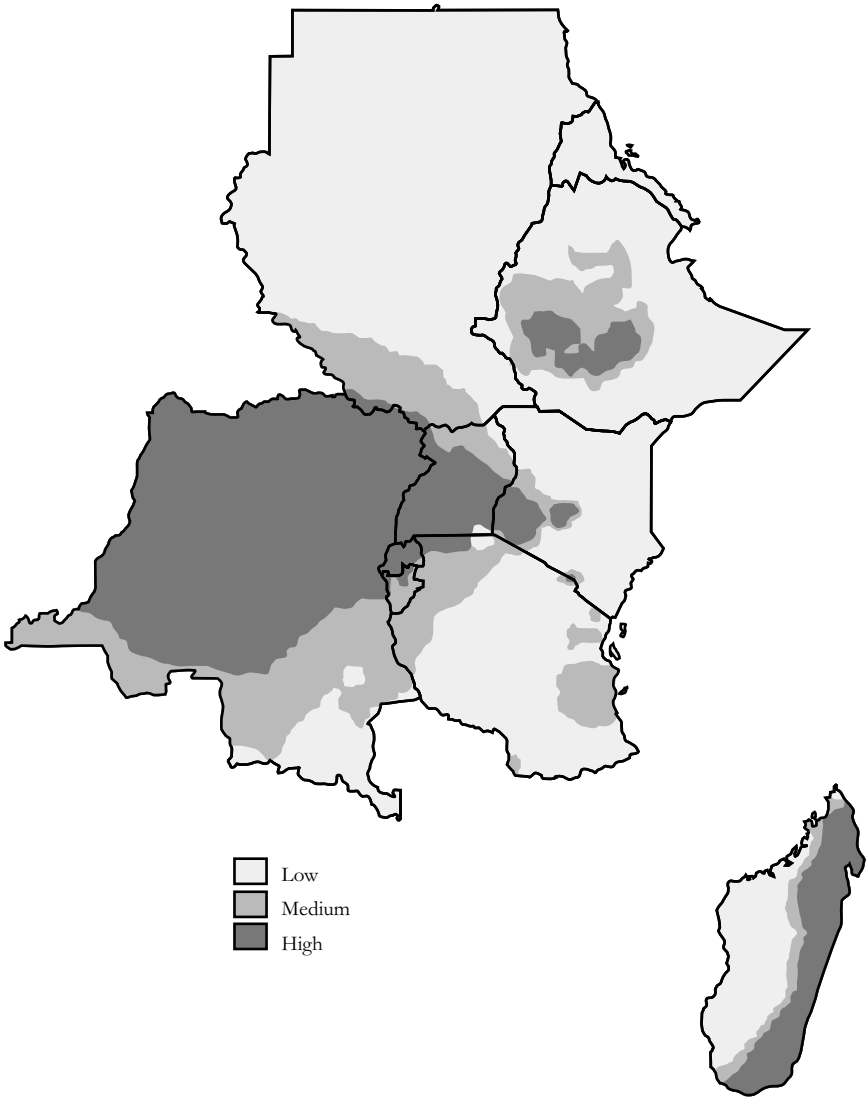
effects of mountains on wind and rainfall patterns. This is observed near Mt. Kenya, where the western slopes are dry compared to the humid southern and eastern slopes. It is also commonly observed in Ethiopia, where pockets of lush vegetation can be found within relatively dry zones (and vice versa). The second implication is that because of the microvariations caused by slope and toposequence, villages and even individual farmers are able to produce a range of crops.

Climate. There is considerable variation in the agricultural potential of highland areas. Some are characterized by high rainfall, two rainy seasons, and fertile volcanic soils, whereas others have low and erratic rainfall with poor inherent soil quality. The highlands for the most part have rainfall totals and patterns that compare very favorably with the rest of Africa. Most of the highlands have average rains of over 1,000 millimeters per year, and for many such sites, rainfall is distributed in a way that allows two growing seasons. In the Ugandan and Kenyan highlands, rainfall is generally 1,200 millimeters or more, rising to averages as high as 1,600 millimeters per year. There are some pockets of the Ugandan and Kenyan highlands that receive significantly less rainfall because of wind currents and mountain effects (e.g., the west of Mt. Kenya, some portions of the Rift Valley in Kenya, and the southeastern highlands in Uganda). Ethiopia is a different case. Its vast highland areas include a significant proportion of semiarid areas with rainfall as low as 400 millimeters per year in the northern and eastern parts of the region, whereas parts of the southern and western highlands received more than 2,000 millimeters per year. The rainfall patterns correspond well to variations in the length of the growing period, and these are displayed in Figure 1.2 for all of East Africa. All areas are prone to drought spells and torrential rains, both creating risks for agriculture. In addition, hailstorms are a feature of some highland areas, and western Kenya is particularly prone to such events (Place et al. 2004).

Temperatures in the highlands are moderated and do not normally exceed 30°C. Low temperatures may reach below 10°C at night, but frosts do not occur except at very high elevations.

Land use. Much of the highlands is under agriculture because of its suitability for cultivation and was settled by people early because it had a lower incidence of human diseases such as malaria. In general, there has been substantial conversion of forests and other natural habitats to agriculture. In both Kenya and Ethiopia, between 80 and 85 percent of original forest cover has been removed to make way for largely agricultural land uses (Earthtrends 2004). In Uganda, only 4 percent of the original forest cover remains, and the converted areas include much of the highlands. A study in medium-elevation central Uganda found that between 1960 and 1990, the share of woodland, forest, and bushland fell from 32 percent to 20 percent to make way for agricultural expansion (Place, Ssenteza, and Otsuka 2001). Nonetheless, the highlands continue to host tropical closed forests that remain important habitats for biodiversity and hosts of headwaters of major rivers, although these are much smaller than previously. These areas represent only 4.0 percent of total land in Ethiopia, 1.9 percent in Kenya, and 3.8 percent in Uganda (FAO 1995). In the drier portions of the highlands, such as in northern and eastern

Figure 1.2 Agroclimatic potential in eastern and central Africa, based on length of growing period



Source: Adapted from Fischer et al. (2001).

Ethiopia or the Rift Valley of Kenya, some of the highlands are covered with low dense woodland or bushland. In Ethiopia, because of the importance of livestock, communities have kept a portion of land under rangeland. In summary, a large proportion of the highlands is under agriculture, and cultivation in particular. Nonetheless, management of natural resources in the highlands is concerned not only with soil and water for agriculture but also with forest, woodland, and rangeland resources that can be vitally important locally.

Soils. There are a variety of soil types found in the highlands, such as nitosols, cambisols, ferralsols, and lithosols, with none being dominant. In Kenya and Uganda, most are relatively high in clay content and are deep. In fact, some mountainous areas have nutrient-rich volcanic soils. As a consequence, most of the highlands of Kenya and Uganda are considered to be medium- to high-potential areas and are expected to be major breadbasket regions. This is not the case in Ethiopia, where, because of its extensive highland area, soils of both inherently high and low potential can be found, including the difficult vertisols, hardpans, and sandy soils. Some of the major problems at the national level (i.e., not necessarily unique features of the highlands) are erosive soils in Ethiopia (31 percent of soils), Kenya (22 percent), and Uganda (16 percent); shallow soils in Ethiopia (30 percent) and Kenya (22 percent); and aluminum toxicity in Uganda (47 percent) (FAO 2000). These national estimates are supported by a number of site-level studies throughout the region that demonstrate high levels of soil erosion in the highlands of Ethiopia (Wright and Adamseged 1984; Hurni 1988), Kenya (van den Bosch et al. 1998; Angima et al. 2003), and Uganda (Bagoora 1988; Tukahirwa 1996).

Even in relatively intact soils, soil nutrient deficiencies are also common. Irrespective of the inherent or parent soil conditions, because of high population density, a large proportion of the highlands has been cultivated on a nearly continuous basis for many decades if not centuries. All the while, few inputs have been applied and conservation measures have been inadequate in most places (there are some exceptions of course, such as central Kenya). At the outset of the twenty-first century, widespread nutrient deficiencies are reported in the soils, nitrogen deficiency being common throughout the highlands, and phosphorus especially in western Kenya (Sanchez et al. 1997). In addition to assessments of stocks, nutrient flow studies in the highlands have shown large negative balances for major nutrients in many locations and farming systems (Stoorvogel and Smaling 1990; Smaling, Nandwa, and Janssen 1997; Elias, Morse, and Belshaw 1998; Van den Bosch et al. 1998; Wortmann and Kaizzi 1998; Soule and Shepherd 2000; Shepherd and Walsh 2002; Lesschen, Stoorvogel, and Smaling 2003; Nkonya et al. 2004, 2005b).

The land degradation debate. The issue of land degradation in East Africa, and elsewhere in Africa, has been the subject of increasing debate in recent years. That land has degraded physically, chemically, or biologically in many places in Africa is not challenged. However, the extent, severity, and the underlying causes and effects of the degradation and what should be done about it are debated. Several studies question the extent of land degradation, providing examples of particular cases where land conditions have improved in recent history (Tiffen, Mortimore, and Gichuki 1994; Fairhead and Leach 1996; Leach and Mearns 1996; McCann 1999) or evidence that earlier land conditions (e.g., forest cover) were not as favorable as previously thought (McCann 1999). Some studies argue that land degradation is highly context specific, acknowledging that land degradation is a problem for some farmers in some places and times but arguing that the problem is not as universal as sometimes claimed (e.g., Elias and Scoones 1999). Some studies critique the methods used by agronomists and others to estimate land degradation as being conceptually flawed, subject to large errors, and driven by political motives (e.g., Stocking 1996; Keeley and Scoones 2000; Bassett and Crummey 2003; Fairhead and Scoones 2005). Many studies deconstruct and critique the "Malthusian narrative," which predicts that land degradation is the inevitable result of population pressure and poverty and that drastic action by governments is required to address it (Hoben 1995; Leach and Mearns 1996; Keeley and Scoones 2000; Bassett and Crummey 2003). Most of the authors in this tradition argue that greater appreciation of farmers' knowledge and ability to adapt and innovate is needed, as well as greater understanding of the local historical, political, and sociocultural context.

Some of these criticisms are well founded (Koning and Smaling 2005). Land degradation is certainly not an inevitable consequence of population growth or of poverty; the relationships among these and other factors are complex and context-dependent, and there are many examples of sound land management being practiced by small farmers in many parts of Africa. Nevertheless, there are many studies that document serious degradation, and some of the studies questioning the importance of land degradation also suffer from methodological flaws such as ignoring sources of soil nutrient outflows that are difficult to quantify (Koning and Smaling 2005). Although there are few long-term experimental studies of land degradation in Sub-Saharan Africa (Braun et al. 1997), those that are available show that under continuous cultivation using low external inputs, soil fertility rapidly decreases, yields decline, and a combination of inorganic and organic sources of soil fertility is necessary to sustain crop production (Juo and Kang 1989; Vlek 1990; Swift et al. 1994; Bationo, Lompo, and Koala 1998). This experimental evidence is supported by reports from numerous participatory rural appraisals and surveys in Africa, in which low or declining soil fertility is often cited as a major

constraint to agricultural production (e.g., Scherr 1999; Deininger and Okidi 2001; Pender et al. 2004a).

Much of the evidence on land degradation is synthesized in the recently completed Millennium Ecosystem Assessment (MEA 2005). The MEA is a compilation, analysis, and synthesis of the widest body of research available on various topics of interest relating to ecosystems. The preponderance of evidence from Africa indicates that land productivity has stagnated or decreased across large areas and that in many instances land degradation can be cited as a major cause. Across Africa and for most staple crops, yields have stagnated or worsened over the past 30 years (FAO 2004) despite increased use of improved varieties of maize and other crops (Smale and Jayne 2003) and factoring out variations in rainfall. In addition, fertilizer input use per hectare and per capita remains extremely low in Africa and in several countries has fallen in recent decades (Jayne, Kelly, and Crawford 2003), contributing to soil nutrient depletion. This may be somewhat compensated for by increased organic inputs, but available evidence would suggest that these too are very limited (Place et al. 2002c).

There is also direct evidence of land degradation on the continent. Although earlier estimates of large-area degradation were based either on expert opinion (Oldeman, Hakkeling, and Sombroek 1991) or on assumptions and relatively few plot-level trials (Stoorvogel and Smaling 1990), recent advances in remote sensing and ground survey methods have substantiated the existence of significant land degradation at landscape scale. Recent use of near-infrared spectrometry to assess soil quality and land degradation over wide areas has been able to provide evidence of the extent of degradation in the Nyando River Basin of Kenya. Cohen, Shepherd, and Walsh (2005) found that about 56 percent of the land was moderately to severely degraded. Further research combining measured soil degradation with estimated effects on crop yields (Cohen, Brown, and Shepherd 2005) calculate the costs of soil erosion at the national scale in Kenya to be equivalent to 3.8 percent of GDP. Estimates of the costs of land degradation in Ethiopia from different methods also indicate large impacts, although there are debates about the methods used and the exact magnitudes of the impacts (Sutcliffe 1993; Böjo and Cassells 1995; Kappel 1996; Sonneveld 2002). Evidence from laboratory analysis of changes in soil properties in plantation agriculture in Tanzania (Hartemink 2003) and from sample plots in small farmers' fields in Uganda that were resampled 40 years after an earlier soil survey (Ssali 2003) also support the view that soil fertility has declined in East Africa. There are also studies showing high costs of siltation resulting from high levels of soil erosion in the East African highlands. In Sudan, for example, the total capacity of the Roseires Reservoir, which supports 80 percent of the country's elec-

tricity, has fallen by 40 percent in 30 years as a result of siltation of the Blue Nile (UNEP 2002).

We conclude, based on the available evidence, that land degradation is a serious problem in many parts of the East African highlands, though it is context-dependent, as farmers in many places are responding to the problem with improved land management practices. As noted earlier, improving understanding of the widespread variation in the causes and extent of land degradation and farmers' land management practices is a major objective of the studies included in this book.

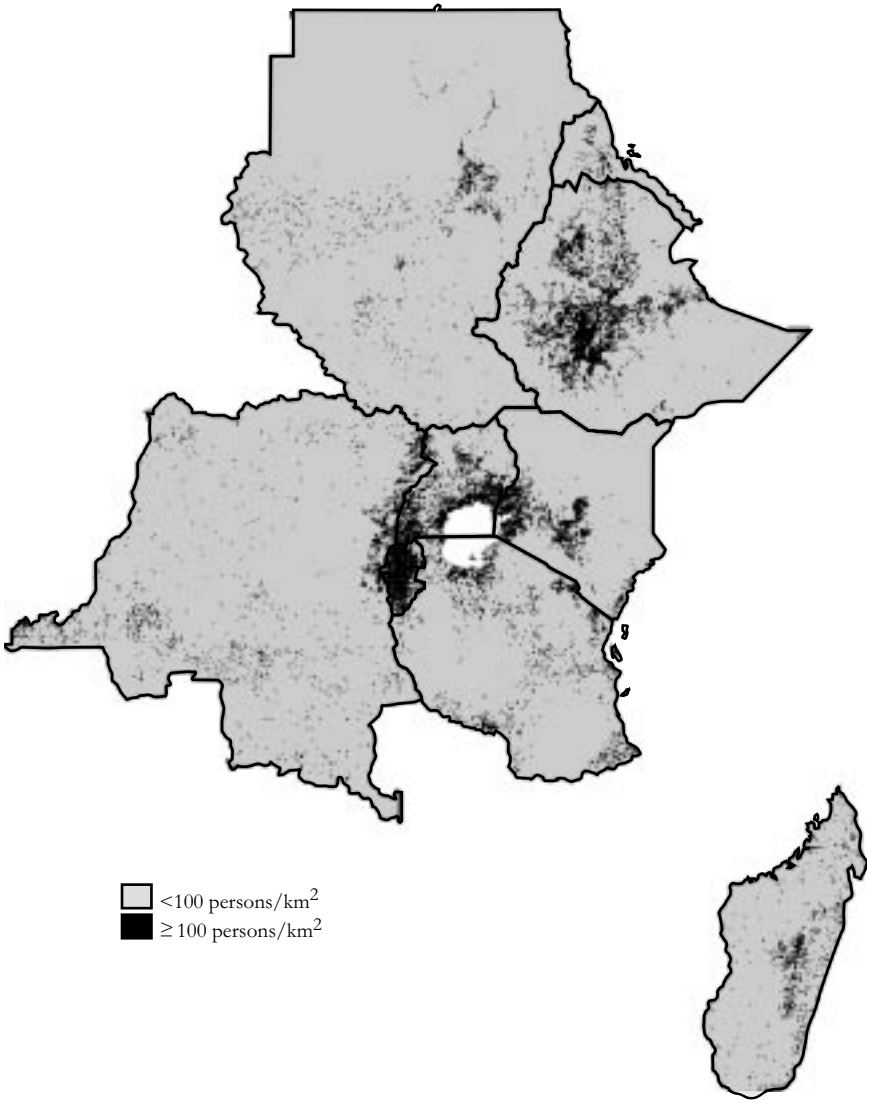
The Social, Economic, and Political Context

Population. The highlands of East Africa are home to the highest rural population densities in Africa because of the attraction of the relatively cool climates, low risks of disease (e.g., malaria), as well as the potential for high agricultural productivity. The Kenyan highlands average between 170 and 190 persons per square kilometer, which is both higher and less variable than rates for Ethiopia (51–130) and Uganda (102–155) (Diechmann 1994). This pattern is represented in Figure 1.3. But densities can reach far above these levels, especially when land unsuitable for agriculture is factored out. Most studies from the highlands indicate an average farm size of about one hectare or less and, with six persons per household, suggesting a population density of around 600 persons per square kilometer of cultivated land. The western Kenyan highlands are the most densely populated, with over 1,000 people per square kilometer in some locations (Republic of Kenya 2002).

Rural population growth rates have slowed recently as a result of urban migration and higher death rates from AIDS (and the ever-persistent malaria). There are no specific figures for the highlands, but rates of HIV/AIDS incidence among adult populations are estimated to be 15.0 percent in Kenya, 6.4 percent in Ethiopia, and 5.0 percent in Uganda (Earthtrends 2004), though there is some dispute about the accuracy of these numbers. The existence of AIDS and continued persistence of other fatal diseases such as malaria and tuberculosis have prevented significant rises in human longevity. Wars and population displacement have not been a prominent feature of the highlands, but the Tutsi–Hutu conflict has periodically spread into the Rwenzori highlands in southwestern Uganda, and the Ethiopia–Eritrea war affected some areas of northern Ethiopia. All of these factors have continued to impinge on life expectancy, which ranges only between 43 and 49 years in the three countries.

Nonetheless, total population annual growth averaged 3.3, 2.9, and 2.2 percent between 1995 and 2002 in Uganda, Ethiopia, and Kenya, respectively (FAO 2004). Although urban areas are growing more than twice as fast as rural areas

Figure 1.3 Population density in eastern and central Africa



Source: CIESEN/IFPRI/ World Bank/CIAT (2005).

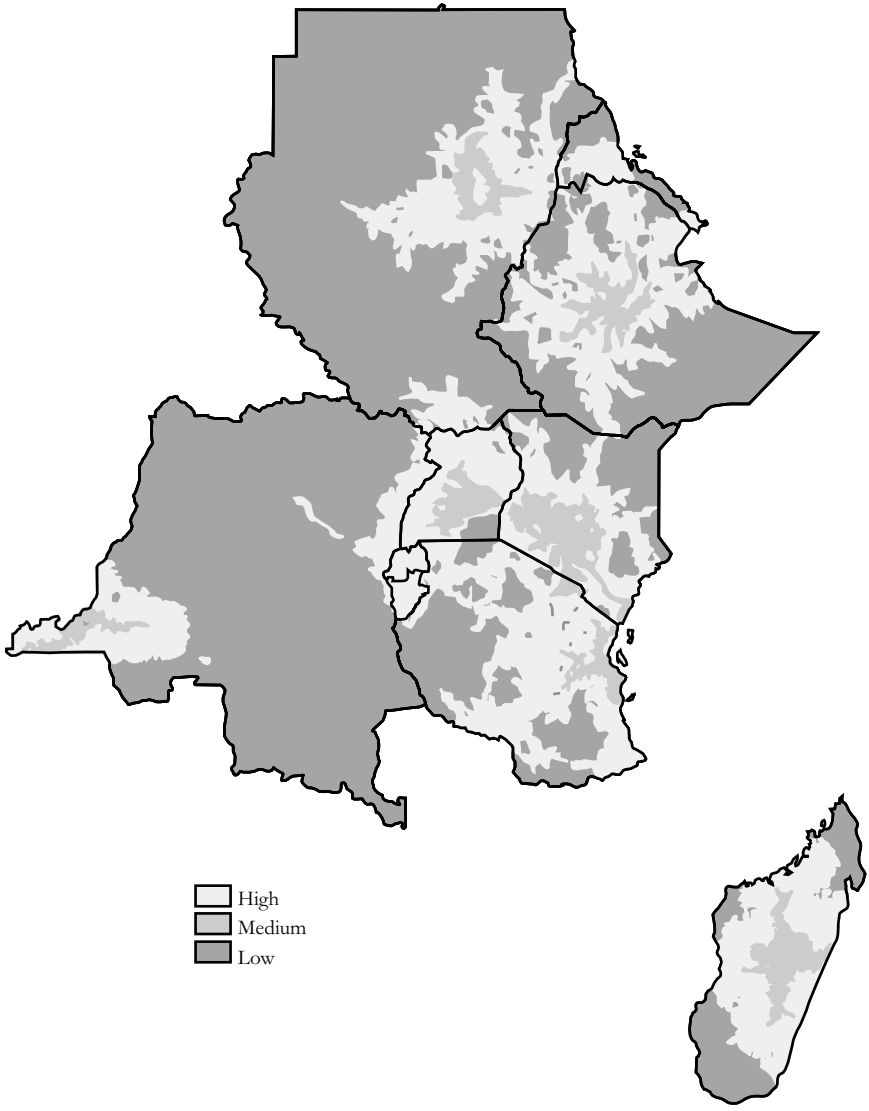
(e.g., urban growth in Kenya was over 6 percent per year in the late 1900s; United Nations 2001), rural population continues to rise. The rate of population growth in the highlands is likely less than those in other rural areas because of their already high densities and the implications this has on emigration to urban or other rural

areas. This pattern of emigration also suggests that the highland communities are typically better connected with cities and towns (many of which are growing rapidly within farming landscapes) than other rural communities. The result is that highland-based households may have very complex economic structures with labor and capital moving between rural and urban settings.

Settlements and land tenure. As a consequence of high population densities, farm sizes are small throughout the highlands, with average sizes at or below 2 hectares almost everywhere. In the western Kenya highlands, average farm size is less than 1 hectare in most areas and even as low as 0.5 hectares in many parts (Wangila, de Wolf, and Rommelse 1999). A national study in Ethiopia found average farm size to be 1 hectare (Ethiopian Economics Association 2002). In Uganda, the 1991 agricultural census found that more than 1.2 million of the 1.7 million rural holdings were 1 hectare or less (Republic of Uganda 1992). Most farms consist of a single holding, and fragmentation of holdings is most common in the highlands of southwest Uganda. Land in the Kenyan highlands had been demarcated and registered in the name of the owner beginning in the 1960s. Most farmers in the central highlands have updated their titles, but many in western Kenya have not. Highland smallholder farmers in Uganda do not have formal titles but normally are secure in their tenure, and rights of land alienation are common throughout Kenya and Uganda. The de facto individualization of tenure in Uganda (especially in the highlands) has led to legal recognition of private rights in the 1998 Land Act. However, regional differences still persist, as exemplified by the parallel *mailo* tenure system in central Uganda (Baland et al. 2003). Ethiopia is distinct from Kenya and Uganda in that land tenure rights have been formally held by the state, and land sales and mortgages are forbidden. However, land reforms have been announced and implemented by regional governments in Ethiopia, including the halting of land redistributions and the issues of land certificates to households. One consequence has been an emerging land rental market (Holden, Shiferaw, and Pender 2001; Pender and Fafchamps 2005). Thus, there is a rich diversity of tenure systems and arrangements across the study countries.

Markets. Road densities and quality are low throughout East Africa, as is the case in Sub-Saharan Africa as a whole. The proportion of paved roads to total road length is on the order of 10 to 15 percent for all the countries. However, in terms of total road densities most of the Kenya highlands are well served compared to Ethiopia. There are only 26 kilometers of road per 1,000 square kilometers in Ethiopia, one of the lowest road densities in the world (Demeke and Abebe 2003). Figure 1.4 shows how market access, in terms of travel time, varies in East Africa.

Figure 1.4 Market access in eastern and central Africa, based on travel time to nearest five markets, weighted by population of markets



Source: Constructed by Jordan Chamberlin, IFPRI.

Note: Based on cities with a population of 1 million people or more.

Growth in telecommunications was dormant for decades until the advent of mobile phones and the privatization of cell phone providers. Growth in Uganda has been staggering. In 1999, it became the first country in the world where the number of mobile telephone users exceeded that of fixed-line users. Kenya shortly followed suit and is experiencing similarly high growth rates. Ethiopia lags the others because of its continued reliance on the government-owned telecommunications corporation. It should be emphasized that the rapid growth rates are applied to very low levels of telephone lines. By 2000, the numbers of fixed and mobile lines per 100 persons were only 1.05 and 0.42, respectively, in Kenya. In Ethiopia, the comparable figures were only 0.37 and 0.03 (International Telecommunications Union 2004). The economic impact of the recent improvement in telecommunications has not yet been documented.

Markets for inputs are much more developed in the Kenya highlands than in the highlands of Uganda or Ethiopia. On the input side, there were as many as 12 fertilizer importers in Kenya and 500 wholesalers in the mid-1990s (Allgood and Kilungo 1996). These are underdeveloped in Uganda and Ethiopia, as is the retail sector. In fact, fewer than 10 percent of Ugandan farmers use any chemical fertilizer (Pender et al. 2004a), and the average fertilizer application rate in Uganda (about 1 kg/ha) is much less than even the low average in Sub-Saharan Africa as a whole (Republic of Uganda and FAO 1999). In Ethiopia, fertilizer use is significantly higher than in Uganda as a result of heavy promotion by the government extension and credit program. The Ethiopian market for fertilizer is controlled by two holding companies supported by government tenders (Jayne, Kelly, and Crawford 2003). Despite rhetoric from the Government of Ethiopia extolling the intention to strengthen the private sector's involvement in agricultural inputs, there is relatively little movement in this direction.

Credit is practically absent for smallholders in East Africa with three notable exceptions. First, cooperatives (i.e., mainly government parastatals) operating in export crops have traditionally maintained credit programs. This was a key contributing factor in building up the coffee and tea sectors as well as ensuring adequate use of inputs, at least in the case of Kenya. A second source is through private firms under contract farming. This is less common but occurs for vegetables and some other horticultural crops. A third way is through the occasional government support program such as that in Ethiopia, where the government is promoting the adoption of modern cereal varieties and accompanying inputs (especially fertilizer). Aside from these formal opportunities, there are very few opportunities for farmers to borrow through formal banks, and they are left with small and uncertain loans from small traders or in revolving credit schemes.

There have been few restrictions on labor markets after the fall of the Derg regime in Ethiopia, which had prohibited the hiring of labor along with restrictions on land transactions. There are examples of migrant labor working on a fixed-term basis (e.g., for tea) and local labor markets (e.g., casual labor tasks) in many highland areas. The quantity of hired labor is strongly linked to the presence of high-value agricultural enterprises, such as coffee and tea, in all countries. In areas where low-value cereal production dominates, relatively little labor is hired except by the wealthier households.

Markets for outputs are heavily influenced by road densities, export opportunities, processing industries, and, of course, general prosperity levels of the country. From the 1960s to the 1990s, Kenya was far advanced in these indicators as compared to Uganda and Ethiopia. However, its advantage has slipped after about a decade of very poor economic growth. Nonetheless, export markets remain relatively strong in Kenya, and high urban growth (6.75 percent annually in the late 1900s) has boosted domestic food demand. Government parastatals, processors, contractors, export buyers, national buyers, and local buyers actively purchase many highland agricultural goods, including crops, milk, meat, and tree products. Uganda has experienced improved market conditions since 1990 in both export and food crops, with significant investment in food processing having taken place. The government has facilitated market linkages to rural communities through major development of road and communications infrastructure. The result is that certain crops enjoy good market channels, notably bananas, the main food crop, tea, coffee, and selected horticultural crops. However, other crops are not as easily sold, and there are reports of rapid gluts in rural markets (Raussen et al. 2002). Ethiopia is clearly lagging in output market growth. Many communities remain disconnected from urban output markets. When production increases do occur, such as with maize in 2001 and 2002, there is no capacity to handle excess supplies, and prices collapse (Gabre-Madhin and Amha 2003).

Political Structure and Policies

International relations and macro policies. There have been quite different political histories in Uganda, Kenya, and Ethiopia in terms of relationships with international organizations. For the entire decade of the 1990s and continuing into the early twenty-first century, Uganda has been a favored recipient of donor funding. This is partly because of the desperate economic and social conditions in Uganda following the long periods of dictatorship under Amin and Obote. Further, the Western countries viewed Uganda's far-reaching macroeconomic stabilization, structural adjustment, market liberalization, and decentralization policies, discussed below, as favorable (World Bank 1996). Following from active IMF and World

Bank programs, and those of numerous other donors, private foreign direct investment was also noticeable, attracting over $100 million per year in the late 1990s (UNCTAD 2003), and its overall balance of payments was 20 times that of Kenya (an economy that is twice the size of Uganda's). This was fostered by encouragement of expelled Asian property and business owners to return to the country and to reclaim their assets.

Kenya has been on the opposite side of the spectrum. The IMF closed down its Kenya facility in the mid-1990s and resumed it only in 2004. The main reason for this was government corruption, and that signal affected donor funds from other countries profoundly. It also had an effect on private capital inflows, which virtually dried up by the late 1990s and were just $5 million in 2001. Certain government programs, such as health, education, and agricultural research and extension, continued to receive support, but there was no general budget support to the government. In 2003, a new government was elected following the formation of a political coalition to oust the long-standing ruling party. The government made an immediate impact with a change to free primary education and has made well-publicized strides to fight corruption. As a result, there has been renewed interest in Kenya on the part of the IMF, the World Bank, and several other donors.

Ethiopia lies somewhere between these cases. It is widely recognized that Ethiopia is one of the world's poorest countries. In addition, the Ethiopian government is not considered to be very corrupt, relative to many other African countries, including Uganda and Kenya (Transparency International 2004). So there are strong interests on the part of the international community to assist the government to mitigate periodic famines and to develop the country. However, the international community became incensed at the diversion of resources to fight a war with Eritrea. This proved to be quite a setback for the continuation of a number of development projects. Finally, because of the low state of development, foreign direct investment has been low, ranging between only $10 million and $20 million per year during the 1990s. Data on external remittances to East African countries are very poor, and estimates vary widely. The IMF (cited in Harrison 2003) estimates that in 2000, the remittances into Ethiopia were $53 million (with the rest of East Africa receiving about $300 million altogether). Farm level surveys from Ethiopia and Uganda (results discussed in Chapters 5, 7, and 9 of this book) do not show remittances (whether from domestic or external sources) to be a major component of farm households' incomes in the regions studied in those countries. In the highlands of Kenya, remittances are probably more important to rural households (as are other sources of nonfarm income as shown in Chapter 8), though evidence on this is limited.

Uganda was the first of the East African countries to liberalize exchange rates (in 1990) and to relax restrictions on capital flows. This enabled, among other things, Asian capital to return. Kenya followed suit shortly after (in 1993), and Ethiopia has likewise moved largely in that direction. As a result, Uganda's currency has depreciated the most against the hard currencies since the early 1990s, followed by the Kenya shilling and then the Ethiopian birr, which had been closely managed to create a stable exchange rate with the dollar until a 240 percent rise in the exchange rate in 1992. By 1997, the parallel currency market rates were very close to official rates. Trade and commodity market liberalization accompanied the exchange rate policy changes. However, by 2004, the countries still maintain import tariffs, and discussions continue to remove these over time, first among Kenya, Uganda, and Tanzania and then with a broader set of eastern and southern African countries.

All governments have sought to control inflation in recent years and in fact have done well in this respect, apart from some bouts of high inflation in Uganda in the early 1990s and in Kenya around elections in 1992 and 1997. Ethiopia has kept inflation under control except during the severe drought years of the mid 1980s and 1990s, when it reached between 15 and 20 percent. On the other hand, government spending has been difficult to balance against revenues in all countries. This has increased tensions between donors/lenders and the governments of these countries, especially because of their large defense budgets.

Decentralization of governance. The three countries also differ in terms of the degree of internal decentralization of political decisionmaking. In the 1990s, Uganda embarked on a broad program to decentralize much decisionmaking to local levels. This program included the direct election of local officials, granting of numerous powers to local authorities, and the ability for local governments to raise and retain their own revenues. This has been done within a single-party framework. Contrary to this movement, Kenya remained, as of 2003, on the other end of the spectrum with a rather centralized political system. To its credit, the Moi government allowed the multiparty system to develop, but it retained key powers in the executive branch at the national level. For instance, all local administrators, from sublocation up to province level, are appointed by the executive branch. Some planning is done at local levels, but the planners are not accountable to the local populations. Ethiopia lies between the two cases. In fact, it has recently increased the powers of its seven regional state governments across a range of decisionmaking areas, including agriculture and the environment, and is also increasing authority and capacity of district (*woreda*) governments. Some fiscal autonomy has also been granted to the regional governments.

Natural resource and tenure policy. As indicated above, the past decades have witnessed substantial conversion of natural habitats to other uses. This includes a large amount of gazetted land supposedly protected by law. Yet, in many cases, exemptions were granted by one office (e.g., lands) in defiance of the rules set by another (forests). In other cases, clearing of land was allowed to proceed because of local corruption or inability to enforce policies. A number of environmental regulations and bylaws are on the books but are routinely flaunted. These include the observance of easements along riverbanks and restrictions on cultivation on hills and steep slopes, the cutting of indigenous trees, and the harvesting of water resources. In most cases, agricultural imperatives, especially those of cultivators, have won out over the implementation of environmental policies where the two were in conflict.

Property rights policies and enforcement play a key role in the management of natural resources. It is necessary to discuss tenure on agricultural land country by country because of distinct differences. But there are many common features of property rights on noncultivated lands in the three countries. Although indigenous populations have enacted management rules over land resources that they cultivate, wide areas of noncultivated lands have been subjected to various claims and uses by an array of users: migrant cultivators, new pastoral communities, charcoal burners, tree cutters, and land-grabbing elites (Deininger and Castagnini 2004). In many of these lands, the degree to which sovereign or traditional rules take precedence is not clear. There are often no mechanisms by which different claimants of rights to the same resources can resolve conflicts or can join together to prevent illegal claimants from using the resources. The lack of clarity of property rights over forests, woodlands, grasslands, and wetlands has only increased under decentralization processes that have devolved more control over natural resources to local levels. Moreover, capacity to manage natural resources at local levels is very poor.

On cultivated lands, Kenya embarked on a freehold system to grant individual titles to farmers operating in all medium- to high-potential areas. This exercise began in the 1960s and was largely completed by the 1980s. Under this system, exclusive rights to household heads, mainly male, were granted. But there remained many secondary rights arrangements that survived this, and land boards were also established to prevent the dispossession of landholdings without full consent of family members. Forty years later, the privatization program continues to flourish in some areas where new recipients of parcels update the land registry. In other areas, however, the land registries are moribund because new recipients of land do not find it worthwhile to invest the time and costs in acquiring a title deed in their name.

Uganda passed a new land law in 1998 that affirmed the importance of private tenure on agricultural land but did not deal uniformly with the different tenure

systems that operated previously. Customary tenure is supposed to be converted into a fully private system in which the legitimate occupant of land rights is now formally recognized as the owner under the law, though the law has not been fully implemented. The *mailo* tenure system, which covers a wide area in central Uganda, developed into one of overlapping rights between owners and long-term occupants. The law has not decided in favor of one over the other but has set forth the process to resolve these competing claims and methods for determining due compensation. The law also establishes a streamlined mechanism by which smallholders can obtain title deed on their property. Although very few Ugandan farmers have a title deed, the buying and selling of rural land is as common in Uganda as anywhere in Africa (Place 2002).

In Ethiopia, the government remains the owner of all land. That is enshrined in the constitution, and all regional governments must adhere to that article when devising land reforms. The national government had, through the 1975 land reform, introduced mechanisms for state and cooperative farms along with redistributions of land to promote equitable distribution of land (through peasant associations). State farms were discontinued after 1991 with land reverting back to communities and households. The extent of commercial farming is limited in the Ethiopian highlands, relative to Kenya and Uganda. Also, sale and mortgage of land were barred and remain prohibited today. But there is some relaxing of other restrictions, and land renting is now allowed, subject to restrictions imposed by regional governments. Importantly, many regional governments have stated that they will no longer redistribute land, and the Amhara and Tigray regions have strengthened this new policy by issuing land certificates to households.

Agricultural sector policies. Government involvement in agriculture has roots from precolonial days and continues today in some form in each country. In Kenya, the major areas of government involvement remain in export crops such as coffee and tea, in the national staple, maize, as well as in a few other areas such as irrigation. There is no doubt that public cooperatives helped develop the Kenya highlands. At the turn of the twenty-first century, Kenya boasted as many as 600,000 smallholder dairy farmers, 500,000 smallholder coffee growers, and 300,000 smallholder tea producers. Many of the parastatals, however, were mismanaged and corrupt and may have even had a negative effect on smallholder production and income in the 1990s. As of 2002, the Ministry of Agriculture managed 40 parastatals, many of which required significant budget support in return for dubious benefits. Coffee is widely held up as an example of a poorly run cooperative in which farmers had little voice in the management of the sector. Tea producers, on the other hand, appear to be reasonably well served by the Kenya Tea Development

Authority (Argwings-Kodhek et al. 1999). The liberalization of the dairy sector had enormous impact, with the number of dairy products increasing by perhaps 30 times and retail shortages becoming a thing of the past. Kenya also long ago liberalized the fertilizer industry and removed subsidies. As noted above, this has resulted in competitive import and wholesaling in fertilizer. Fertilizer is available in retail shops throughout the country. The major problem is with costs. Because of the poor road conditions, poor transport means, and lack of competition in the transportation sector, transport costs more than double the price from Mombasa to the farm. Liberalization has not worked in all cases, however, and there remains a concern about input delivery to remote areas, output processing of meats from the pastoral areas, the prices paid to maize farmers, and the incentives to ensure a domestic sugar industry, to name just a few. Credit remains problematic. The government's solution to rural credit was the Agricultural Finance Corporation, but that institution has concentrated almost exclusively on medium- to large-scale farmers in selected high-potential areas (Argwings-Kodhek et al. 1999).

In Uganda, the Museveni government acted quickly in concert with foreign donors to reform the ways in which the government was to be involved in the agricultural sector. After a period of discussion, the Produce Marketing Board, the Coffee Marketing Board, and the Lint Marketing Board lost their monopoly status in 1989, 1991, and 1993, respectively. Consequently, participation of the private sector in agricultural input and output trading increased significantly (Balihuta and Sen 2001; Nkonya 2002), and the farmers' share of the international price of major traditional export crops increased substantially, for example, from 30 percent to nearly 80 percent for coffee (Balihuta and Sen 2001). In 2000 the government initiated the Plan for the Modernization of Agriculture, which sought to enhance the intensification and commercialization of the agricultural sector through agricultural research and advisory services, support to agricultural processing, and promoting the use of high-value enterprises and inputs. There have been successes, for example, in responding to a global shortage of vanilla. However, Ugandan farmers continue to apply few soil inputs as compared to farmers elsewhere in Africa for many reasons, including the high costs of inputs delivery. The Uganda government is also supporting the development of microcredit and has established a high-level government department in this area.

The Ethiopian government has historically been heavily involved in agriculture, especially during the Marxist/socialist regime that lost power in 1991. The policy statements of the current government have been to promote the private sector, but their actual practices are not always reflective of this. For instance, the government has become heavily involved in credit for fertilizer and seed to the extent that private fertilizer dealers have closed down. This has been targeted to

cereal-producing areas, chiefly maize and wheat. It has been successful in raising yields, especially in higher-rainfall areas, sometimes so successful that surpluses could not be handled by either the market or the government, leading to price collapses. The government has been less successful in promoting productivity increases for other commodities and in the drier regions.

All three countries have had functioning agricultural research systems, with Kenya's arguably the strongest in terms of length of uninterrupted research, its decentralized structure, and its successful delivery of improved technologies. Uganda and Ethiopia have recently moved to decentralize their research systems. Both the Kenyan and Ugandan research institutions rely heavily on World Bank and other donor funds, whereas the Ethiopian national and regional governments provide a large share of research capital and operational funds. Extension systems have faced serious deficiencies in all three of the countries, and thus, they all have recently undergone major overhaul. Kenya moved away from a training and visit approach to a focal area approach in which teams of staff concentrate efforts in selected communities each year. Uganda is in the process of transforming its public system into a farmer-led system (Uganda National Agricultural Advisory Services), but this will take considerable time to fully implement (if indeed the system is found to be effective). Ethiopia is investing heavily in increasing the number of extension agents (to three per community), developing a large number of farmer-training centers, and broadening its Participatory Demonstration and Training Extension System to promote a wider variety of commodities and technologies that have market potential.

Livelihoods and Agricultural Systems

Major crops. In Kenya, almost all the highlands are considered to be medium to high potential. As a result, a variety of crops can be found throughout the highlands. The main factor in explaining differences is not agricultural potential, therefore, but rather market access and cultural factors such as the commercial mindset of the population. In central Kenya, the practice of growing commercial products and buying food items is well entrenched. Therefore, the notion of a subsistence farmer is practically unheard of. Farmers integrate a wide range of food and nonfood crops on their farms. On the other hand, there are a large number of farmers in the western Kenya highlands who produce mainly food crops and sell a small portion of their output, those being mainly distress sales (i.e., out of the need to pay for another critical household need). The key staple food crops in the Kenya highlands are maize, beans, potatoes, and bananas, followed by sorghum, cassava, and rice. Maize accounts for 80 percent of all cereal value and occupies about 1.5 million hectares of land. Vegetable production of kale, peas, onions, carrots, and

tomatoes is also common. Nonconsumed cash crops include coffee, tea, sugar cane, and French beans.

In Uganda, banana is the main staple and, at 1.5 million hectares, accounted for the largest share of acreage under cultivation (FAO and World Food Programme 1997). Several important crops follow, including beans, maize, and sweet potato, with maize production experiencing good growth with markets in Kenya. Uganda is one of the largest growers of coffee in Africa, with 90 percent of production being robusta. It can be found in many districts, including all lakeshore, southwest, and western districts. A number of specialty crops are also produced; the more commercially traded include vanilla, passion fruit, and pineapples.

In Ethiopia, teff is the main staple food and, at 2.7 million hectares, occupies the largest share of cultivated land, especially in the central and northern regions (FAO and World Food Programme 2000). Maize, wheat, and barley are also produced on over 1 million hectares each, with the maize area expanding at high rates. Pulses as a group also occupy about 1.5 million hectares of land. Coffee is the major cash crop, found mainly in the southwest of the country. Almost all coffee is grown by over 700,000 smallholder farmers and together accounts for 60 percent of Ethiopia's export earnings. Also important as a food crop in more humid areas is enset (a root crop), and chat (a mild narcotic) is increasingly important as a cash crop in many such areas, particularly in the wake of low world coffee prices in recent years.

Livestock. There are about 12 million head of cattle in Kenya and 20 million sheep and goats. The sector contributes about 42 percent of total agricultural income (Argwings-Kodhek et al. 1999). Although many of these animals are located in pastoral areas, a large number are in the highlands, and over 3 million dairy cattle can be found in the highlands (Aklilu 2002). Livestock systems in the Kenya highlands are intensive and productive. Most cattle in Central and Rift Valley Provinces are high-grade animals and are raised in zero grazing units. Indigenous cattle breeds raised in tethered or guarded grazing systems are more common in the western highlands. Poultry keeping is also very common at small and medium scales. Goats are also common; the Kenya highlands host the largest number of improved dairy goats in Africa.

Ethiopia has the largest livestock herd in Sub-Saharan Africa. There are over 35 million head of cattle, 30 million sheep, and 21 million goats. About 80 percent of cattle and 75 percent of sheep are found in the highlands, whereas most of the goats are raised in the lower elevations (Demeke and Abebe 2003). The livestock sector contributes 20 percent of gross domestic product.

In Uganda, there are about 5.9 million head of cattle and 7.3 million sheep and goats (Mwebaze 2002). Poultry are the most common of all, numbering about

22 million. Most of the cattle are under extensive feeding systems in the drier zones. There is a growing dairy industry, estimated to produce about 511,000 metric tons of milk annually (Mwebaze 2002), but the number of high-grade animals is small in comparison to Kenya. The major pockets of modern dairy production systems are in the western and eastern highlands, the southwestern districts of Mbarara and Bushenyi, and in periurban areas near Kampala and Jinja.

Trees and other agricultural products. Another notable agricultural product in Ethiopia is eucalyptus poles, which comprise nearly all the trees planted by farmers. The demand for poles is high because of construction booms in the cities and towns and for poles for making plow beams. Eucalyptus is also a major source of fuelwood. Some fruit trees are also found but are not extensively commercialized. A final important product is honey production, which is produced in the drier parts of the highlands. In Kenya, there are a variety of valuable trees, including macadamia and avocado fruit trees and grevillea timber trees in central Kenya and eucalyptus woodlots in western Kenya. For example, avocados generate about $6.5–7.0 million in export revenue each year, the third largest export among fruits and vegetables (FBAK Feld Consulting 2001). In Uganda, eucalyptus is also a common timber/pole tree, mainly found in woodlots. Fruit trees such as avocado, jackfruit, and mango are common in the highlands of Uganda but in small numbers per farm.

Agricultural Productivity and Growth

The three countries have experienced significantly different trends in per capita agricultural production in recent years. As indicated in Table 1.1, Ethiopia has exhibited the highest growth rates in agricultural production between 1995 and 2003 (5.5 percent), fueled by impressive increases in cereal production. This has come about because of three factors: the very low baseline yields, characteristic of the military regime; slight expansion of cultivated land (mostly outside of the highlands); and improved yields from intensified use of inputs, especially fertilizer. Kenya attained modest growth in per capita agricultural production (1.8 percent) over the same period but actually experienced a large drop in per capita cereal production. This indicates a shift toward higher-value production systems, such as tea, dairy, and horticulture. In Uganda, trends in both indicators have been negative. Part of the reason for this is the rapid agricultural growth that occurred in the 1986–95 period, especially in terms of cultivated areas. Further increases are going to be difficult to realize unless input use (especially of organic or inorganic sources of soil nutrients) increases from its extremely low level.

Table 1.1 Some indicators of agricultural performance in Ethiopia, Kenya, and Uganda

Indicator	Ethiopia	Kenya	Uganda
Per capita agricultural production 2003 (1990 = 100)	103.9	94.0	94.1
Growth in per capita agricultural production 1995–2003	5.5	1.8	–1.8
Per capita cereal production 2003 (1990 = 100)	155.0	70.1	95.2
Growth in per capita cereal production 1995–2003	9.5	–28.0	–11.5

Source: FAO (2004).

The Critical Variables

Here are some of the critical variables that take various patterns across the landscape of the highlands and that are expected to have large effects on the development pathways of communities and the households within them.

Climate. The more humid portions of the highlands receive a high and relatively well-distributed rainfall, perhaps the most favorable for agriculture in all of Africa. In such areas, the highlands host a wide variety of perennials, annuals, livestock, and trees that is unparalleled in Africa and perhaps the world. In such places (e.g., central Kenya, western Uganda, southwest Ethiopia), there are very few supply constraints impeding the choice of agricultural options. It is rather the markets, entrepreneurial expertise, and access to productive factors that become critical. The drier areas are quite different, and production possibilities are much more limited. Perennials tend to disappear from the landscape, and the low-moisture annuals such as sorghum, millet, barley, and wheat predominate. Because of the lack of vegetation, zero grazing units of improved breeds give way to free-grazing native breeds.

Population. Virtually all of the highlands are densely populated, implying that land is scarce in almost all regions. Indeed, farm sizes average no more than 2 hectares anywhere in the study sites (apart from some larger commercial areas in Kenya). This will of course limit opportunities for mechanization, which indeed is not found to a significant extent anywhere in the highlands. There are some subtle differences in population pressure in that some areas have been reduced to farm sizes of 0.5 hectare or smaller. In those cases, off-farm income has become so important as to render further on-farm innovation problematic.

Markets. Especially within the high-potential areas, market opportunities and infrastructural investment play a significant role in agricultural enterprise selection

and farm investment production. Casual observation suggests that sites where significant investment has taken place (e.g., all-year roads or tea factories) or that are close to the capital cities have become relatively commercialized and prosperous. Farmers are often innovative and tend to make investments where returns are high. In contrast, farmers in remote locations do not adopt the same types of enterprises as will others and will tend to focus on food crops and other subsistence commodities.

Land tenure. There are several significant tenure arrangements that operate in the highlands of East Africa, and they have been uniquely shaped by differences in national policies. Kenya has for a long time promoted individual freeholds, especially in the highlands; Uganda is home to a variety of legal and customary systems; and Ethiopian farmers have been uniformly subjected to strong state ownership rules with emerging transfers of some land rights to households. Ethiopian farmers had further been subjected to periodic land redistributions that have likely inhibited long-term fixed investments such as trees, fences, livestock-feeding units, and the complementary enterprises that they promote. Only in Kenya have a large number of households had access to titles and theoretically to commercial credit.

Government programs. Irrespective of climatic, physical, and market conditions, government programs and policies can have significant effects on rural communities. Ethiopia has been proactive in cereal production promotion, which led to large increases in production and consequent marketing problems in high-potential areas almost overnight. In Kenya, government investment in tea and coffee factories in the 1960s and 1970s had a tremendous effect in creating smallholder commercial farmers. More recently, it has been the move toward liberalization that has tended to improve incentives in many sectors, especially dairy. In Uganda, by most accounts, the liberalization policies adopted have been praiseworthy. This has had some impacts, albeit of a limited nature because of inherently weak public and private systems for disseminating information and for transporting inputs.

Overview of the Book Chapters

The next chapter presents a broad conceptual framework and the key hypotheses that are explored in the empirical chapters. Chapters 3 through 5 form the second part of the book, which focuses on development domains and pathways in the East African highlands. These relate to livelihood strategies emphasized by different communities and, in particular, their agricultural and natural resource management strategies. Chapter 3 focuses on the central and western Kenya highlands, and Chapters 4 and 5 pertain to Ethiopia.[2] All chapters go beyond descriptive

analysis to investigate relationships among development domains and pathways, biophysical conditions, and driving forces of change.

The third part of the book includes six studies of the determinants of land management practices by households and communities in the East African highlands. Chapters 6, 7, and 8 focus on household-level land management in Ethiopia, Uganda, and Kenya, respectively. The Ethiopian and Ugandan studies draw on recent household surveys that were coordinated and are thus able to test a wide range of similar hypotheses. The Kenyan chapter is a synthesis of several recent studies that have individually focused on discrete segments of the conceptual framework. Chapter 9 focuses on the land management impacts of land policy in the case of Ethiopia. Land policy is particularly important in Ethiopia where there is concern that the nationalization of all land has inhibited agricultural development. The chapter will investigate the effects of recent easing in restrictions on individual rights. Chapters 10 and 11 focus on the role of collective action and organizations in particular on natural resource management at the community and household levels in Ethiopia and Uganda, respectively.

The fourth part of the book builds on the analyses of the context and the determinants of land management to examine possible technological and policy options to address land degradation, low agricultural productivity, and poverty in the East African highlands. Chapters 12 and 13 analyze the potential for selected land management technical options to be effective, be adopted, and have an effect on smallholder farmers in the three countries. Chapters 14 and 15 emphasize policy options for Ethiopia and Uganda. Both chapters evaluate the influences of alternative policy options with the aid of bioeconomic models in order to address the potential trade-offs among economic, social, and environmental effects.

Last, Chapter 16 includes a summary of key results, some conclusions based on a synthesis of findings, and implications for policy. The chapter devotes considerable space to reviewing the main findings of the preceding chapters because they are numerous and some readers will not have had the time to read all the empirical chapters. The conclusions are organized around the variables emphasized in the Chapter 1 description and in the hypotheses developed in Chapter 2. The principal implications pay attention to important distinctions among the widely different contexts existing in the East African highlands.

Notes

1. We define a development pathway as a common pattern of change in households' livelihood or income strategies (Pender et al. 2004a). We define income strategies as the set of activities that households pursue to produce or acquire income and consumption goods, such as subsistence

production of food crops, production of perishable cash crops, livestock production, forestry, and nonfarm activities (Nkonya et al. 2004). We use the term "income strategies" rather than "livelihood strategies" for clarity because the latter has been defined by some authors in a very expansive way. See endnote 2 of Chapter 2 for more discussion.

2. Development domains and pathways in Uganda are already described in published work (e.g., Pender et al. 2004a).