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Poverty and Welfare Measures in the Horn of Africa

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PREFACE

This is the 8th of a series of working papers prepared for the IGAD Livestock Policy Initiative (LPI). The IGAD Livestock Policy Initiative has been established by the Intergovernmental Authority on Development (IGAD) in collaboration with FAO and with the financial support of the European Commission and its main objective is to enhance the contribution of the livestock sector to sustainable food security and poverty reduction in the IGAD region. The initiative will align itself with the core outputs of IGAD's programmes on policy harmonization, agriculture and the environment, regional integrated information systems and the IGAD livestock marketing information system.

This paper is part of a project designed to provide standardised and cleaned spatial data for use by the IGAD LPI to help target the policy interventions identified by the project and to contribute to the evidence base for developing pro-poor livestock policies. It will also be used as baseline data from which the impact of policy interventions can be assessed and predicted.

The objective of this paper is to illustrate the poverty estimates that are available in the IGAD region, in the context of analyzing the impact of livestock policies on poverty reduction. The poverty measures described include those derived from socio-economic surveys and those derived from poverty mapping and modelling efforts. The more traditional approaches to measuring and mapping poverty rely on either economic measures, such as income or expenditure, or on a number of social indicators such as life expectancy, under-five mortality, nutritional status, level of education and so on, usually collected through household surveys. The level of information that can be extracted from socio-economic or demographic surveys might not be sufficient for many policy and research applications. Researchers and policy makers therefore increasingly construct geographically disaggregated indicators that provide information about the spatial distribution of inequality and poverty within a country – so-called poverty maps.

In addition to describing the different sources of poverty measures in the IGAD member states (Section 2), we provide an analytical comparison of such poverty measures for selected countries in the IGAD region (Section 3). Finally, we discuss the relevance of such measures for the livestock sector and the implication for poverty reduction strategies in the context of livestock development (Section 4).

Disclaimer

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Francesca Pozzi works as a consultant and was contracted by the IGAD Livestock Policy Initiative (IGAD LPI) to lead this study. Her research interests focus on the use of GIS, remote sensing and statistical tools to analyze poverty distribution and the linkages between poverty and livestock, agriculture, population distribution and the environment.

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Keywords

Poverty, welfare, food security, livelihoods, poverty mapping, small area estimation.

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ABBREVIATIONS

AGAL	FAO Livestock Information, Sector Analysis and Policy Branch
CBS	Central Bureau of Statistics (Kenya)
CGIAR	Consultative Group on International Agricultural Research
CIESIN	Center for International Earth Science Information Network
CSA	Central Statistical Authority (Ethiopia)
DHS	Demographic and Health Survey
DNAS	Direction National de la Satistique de Djibouti
FAO	Food and Agriculture Organization of the United Nation
FEI	Food Energy Intake
FEWS-NET	Famine Early Warning System Network
FGT	Foster-Greer-Thorbecke
ICRC	International Committee of the Red Cross
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
LPI	Livestock Policy Initiative
LSMS	Living Standards Measurement Study
MDGs	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
NRCB	FAO Natural Resources Management and Environment Department: Climate Change and Bioenergy
NRME	Natural Resources Management and Environment Department of FAO
PEAP	Poverty Eradication Action Plan
PPLPI	Pro-Poor Livestock Policy Initiative
REC	Regional Economic Community
SDRN	FAO Environment and Natural Resources Service
SNNPR	Southern Nations, Nationalities and People's Region (Ethiopia)
TCEO	FAO Technical Cooperation Department: Emergency Operations Service
UBOS	Uganda Bureau of Statistics

UNDP	United Nation Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization
WMS	Welfare Monitoring Survey

EXECUTIVE SUMMARY

In the IGAD region, as with most developing countries, the majority of the poor population live in rural areas and are largely dependent on agriculture for their welfare. Factors such as climatic variability, soil characteristics, water availability and animal health affect the productivity of land and livestock and have, therefore, a massive impact on the welfare of the population. Fluctuations in these factors contribute to year-to-year changes in levels of poverty and food security. This paper reviews the available poverty measures in the IGAD region and the role of poverty maps in the context of livestock interventions for poverty reduction.

Poverty measures can be based either on economic indicators, such as income or expenditure, or on a number of social indicators such as life expectancy, under-five mortality, nutritional status, and so on, usually collected through household surveys. In the IGAD region, economic measures of poverty are available through surveys that were designed specifically to collect income or expenditure data (as in the case of Ethiopia and Kenya), but also household surveys that might include income or expenditure data, such as the World Bank Priority Surveys, the Uganda National Household Survey and the Somalia Socio-Economic Survey. Another approach to measuring poverty is through the use of an asset index, such as the DHS wealth index, which provides information on the economic status of surveyed households based on some characteristics of the dwelling and ownership of assets. The wealth index is available, at different levels of aggregation, for five out of the seven IGAD member states (except Djibouti and Somalia).

Researchers and policy makers also analyze poverty through the use of geographically disaggregated indicators that provide information about the spatial distribution of inequality and poverty within a country: these are usually referred to as "poverty maps". The most common approach to poverty mapping is the small area estimation technique, developed by the Word Bank, which combines census and survey data to provide sub-national estimates of welfare. Another more recent approach involves the combination of household survey data with a suite of environmental and other spatial variables not only to map but also to try and explain and possibly predict the distribution of poverty. From a spatial perspective, welfare can also be examined using the livelihood analysis approach adopted by the USAID Famine Early Warning System Network (FEWS-NET), which collects information on how people secure food and other basic necessities such as health care, water and clothes and maps these as discrete livelihood zones.

An exploratory analysis to compare the different poverty measures for Kenya and Uganda shows that the choice of welfare indicator can make a difference to measured inequality. Even though they may be considered proxies for the same underlying variables and show similar patterns at regional levels, the different poverty indices can in fact measure quite different things, and may not be perfectly correlated. As a result, we can reach different conclusions about the distribution of poverty depending on how we define and measure it. Whilst comparing different measures of poverty at regional levels can be used to identify general patterns of poverty distribution within a country, in order to define more effective poverty reduction strategies it is more appropriate to use disaggregated data, such as those provided by the small area estimates or environmental approaches.

The use of disaggregated poverty data is recommended to assist governments in developing or improving policies and strategies for livestock interventions and poverty reduction. Analyzing the relationships between livestock production systems and the characteristics of the poor, and exploring the contribution made by livestock to household incomes can prove useful tools to help prioritize livestock interventions in the context of poverty alleviation.

1. INTRODUCTION

The Intergovernmental Authority on Development (IGAD)[1] is a regional economic community (REC) whose member states are: Djibouti, Eritrea[2], Ethiopia, Kenya, Somalia, Sudan and Uganda. IGAD's mission is to assist and complement the efforts of the member states to achieve, through increased cooperation, food security, environmental protection, promotion and maintenance of peace and security and economic cooperation and integration (IGAD, 2003). Crop and livestock production provide the basic food supply, export earnings and employment for over 80% of the population of the Horn of Africa (IGAD, 2003), thus playing an important role both in economic development and in rural livelihoods.

It is reported that more than half of the population in the IGAD region live below the poverty line of 1 US dollar a day (IGAD, 2003), while at least 70 million (out of some 160 million living in the region) face chronic hunger and poverty (IGAD, 2005). The majority of the poor population in the IGAD region live in rural areas and are largely dependent on agriculture for their welfare. Factors such as climatic variability, soil characteristics, water availability and animal health affect the productivity of land and livestock and therefore have a massive impact on the welfare of the population. Fluctuations in these factors contribute to year-to-year changes in levels of poverty and food security.

Knowing the distribution of poverty will allow governments and development agencies to prioritize and target interventions more effectively, but an understanding of the various factors that are associated with and possibly causing poverty will go further still: helping governments and development agencies to devise interventions that will address these underlying factors.

The more traditional approaches to estimating poverty rely on either economic measures, such as income or expenditure, or on a number of social indicators such as life expectancy, under-five mortality, nutritional status, level of education, etc., usually collected through various types of household survey.

Monetary estimates are considered by economists as the indicators of choice to measure the economic status of a household. They are available for many countries but are quite difficult and expensive to collect. Information on income or expenditure may not be shared within the household, levels may differ among household members, income may vary seasonally, and furthermore there is no agreement on what components of income, or what types of expenditure are most appropriate to calculate a poverty index. Researchers typically use total income from employment, and food expenditure to calculate living standards and poverty indices, but there are ongoing debates about details such as what should be considered "productive activities" and whether other expenditures or loan payments should also be included (World Bank, 2003). Economic measures of household wealth are compared to thresholds that distinguish the poor from the non-poor, so-called poverty lines, to create poverty indices, such as those among the "Foster-Greer-Thorbecke" (FGT) class of poverty indicators (Foster *et al.*, 1984; Foster and Shorrocks, 1988). The most widely used is the "head count index" (Foster *et al.*, 1984), which is calculated as the proportion of households classified as poor (i.e. for which the income or expenditure measures fall below the chosen poverty line).

The social indicators used to measure poverty are also collected through household surveys. The most widespread mechanism through which this type of information is

[1] The Intergovernmental Authority on Development (IGAD) in Eastern Africa was created in 1996 to supersede the Intergovernmental Authority on Drought and Development (IGADD), which was founded in 1986 as an intergovernmental body for development and drought control in the Horn of Africa.

[2] At the time this paper was written, Eritrea had suspended its membership of IGAD.

collected, through relatively standardized questionnaires that facilitate cross-country comparisons, is the Demographic and Health Survey (DHS) – a USAID-funded project designed to collect data on marriage, fertility, family planning, reproductive health, child health, and HIV/AIDS[3]. In addition, information is collected about the dwelling itself, such as the source of water, type of toilet facilities, materials used to build the house and ownership of various consumer goods. These data are used to construct an asset index (the DHS "wealth index") that estimates the wealth status of households.

Information extracted directly from socio-economic or demographic surveys may not in itself be sufficient for many policy and research applications. Researchers and policy makers therefore increasingly produce geographically disaggregated indicators that provide more detailed information about the spatial distribution of inequality and poverty within a country. These data sets are usually referred to as "poverty maps" and can be constructed in different ways. The most common approach is the small area estimation technique, developed by the Word Bank (Ghosh and Rao, 1994; Hentschel *et al.*, 1998), which combines survey and census data to provide welfare measures for all households in the census. In the small area approach extensive census data (with few variables and no measure of poverty) are combined with intensive socio-economic survey data (with many variables, including chosen indices of poverty) in nested regression analyses that assume the local degree of poverty to be due to a combination of broad-scale regional phenomena and finer-scale local phenomena, coupled finally with an error term. At the moment, in the IGAD region, such poverty maps are available only for Kenya (Ndeng'e *et al*. 2003) and Uganda (Emwanu *et al*. 2003).

Another way in which welfare can be examined, and indeed mapped, though not at high resolution, is through the livelihood analysis approach adopted by the USAID Famine Early Warning System Network (FEWS-NET)[4]. Livelihood analysis provides information on how people secure food and other basic necessities such as health care, water, clothes, etc., and how households' normal patterns of food access have been affected by traumatic events (drought, floods, wars, etc.). Livelihood zones are mapped out, grouping together households that have similar livelihoods profiles. This approach represents a useful input to the analysis of poverty distribution, but also may be useful in devising interventions.

More recently a new technique has been developed to describe and analyze the spatial distribution of poverty (Rogers *et al.*, 2006; Robinson *et al*., 2007). The authors combine household survey data with a suite of environmental variables that are either direct measures of key climatic variables, descriptor variables of poverty-generating processes or proxies for constraints to the health and well-being of the population. The assumption is that poverty is a function of several interlinked factors including, for example, agricultural activities, human and animal diseases, natural resources, and access to markets. By incorporating the driving factors that are associated with the different levels of poverty, the modelling approach allows not only for a description, but potentially also for an explanation and, ultimately, a prediction of the distribution of poverty.

The main objectives of this paper are threefold: first to explain how poverty is measured and mapped, second to review the available poverty measures in the IGAD region, and third to explore the role of poverty maps in the context of livestock policy interventions for poverty reduction. In Section 2, we explain the different ways to measure and map poverty, and describe what is available in the IGAD region. These measures include income and expenditure surveys (Ethiopia and Kenya), household surveys with an expenditure module (Djibouti, Somalia and Uganda), DHS surveys (most of the IGAD member states), small area poverty maps (Kenya and Uganda); the

[3] http://www.measuredhs.com/

[4] http://www.fews.net/livelihoods/index.aspx?pageID=livelihoodsZoneMapsAndProfiles

environmental approach to poverty mapping (Uganda); and the livelihood zone approach (most of the IGAD member states). Then, in Section 3 we present comparisons of the different measures for selected countries, to illustrate how the choice of the welfare measure may have a significant bearing on the measure of inequality and thus on policy analysis and targeting. Finally, in Section 4, we discuss the relevance of the different approaches to the livestock sector and to pro-poor livestock sector policy development. We draw linkages between livestock and poverty and show how poverty maps can be used in the context of livestock policy, for targetting and impact assessment.

2. POVERTY AND WELFARE ESTIMATES

In this section we examine the different types of poverty measures that are available for the IGAD member states. These include both surveys and poverty maps. The surveys that we review include those designed specifically to collect income or expenditure data, such as the Kenya or Ethiopia Income and Welfare Monitoring Survey; those that might include income or expenditure data, such as the World Bank Priority Surveys, the Uganda National Household Survey and the Somalia Socio-Economic Survey; and the Demographic and Health Surveys (DHS). In terms of poverty maps and poverty mapping approaches we describe under-nutrition and infant mortality maps; the small area estimate methodology; the environmental approach to poverty mapping; and the livelihood zones estimates.

Table 1 summarises the various welfare surveys that have been conducted since 1990 in the IGAD region, while Table 2 summarizes the poverty maps produced for the IGAD member states.

Table 1: Sources of poverty and welfare data in the IGAD member states

Country	Survey	Year	No. of h-holds	Data available	Type of data
Djibouti	Enquête Djiboutienne auprès des Ménages - Indicateurs sociaux	1996	2,400	N	Socio-economic indicators; income and expenditure data.
		2002	41,254	N	
Eritrea	Health Status, Utilization and Expenditure	1997	1,200	N	Household health status; utilization and expenditure survey.
	Demographic and Health Survey (DHS)	1995	5,469	N	Demographic and health indicators; wealth index.
		2002	9,389	Y	
Ethiopia	Welfare Monitoring Survey	1995	11,687	N	Household economic and demographic characteristics; income, consumption and expenditure data.
		1999	45,123	N	
	Income, Consumption and Expenditure Survey	2000	16,982	N	Household economic and demographic characteristics; income, consumption and expenditure data.
	Rural Household Survey	1994/5	1,477	Y	Household characteristics; agriculture and livestock information; community level data on electricity, water, sewage and toilet facilities; health services for a sample of 15 villages
	Demographic and Health Survey (DHS)	1999/2000	14,072	Y	Demographic and health indicators; wealth index.
		2005	13,721	Y	
Kenya	Welfare Monitoring Survey	1992	12,050	N	Basic individual household characteristics; consumption and expenditure data; agriculture questionnaire for rural households.
		1994	10,857	N	
		1997	10,874	Y	
	Demographic and Health Survey (DHS)	1993	7,950	Y	Demographic and health indicators; wealth index.
		1998	8,380	Y	
		2003	8,561	Y	
	Multiple Indicator Cluster Survey (MICS)	2000	8,993	Y	Health and nutrition indicators pertaining to children; household variables ; Wealth Index.
Somalia	World Bank/UNDP Socio-economic Survey	2002	3,600	N	Indicators pertaining to demographics and housing; employment and income; expenditure; basic services.
	Multiple Indicator Cluster Survey (MICS)	1999	4,170	N	Health and nutrition indicators pertaining to children; household variables; wealth index.
Sudan	Demographic and Health Survey (DHS)	1990	6,891	Y	Demographic and health indicators; wealth index.
	Multiple Indicator Cluster Survey (MICS)	2000	26,806	Y	Health and nutrition indicators pertaining to children; household variables; wealth index.
Uganda	National Household Survey	1992/3	9,929	Y	Socio-economic indicators; expenditure data.
		1999/2000	10,696	Y	
		2002/3	9,711	Y	
		2005/6	7,426	N	
	Demographic and Health Survey (DHS)	1995	7,550	Y	Demographic and health indicators; wealth index.
		2000/1	7,885	Y	
		2006	9,000	N	
	WFP Comprehensive Food Security and Vulnerability Assessment	2005	2,987	Y	Socio-economic indicators; income and expenditure data for rural households.

Table 2: Poverty maps in the IGAD member states

Country	Under-nutrition	Infant Mortality	Poverty Maps (small area estimates)	Poverty Maps (environmental approach)	Livelihood Maps*
Djibouti	✓	✓			✓
Eritrea	✓	✓			
Ethiopia	✓	✓			
Kenya	✓	✓	✓		✓
Somalia	✓	✓			✓
Sudan	✓	✓			
Uganda	✓	✓	✓	✓	✓

* Livelihood zones are available both as country profiles and maps. Here we only report the availability of maps.

2.1 Income/Expenditure Surveys

For many economists household income would be the indicator of choice to determine economic status. However, it is extremely difficult to measure income accurately for a number of reasons. For example, many people tend to hide their income from interviewers, do not provide the exact amount, respondents may not share their income with other household members or income may vary considerably depending on the time of year. Income is generally defined as being composed of earnings from productive activities and transfers. It is customary to distinguish four main components in the measurement of income: (i) wage income from labour services; (ii) rental income from the supply of land, capital, or other assets; (iii) self-employment income; and, (iv) current transfers from government or non-government agencies, or other households (World Bank, 2003). There is disagreement, however, regarding what exactly should be considered "productive activities", and what should be included in income measures. Although some surveys in developing countries have collected detailed income data, total income from employment is typically used to calculate living standards and poverty indices.

An alternative approach, which avoids the difficulties associated with measuring household income, is to measure household consumption expenditure. Consumption expenditure is generally easier to collect and more readily standardized across countries (World Bank, 2003). Moreover, consumption is thought to be a more stable measure of poverty over time than is income in agricultural economies (Deaton and Zaidi, 2002). Expenditures are generally measured with a particular reference period in mind, usually the last year. In this way, temporary drops in consumption are ignored, while it is still possible to capture changes in living standards of a single individual or household over time. Nevertheless, measuring expenditure also has drawbacks: expenditure may vary considerably among household members, for example. Poverty is usually estimated from data on food expenditure, or a combination of food and non-food expenditure, usually health, education, shelter expenditure. However, there is no agreement in the literature on how to determine the non-food allowance component of the minimum basic needs, nor whether to include loan payments, or how to account for non-purchased food items.

Income or expenditure data are collected either through household surveys that are specifically designed to collect such information (i.e. welfare monitoring surveys) or through more generic surveys, primarily designed to collect and update social and demographic indicators, but that also include a socio-economic module.

Income or expenditure data can then be used to estimate poverty through the definition of poverty indices and poverty lines. After defining the monetary indicator of household welfare (y_i), a threshold must be determined that distinguish a poor household from one that is not poor. This threshold, the so-called poverty line (z_i), is defined as the cost to the i^{th} household of escaping poverty. One method of setting poverty lines is by finding the consumption expenditure or income level at which food energy intake is just sufficient to meet pre-determined food energy requirements (Ravallion, 1998). For example, poverty can be estimated from food expenditures using the Food Energy Intake (FEI) method (Greer and Thorbecke, 1986; Paul, 1989), which aims to establish a monetary value at which basic needs are met. Using this approach, and based on the minimum calorie intake of 2,250 calories per day per adult person recommended by FAO and WHO, a rural food poverty line in Kenya has been established at KShs. 927 per adult person per month (Government of Kenya, 2000).

We can then generate some poverty index, that incorporates the measured y's and z's, in some manner appropriate to the application at hand. The simplest is the 'head count index': the proportion of total households classified as poor, for which incomes/expenditures are below the poverty line ($y_i/z_i<1$). Whilst the head count

index is an intuitively simple indicator and is good for making national comparisons, it cannot account for the degree of poverty among individuals. To overcome this, a number of 'poverty gap indexes' has been developed that are some function of the summed differences between the poverty line and the incomes/expenditures of each household. These include the poverty gap index (Foster *et al.*, 1984); the squared poverty gap index (Foster *et al.*, 1984); the Sen index (Sen, 1976); and the re-normalised Sen index (Shorrocks, 1995).

A widely used set of indicators is the "Foster-Greer-Thorbecke" (FGT) class of poverty indicators (Foster *et al.*, 1984; Foster and Shorrocks, 1988) that can be summarised as:

$$\frac{1}{N}\sum_{i=1}^{Q}(z_i - y_i)^{\alpha}$$

where N = the total population, z_i is the poverty line, y_i is the welfare indicator for individual i and Q is the total population below the poverty line. For the head count index a = 0; for the poverty gap index a =1 and for the squared poverty gap index a = 2.

Regional deflators are usually applied to adjust for regional differences in the cost of living and are relative to some standard for which detailed and reliable cost data are available (e.g. the capital city).

Another way to examine poverty is by looking at the Gini coefficient, which may be used as a measure of inequality of income or wealth distribution (Gini, 1921). The Gini coefficient is based upon a Lorenz curve – an effective way of showing inequality of income. In a Lorenz curve the cumulative percentage of population is plotted along the horizontal axis whilst the cumulative percentage of income is plotted along the vertical axis. The 45 degree line is the line of absolute equality (in which 20% of the population would earn 20% of the income, etc.). The closer the Lorenz curve of a sample population is to the 45-degree line the more equal the distribution of income is for that population. The more the Lorenz curve deviates from the 45-degree line of absolute equality, the less equal is the distribution of income.

The Gini coefficient is defined as a ratio with values between 0 and 1: the numerator is the area between the Lorenz curve of the distribution and the line of absolute equality; the denominator is the entire area under the line of absolute equality. Thus, a low Gini coefficient indicates more equal income or wealth distribution, while a high Gini coefficient indicates more unequal distribution

If the Lorenz curve is represented by the function $Y = L(X)$, the Gini coefficient can be generally calculated as:

$$G = 1 - 2\int_0^1 L(X)dX$$

Different functions and interpolations can then be applied to calculate the coefficient without direct reference to the Lorenz curve or when the entire curve is not known. The use of the Gini coefficient has many advantages: first of all it is a ratio, not a variable, like income and it can be used to compare distribution across countries and over time (although caution should be used as countries might collect data differently and might have different benefit systems). One of the main limitations is that economies with similar incomes and Gini coefficients can still have very different income distributions: this is because the Lorenz curves can have different shapes and yet still yield the same Gini coefficient. Furthermore, Gini coefficients do include income gained from wealth, but are used to measure net income more than net worth, which can be misinterpreted.

In the following paragraphs we describe the different surveys available in the IGAD region, including both the Welfare Monitoring Surveys (Ethiopia and Kenya) and the socio-economic surveys (Djibouti, Eritrea, Somalia and Uganda) that provide data on income or expenditure.

2.1.1 Welfare Monitoring Surveys

The most widespread welfare survey is the World Bank's Living Standards Measurement Study (LSMS), which measures the economic aspects of well-being. The survey is focussed on measurement of consumption, but there are also detailed questions on cash expenditures, on the value of food items grown at home or received as gifts and on the ownership of housing and durable goods. At the time this paper was written there were no LSMS data available for IGAD member states.

In the IGAD region, the only surveys designed directly to collect welfare measures are the country-specific income and expenditure surveys for Ethiopia and Kenya.

2.1.1.1 Ethiopia Welfare Monitoring/Household Income, Consumption and Expenditure Survey

This survey was conducted in two phases: the first in the summer of 1999 (Welfare Monitoring Survey) and the second in early 2000 (Household Income, Consumption and Expenditure Survey). The survey was conducted by the Central Statistical Authority (CSA) in collaboration with the World Bank and it covered the population in sedentary areas but excluded the non-sedentary populations in the Afar and Somali regions. About 26,000 household were sampled in the first phase and more than 17,000 in the second. The total number of household with valid estimates of basic population and expenditure, which could thus be used for analysis, was a little less than 17,000.

The main object to provide data on the level, distribution and pattern of household income, consumption and expenditure that could be used to analyse changes in living standards over time by various aggregations, such as socio-economic group and geographical area. The survey would provide the government with information to assess the impact of existing or proposed socio-economic policies and programs on household living conditions.

2.1.1.2 Kenya Welfare Monitoring Survey

In the early 1990's the Government of Kenya initiated a series of household surveys, called Welfare Monitoring Surveys (WMS) to monitor the possible socio-economic effects of Structural Adjustment Programmes. The latest was conducted in 1997 by the Central Bureau of Statistics (CBS) with support from the World Bank and other bilateral donors. The survey had 3 modules: (i) a core welfare indicators questionnaire, which covered basic individual household characteristics; (ii) a consumption and expenditure module; and (iii) an agriculture questionnaire (for rural households) and a non-agricultural income and farm labour questionnaire (for both rural and urban households).

The survey covered about 10,000 households, though many districts were not sampled due to insecurity or lack of adequate resources. Whilst the sample was designed to be representative at the district level, it was noted that even the district classification was not ideal for poverty analysis because the districts were not internally homogeneous with respect to general living standards and conditions (Kenya Government, 2000).

2.1.2 Socio-Economic Surveys

In most IGAD member states, the World Bank, in collaboration with the national governments or other international agencies, has conducted a series of household surveys to collect socio-economic data at the household level. In some cases (e.g. Uganda) the central government has conducted National Household Surveys, with very similar objectives. These surveys usually contain information on demographics, health, education, employment, income, expenditure, as well as household characteristics and agricultural and livestock assets. In the following paragraphs we list the socio-economic surveys available for the IGAD member states. In addition, we include the Uganda Comprehensive Food Security and Vulnerability Analysis because it provides useful data on assets, income, expenditure, food sources and consumption.

2.1.2.1 Djibouti Enquête Djiboutienne auprès des Ménages - Indicateurs sociaux

The survey was carried out on behalf of the Statistics Division (Direction National de la Statistique – DNAS) of the Ministry of Commerce and Tourism in 1996 and subsequently updated in 2002. The objective of the survey, which included 2,400 households (and more than 40,000 in the 2002 survey), was to provide information on household status, in order to help better define programs of socio-economic reform and the national program of poverty reduction. The survey collected information on social indicators (land, livestock ownership, etc.), demography, education, water facilities, health indicators and services (access to market, health facilities schools, water, etc.). It also includes data on expenditure (for housing, health, education, taxes and transport), consumption (food and non-food) and income (labour and non-labour).

2.1.2.2 Eritrea Household Health Status, Utilization and Expenditure Survey

The survey was carried out in 1997 by the Ministry of Health and the World Bank. The survey collected data on household consumption, health, education and access to public services for about 1,200 households.

2.1.2.3 Somalia Socio-Economic Survey

The Somalia Socio-Economic Survey, which was conducted in 2002 by the World Bank and UNDP Somalia, with the support and participation of functional Somali administrations and other international partners, is the outcome of a multi-sectoral nationwide household survey. The survey compiled baseline demographic and socio-economic data for 3,600 households to address some of the critical needs and gaps and to establish a socio-economic database for better policy formulation and planning. The survey covered the areas of: (i) demographics and housing; (ii) employment and income; (iii) basic services; (iv) communication; (v) participation of women; and (vi) environmental concerns.

In terms of welfare measure, the survey, like income and expenditure surveys, collected data on household-level income and expenditure. In particular, the income module included income from all sources: household economic activities, wage income, income from self-employment and transfers, as well as data on income from crop production and livestock rearing and remittance (World Bank and UNDP, 2003).

2.1.2.4 Uganda National Household Survey

The Uganda Bureau of Statistics (UBOS) has carried out 8 rounds of nationally representative surveys since 1988 to collect and update data on a wide range of demographic, economic and social indicators. All the surveys have a socio-economic module, providing useful information for monitoring welfare in Uganda. The surveys

are designed to be representative at the regional level, within which urban and rural households are distinguished.

The most recent of these surveys was the third Uganda National Household Survey, conducted in 2005/2006 and which covered about 7,400 households. The survey had five modules: Socio-economic, Agriculture, Community, Market and Qualitative. The survey collected socio-economic data required for measurements of human development and monitoring social goals with special reference to the measurement of poverty under the Poverty Eradication Action Plan (PEAP) and Millennium Development Goals (MDGs) (Uganda Bureau of Statistics, 2006).

It is also worth mentioning the previous round of surveys, conducted in 2002/2003, which covered almost 10,000 household. Data were collected at the same time and from the same enumeration areas, facilitating matching of households to their respective communities. Like the other surveys, this one was designed to gather estimates at the national and regional levels with rural/urban breakdown. However the sampling design also made it possible to generate district-level estimates for seven districts (Masaka, Mukono, Wakiso, Mbale, Lira and Mbarara). The survey was further designed to be integrated with the 2002 National Population and Housing Census for detailed poverty mapping using small area techniques (See Section 2.3.1).

2.1.2.5 Uganda Comprehensive Food Security and Vulnerability Analysis

This analysis was conducted by the World Food Program and other partners to complement the information available to the government of Uganda in terms of food insecurity and vulnerability among rural households. The analysis is based on secondary data and the analysis of a national household survey (covering almost 3,000 rural households) carried out in July/August 2005. The methodology involved characterising 14 homogeneous strata with regards to agro-ecological factors, based on secondary data, followed by a representative multi-stage sampling procedure to select households within each stratum (WFP, 2006).

The household questionnaire was designed to collect information on 11 sectors, including demographics, housing and facilities, assets, income, expenditure, food sources and consumption, shocks and food security, health and nutrition. As far as welfare measures are concerned, this survey provided detailed data on income and expenditure. In terms of income, data were collected on the type and amount of income for five main sources of income for the previous year, while in the case of expenditure, data were collected on food-related expenditure during the previous month, and non food-related expenditure during the previous six months. Information on household assets and productive assets (e.g. land ownership, crop production and livestock ownership) was also collected.

The survey also included a community questionnaire, to collect qualitative information on demographics, migration, transportation, water and sanitation, education, health, markets, agriculture and animal husbandry, livelihoods, and assistance and food aid. The community questionnaire was intended to contextualize the information collected at the household level.

2.2 Demographic and Health Surveys

The Demographic and Health Survey (DHS) program was established by the United States Agency for International Development (USAID) in 1984. It was designed as a follow-up to the World Fertility Survey and the Contraceptive Prevalence Survey projects. The DHS project was first awarded in 1984 to Westinghouse Health Systems (which subsequently evolved into part of OCR Macro), and it has been implemented in overlapping five-year phases. MEASURE DHS is funded by USAID with contributions from other donors.

The objectives of the DHS program are, among others, to provide decision-makers in participating countries with improved information and analyses useful for informed policy choices, to improve coordination and partnerships in data collection at the international and country levels and to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

The basic approach of the DHS program is to collect data that are comparable across countries, so standard model questionnaires have been developed, accompanied by manuals. Since 1984, more than 130 nationally representative household-based surveys have been completed under the DHS project in about 70 countries. Many of the countries have conducted multiple DHS surveys to establish trends, enabling them to gauge progress in their programs.

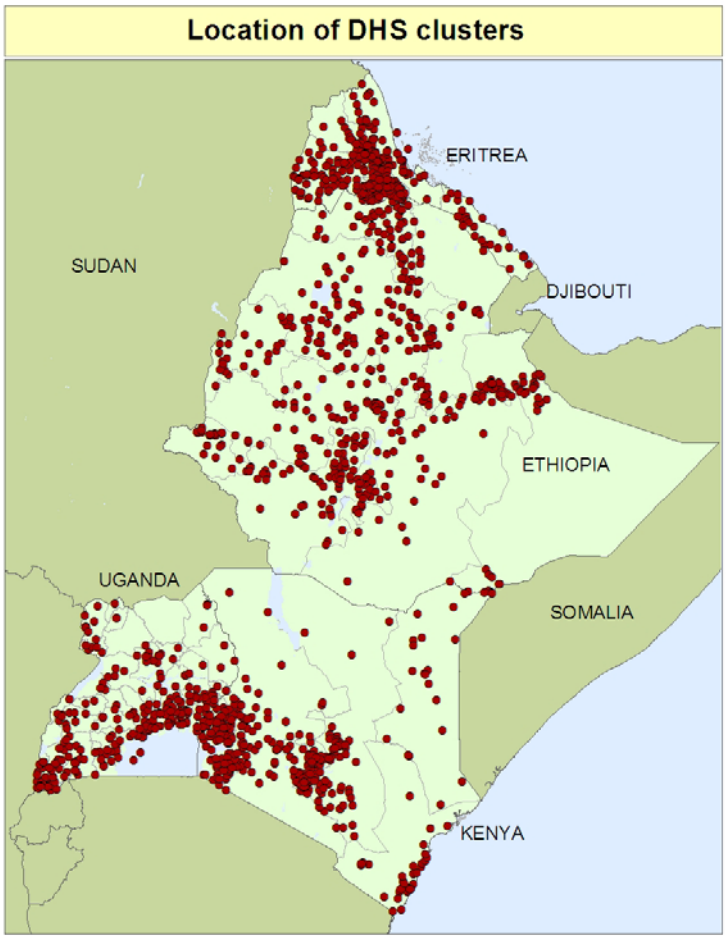
The primary output of the project consists of a series of reports that are available for free download from the DHS website[5]. The DHS policy is to release survey data to researchers after the main survey report has been published, generally within 12 months of the fieldwork being completed. The survey data are made available on the DHS website, through a process of electronic registration.

The DHS surveys are designed to collect data on marriage, fertility, family planning, reproductive health, child health, and HIV/AIDS, through two questionnaires: a Household Questionnaire and a Women's Questionnaire. More information on the surveys and the questionnaires can be found in Rutstein and Rojas (2003). The main purpose of the Household Questionnaire is to provide the mechanism for identifying women eligible for individual interview and children under five who are to be weighed, measured, and tested for anaemia. In addition, information is collected about the dwelling itself, such as the source of water, type of toilet facilities, materials used to construct the house and ownership of various assets.

The most recent DHS surveys are accompanied by a file with global positioning system (GPS) coordinates at the cluster level, where a cluster is usually a census enumeration area, sometimes a village in rural areas or a city block in urban areas. Collecting only one location point for a cluster greatly reduces the chance of compromising the confidentiality of respondents, but it is enough to allow the integration of multiple datasets for further analysis (Montana and Spencer, 2004). Figure 1 shows the georeferenced DHS clusters in the IGAD region.

[5] DHS home page: www.measuredhs.com

Figure 1: Location of the DHS georeferenced household clusters from the most recent DHS year. Eritrea (2002), 368 clusters; Ethiopia (2005), 535 clusters; Kenya (2003), 400 clusters; and Uganda (2001), 298 clusters.



Source: ORC-MACRO

2.2.1 The Wealth Index

The DHS surveys do not collect information on economic measures of poverty, such as income or expenditure. A proxy that can be used and that takes into account a number of indicators that are thought to be correlated with a household's economic status is the wealth index (Rutstein and Johnson, 2004). The composite wealth index is thought to represent a more permanent welfare status than income or consumption in terms of measuring economic status and allows for the identification of problems particular to the poor, such as unequal access to health care (Rutstein and Johnson, 2004). Component indicators include, for example, possession of assets such as a television, radio, telephone or refrigerator, and variables related to the dwelling, such as the type of flooring, water supply, sanitation facilities and number of people per sleeping room. Table 3 reports the list of variables used to calculate the wealth index in Kenya, from the DHS 1998.

Table 3: Indicators used to calculate the wealth index in Kenya, from the DHS 1998 (Rutstein and Johnson, 2004)

Indicator	Indicator
Has electricity	Has own flush toilet
Has radio	Uses shared flush toilet
Has television	Has pit latrine
Has refrigerator	Has ventilated pit latrine
Has bicycle	Uses bush as latrine
Has motorcycle	Uses other type of latrine
Has car	Has dirt, earth principal floor in dwelling
Has telephone	has wood planks principal floor in dwelling
Number of members per sleeping room	Has tile flooring
Drinking water is piped in residence	Has cement flooring
Drinking water is piped in public tap	Has other type of flooring
Drinking water from well in residence	Has natural material roofing
Drinking water from public well	Has corrugate iron roofing
Drinking water is from surface water	Has roofing tiles
Drinking water is rainwater	Has other roofing
Other source of drinking water	Has domestic servant
	Household works own or family agricultural land

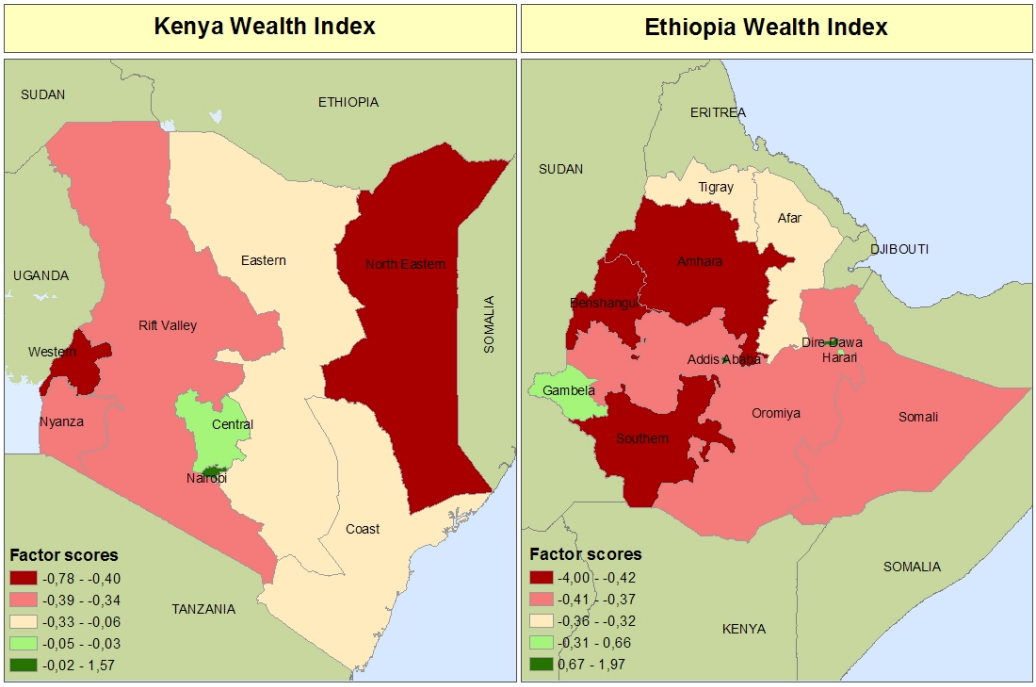
The wealth index is constructed by way of a Principal Component Analysis (PCA) on the recorded set of assets and services. DHS uses the SPSS factor analysis procedure. This procedure first standardizes the indicator variables (calculating z-scores); then the factor coefficient scores (factor loadings) are calculated; and finally, for each household, the indicator values are multiplied by the loadings and summed to produce the household's index value. In this process, only the first of the factors produced is used to represent the wealth index. The resulting sum is itself a standardized score with a mean of zero and a standard deviation of one.

Each household is assigned a standardized score for each asset, where the score differs depending on whether or not the household owned that asset (or, in the case of sleeping arrangements, the number of people per room). These scores are summed by household, and individuals are ranked according to the total score of the household in which they reside. The sample is then divided into population quintiles - five groups with the same number of individuals in each. A single asset index is developed based on the data from the entire country sample and used in all the tabulations presented. No distinction is made between rural and urban population groups in the calculation of the wealth index.

The wealth index is available also from the Multiple Indicator Cluster Survey (MICS), which is a household survey developed by UNICEF to help countries assess progress with respect the welfare of children at the end of each decade. The survey was originally designed to collect data on child health and nutrition status, but since 2000 UNICEF has introduced a module to assess the economic status of households. The MICS2 questionnaire therefore includes questions about to housing characteristics and asset ownerships very similar to those of the DHS. In the IGAD region, MICS surveys have been conducted in Kenya, Somalia and Sudan. Both the DHS and the MICS are representative at the regional level, so aggregation of the various indicators at administrative levels smaller than the region should not be considered for analysis or mapping.

Some authors recommend that the wealth index should not be used as a poverty measure (Montgomery *et al.*, 2000; World Bank, 2003; Rutstein and Johnson, 2004) because it was designed to produce a measure of the household's economic status that is not directly related to income- or expenditure-based indices. Furthermore, despite the fact that it is constructed from a set of standardized variables, the wealth index is a measure of wealth relative to a given survey, and therefore does not allow cross-country comparisons (a wealth score of 0.38 in Uganda would not reflect the same level of wealth as a score of 0.38 in Ethiopia). Nevertheless, comparisons between expenditure and the wealth index in Kenya and Uganda show a good correlation between the two measures (reported in Section 4) and represent the first step in determining the potential use of the wealth index as a regional poverty indicator.

Figure 2: Wealth index factor scores for Ethiopia and Kenya, aggregated at the province level, from the most recent DHS year: Ethiopia, 2005 and Kenya, 2003. Note that the two measures are not directly comparable.



Source: ORC-Macro

2.3 Poverty Mapping

The information that can be extracted from socio-economic or demographic surveys might not be sufficient in spatial detail for many policy and research applications. Researchers and policy makers therefore increasingly collect or construct geographically disaggregated indicators that provide information about the spatial distribution of inequality and poverty within a country. Whilst the value of these approaches has been widely recognized for geographical targeting (Elbers *et al.*, 2007), such indicators are usually estimated using country-specific data that do not allow cross-country comparisons. Other estimates of welfare, such as under-nutrition and infant mortality (FAO, 2003; CIESIN, 2005), are more general in nature so do allow

cross-country comparisons to be made. Thus they may be used for visual representation and analysis of welfare distribution at regional levels.

In this section we first review poverty maps obtained by mapping survey data at the level of which they were designed to be representative (in particular, under-nutrition and infant mortality); we then describe spatially disaggregated poverty maps, based on small area estimation and environmental techniques; and finally we review the livelihood zone approach.

2.3.1 Under-nutrition and infant mortality

Under-nutrition and infant mortality maps are generated from household survey data, such as the DHS or MICS, which are usually representative at the regional level. They are useful for a visual representation of the poverty distribution for large areas and certainly allow cross-country comparisons and broad regional analyses to be made, but they do not provide detailed information on the distribution of poverty and cannot contribute significantly to planning small scale interventions.

The prevalence of under-nutrition is thought to be a good measure of endemic, or chronic poverty (FAO, 2003), as it reflects long-term cumulative effects of inadequate food intake and poor health conditions. The former Environment and Natural Resources Service (SDRN)[6] of FAO has produced global maps of chronic under-nutrition at national and sub-national levels using stunting in growth among children under five years of age as an indicator. Stunting is defined as having a height-to-age ratio of more than two standard deviations below the median of the National Center for Health Statistics/World Health Organization international reference (WHO, 2007). Stunting has a negative impact on the intellectual and physical development of children, and persistent high prevalence of stunting among children indicates chronic failure in poverty alleviation (FAO, 2003).

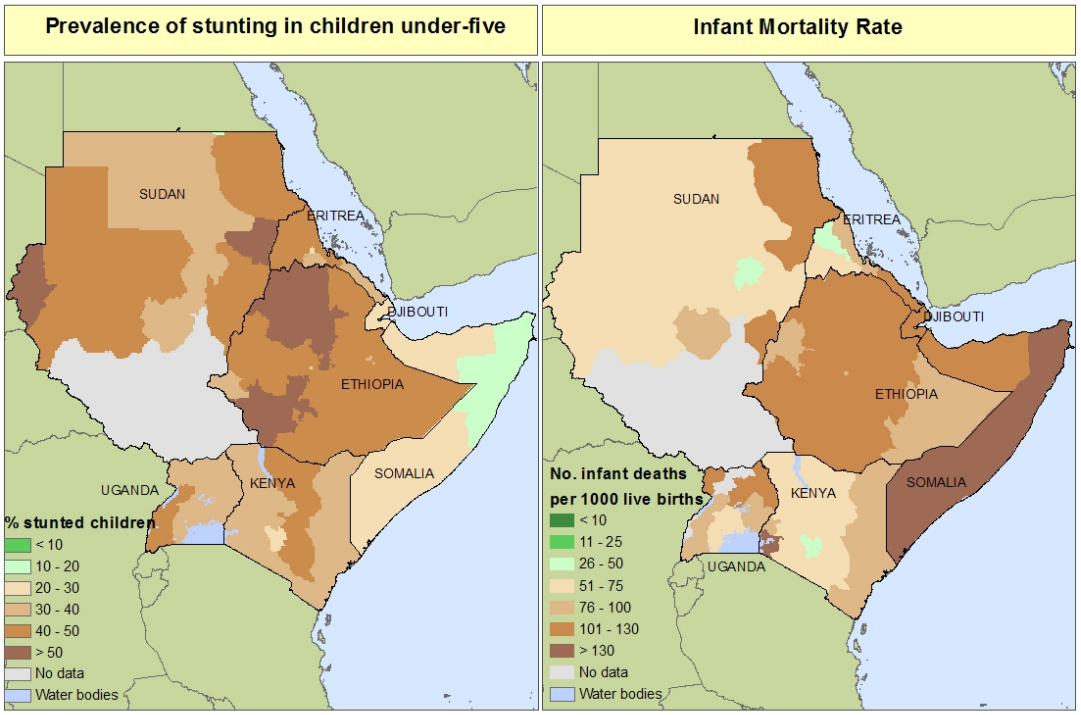
The data on prevalence of stunting among children under five at national or sub-national levels are taken from nutrition surveys conducted between 1987 and 2002, using representative samples of the child population. In compiling these maps FAO has called upon data from the DHS and MICS surveys, the WHO Global Database on Child Growth and Malnutrition, and various national sources where available. The maps are produced at a spatial resolution of 5 arc-minutes and the percentage of stunted children under five years old is reported according to the lowest available sub-national administrative units (FAO, 2003).

The global sub-national infant mortality rate maps (CIESIN, 2005) consist of estimates of infant mortality rates for the year 2000. Infant mortality rate is defined as number of children who die before their first birthday for each 1,000 live births. Data are collected through surveys (DHS, MICS), UN Human Development Reports, UNICEF statistics and various national sources. The global dataset was gridded at a spatial resolution of 2.5 arc-minutes and is also available for download at the first administrative level.

The figure below shows the prevalence of stunting among children under five and the infant mortality rate in the IGAD region.

[6] SDRN has since been reorganised into the Environment Assessment and Management Unit (NRCE) and the Climate Change and Bioenergy Unit (NRCB).

Figure 3: Prevalence of stunting among children under five (left-hand panel) and infant mortality rate (right-hand panel) in the IGAD region.



Source: FAO (2003) Source: CIESIN (2005)

2.3.2 Small area estimation

Various methods have been used to construct geographically disaggregated indicators of poverty (Davis, 2003). The most common is the small area estimation technique, developed in a series of World Bank studies (e.g. Ghosh and Rao, 1994, Hentschel *et al.*, 1998; Hentschel *et al.*, 2000; Elbers and Lanjouw, 2000; World Bank, 2000, Elbers *et al.,* 2003), and now applied to a number of countries, for example Ecuador (Hentschel *et al.*, 2000), South Africa (Alderman *et al.*, 2000; Statistics South Africa, 2000), Nicaragua (Arcia *et al.*, 1996); Vietnam (Minot *et al.*, 2003; Epprecht and Heinimann, 2004); Kenya (Ndeng'e *et al.*, 2003); and Uganda (Emwanu *et al.*, 2003). These and other studies have been brought together in various publications: see for examples Demombynes *et al.* (2002), Henninger and Snel (2002), the World Bank PovertyNet homepage[7], and a recent atlas by Columbia University's Center for International Earth Science Information Network and the World Bank (CIESIN, 2006).

The method combines survey and census data, based on the consideration that household surveys provide measures of poverty (usually consumption or expenditure-based indicators of welfare) but only for a sample of households, while the census provides complete national household coverage but without a direct measure of poverty. The small area estimation technique uses regression models to predict the welfare indicators for all households covered by the census. The methodology (Elbers *et al.*, 2002; Elbers *et al.,* 2003) involves the following stages. In a so-called 'zero stage' variables common to the survey and census are identified, and the two datasets are generally examined for comparability, sampling strategies and so-on. In a first stage, regression parameters are estimated based on the variables that are common to both the survey and the census. In the second stage these parameter estimates are taken to the census data to predict the chosen welfare measure for each population of

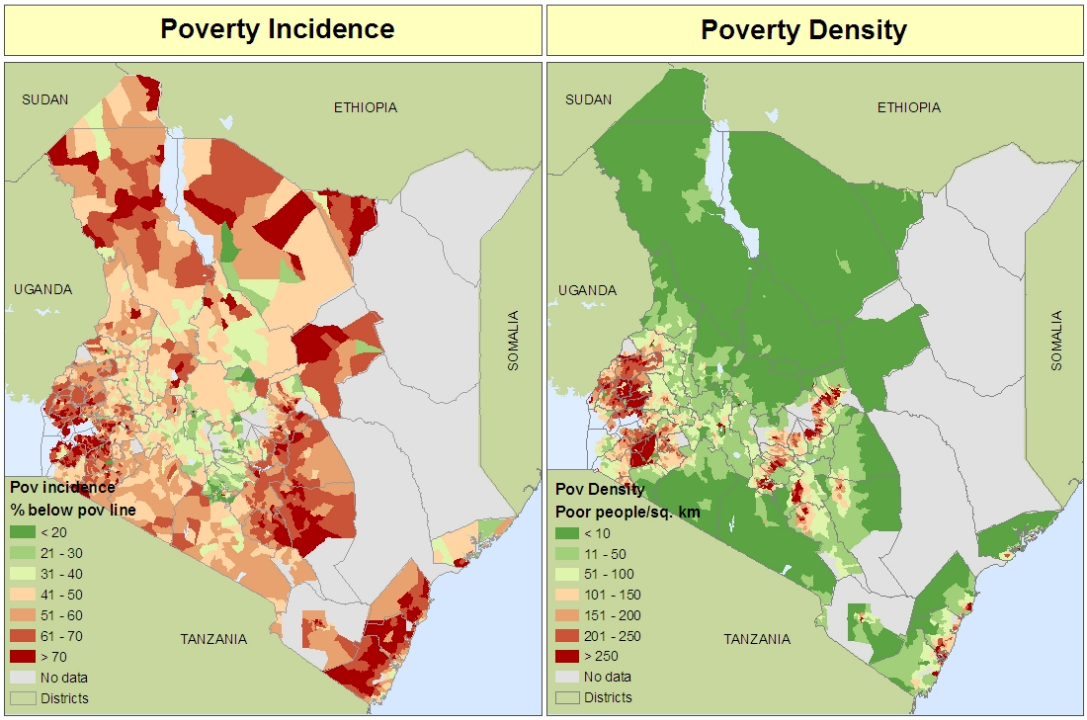
[7] www.worldbank.org/poverty/

interest. It is particularly important to evaluate the precision of the predicted welfare estimates by computing standard errors. The standard errors increase with the level of disaggregation and are highly dependent on the compatibility of the datasets and the sampling frame used for the survey.

In the IGAD region, small area estimates have been produced for Kenya (Kilele and Ndeng'e, 2003; Ndeng'e et al., 2003) based on 1997 Welfare Monitoring Survey and the 1999 Population and Housing Census; and for Uganda (Emwanu et al., 2003) based on the 1992/1993 Integrated Household Survey and the 1991 Population and Housing Census. For Uganda, poverty maps have also been produced using the more recent data from the 2002/2003 National Household Survey and the 2002 Population and Housing Census (UBOS and ILRI, 2007).

Figure 4 shows the small area estimate poverty maps for Kenya, at the "location" level. Poverty data are often expressed as the proportion of people below the poverty line (poverty incidence or poverty rate, shown in the left-hand panel), but they may also be represented as poverty density (right-hand panel), where the density is the number of people below the poverty line per unit of area (number of poor people km^2).

Figure 4: Small area estimates of poverty incidence and density in Kenya.



Source: CBS and the Ministry of Planning and National Development, based on the 1997 Welfare Monitoring Survey and the 1999 population census. Adapted from Ndeng'e *et al*. (2003).

The small area estimation technique is a now well-established procedure for mapping poverty, but goes no way towards explaining the causes of poverty. Whilst there is an appreciation of the need for a multidimensional approach that considers both monetary and social and environmental indicators (CGIAR, 1998), relatively little progress has been made in developing a combined approach. Birungi *et al*. (2005) have used the small area estimation methodology coupled with spatial regression techniques to improve poverty maps and to analyze the linkages between poverty and

the environment. The results indicated that a number of environmental factors were associated with welfare amongst the rural communities in Uganda. Epprecht (2005) analyzed geographic linkages among livestock, poverty and the environment in Vietnam, by applying local spatially weighted regression models, which allowed the spatial variations in linear relationships among different factors to be quantified. The results showed there to be strong spatial variations in relationship among livestock, accessibility and environmental variables, implying that an understanding of such geographical variation would be important in developing poverty-reducing policies and interventions.

2.3.3 Environmental approaches

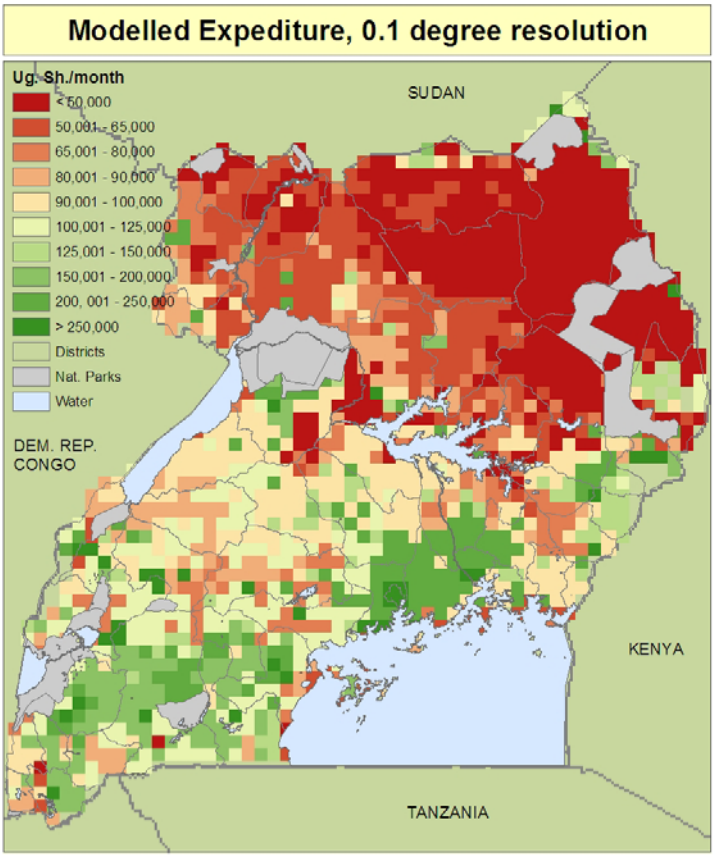
Reinforcing the importance of incorporating environmental factors into poverty mapping efforts, Rogers *et al.* (2006) and Robinson *et al.* (2007) have recently developed an approach to poverty mapping that is based entirely on the use of environmental data (as opposed to census data). In order to describe and analyze the spatial distribution of poverty the authors combine household survey data with a suite of environmental variables. By incorporating the driving factors that are associated with the different levels of poverty, the modelling approach allows not only for a description, but potentially also for an explanation and, ultimately, a prediction of the distribution of poverty.

In this approach, household survey data are combined with a suite of environmental variables that are either direct measures of key climatic variables (such as temperature), descriptor variables of poverty-generating processes (such as agricultural production systems) or proxies for constraints on the health and well-being of population (such as the distribution of disease-causing pathogens). The predictions are made using a discriminant analysis model, in which a poverty index is estimated by the likelihood of each pixel falling within a specified "poverty" class, based on the combination of values of the predictor variables. The original analysis in Uganda was performed using household expenditure data at different spatial resolutions, ranging from 0.01 to 1 degree (approximately 1.1 and 110 km at the equator).

Results showed that environmental data derived from ground surveys and satellites appeared to be at least as good as census and survey data at describing the spatial distribution of poverty in Uganda, but the environmental approach is more likely to identify the causes of poverty and thus more helpful to determine appropriate interventions. In fact, it is likely that the ultimate causes of poverty vary locally; the environmental approach can establish the environmental correlates of these causes, which may include factors such as soil fertility, agricultural production, health and the availability of fuel and water. Appropriate, targetted intervention can thus be designed once the causes are identified from their environmental correlates (Rogers *et al.*, 2006).

A potential advantage of the environmental model, as opposed to the more traditional census-based small area estimates, is that since the environmental data used are fairly standard and ubiquitous (as opposed to census data that can vary from country to country) the approach lends itself to the possibility of making predictions outside the study area, not just within it, and over relatively large areas.

Figure 5: Estimates of monthly household expenditure in Uganda, derived from the discriminant analysis model, adapted from Rogers et al., 2006.



2.3.4 Livelihood Zones

Livelihood analysis[8] was adopted by the Famine Early Warning Systems Network (FEWS NET) in 2000 in order to provide essential baseline material for interpreting early warning and vulnerability information related to food security. It provides the information and structure to guide field work in affected areas and to determine the impact of shocks on households. Such information also facilitates rapid scenario analysis in order to improve emergency planning and rapid response. The general aim is for more efficient monitoring, improved food security planning and better focused reporting.

Livelihoods are the sum of ways in which people make a living. In most communities in low-income countries, poor families balance a set of food and income-earning activities. Acute food insecurity results when the failure of one or more of these activities cannot be compensated for by others. In addition to analyzing food production and acquisition, livelihood analysis considers the means by which people secure other basic necessities such as health care, water, clothes or agricultural inputs. Therefore, by providing information on how, and why, people survive (or fail to survive) difficult times, and in particular on the extent to which households' normal

[8] More information on the FEWS NET livelihood analysis can be found at http://www.fews.net/livelihoods/index.aspx?pageID=livelihoodsHome

patterns of food access are affected during these times, livelihood analysis represents a useful input into the analysis of poverty distribution.

Livelihoods products currently produced by FEWS NET include (i) livelihood zone maps; (ii) livelihood profiles (detailed description and analysis of livelihoods and livelihood zones); (iii) national overviews (summary descriptions of livelihood zones at the national level); and (iv) needs assessment reports (analysis of recent conditions and needs). FEWS NET assesses livelihoods and vulnerability using the food economy approach. Food economy analysis demands village-level field work to gather first-hand accounts about how people secure their food and income. To measure food access, food and income sources are converted into kilocalorie equivalents, and interviews are conducted to establish how households meet their annual food needs (a kilocalorie measure of 1,900-2,100 kcal/day/person).

In addition to the livelihood zones description, the livelihood profiles also provide the "core information on the food economy of the zone", including:

- Wealth breakdowns, which represent the proportion of poor, middle and better-off households in a given livelihood zone. Wealth groups are typically defined in terms of their land holdings, livestock holdings, capital, education, skills, labour availability and/or social capital.
- Expenditure patterns (through analysis of sources of food and sources of cash, by wealth breakdowns group), which show what proportion of households' annual cash budget is spent on food, household items, production inputs, etc.

The breakdowns provide a relative classification only, being based on indicators specifically tailored to a particular livelihood zone and are thus not suitable for comparisons across different livelihood zones or across different countries.

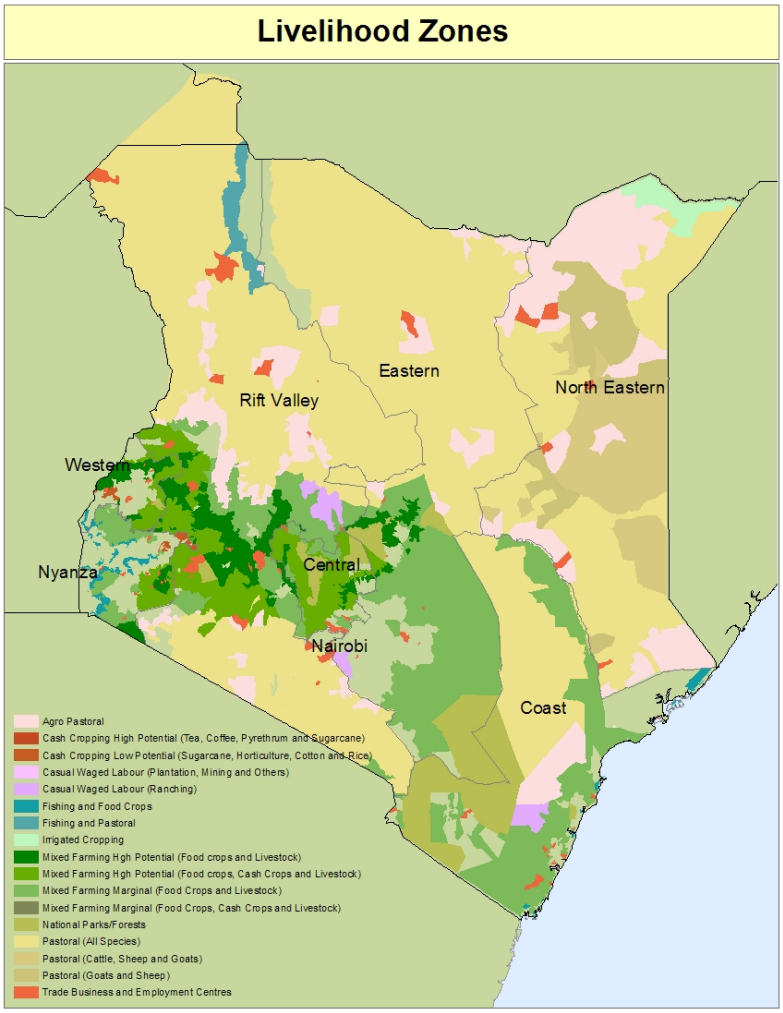
In the IGAD region, livelihood maps and profiles are currently available for Djibouti, Ethiopia (only the So----------uthern Nations, Nationalities, and People's Region - SNNPR), Kenya and Somalia, livelihood profiles only are available for Sudan, while work is in progress for Eritrea and preliminary data are available for Uganda. The table below summarizes the type of livelihood products available in the IGAD region, while Figure 6 shows the Livelihood Zones in Kenya.

Table 4: Livelihood products in the IGAD region

Country	Livelihood Zones (maps)	Detailed Livelihood Profiles	National Overview
Djibouti	Y	Y	Y
Eritrea	N	Draft for 50% of the country	N
Ethiopia	Y (SNNPR, Afar and Tigray)	Y (SNNPR and Somaliland)	Y (only SNNPR)
Kenya	Y	Y	Y
Somalia	Y	Draft for 4 (out of 32) zones	Only for 10 zones
Sudan	N	Y (only Southern Sudan)	Y (only Southern Sudan)
Uganda	Y (preliminary)	Y (preliminary)	Y (not detailed)

Note: Data for Djibouti, Ethiopia, Somalia (maps), Sudan and Uganda are available from the FEWS-NET website or were obtained through FEWS-NET contacts, while data for the other countries and the profiles for Somalia were made available through FAO and FAO-Food Security Analysis Unit (FSAU) contacts.

Figure 6: Livelihood Zones in Kenya.



Note: Adapted from the FAO Emergency Operation Service (TCEO), based on data from FEWS NET.

3. COMPARISON OF METHODOLOGIES

In the preceding paragraphs we have examined a range of indicators that can help policy-makers better understand the distribution of poverty. Such indicators include economic measures of poverty, like income or expenditure; asset indices, like the DHS wealth index; estimates of health status, like the under-nutrition maps; and evaluations of livelihoods, like the livelihoods zones and profiles. The choice of the welfare indicator can have a significant bearing on the measure of inequality (World Bank, 2003) and thus on policy analysis, targeting etc. Whilst there will be broad agreement among different measures - 'poor' people will generally have low incomes/expenditures, few assets and a low health status – the correlations will not be perfect. For example, interventions in inherently poor areas, such as distributions of anti-malarial bed-nets or food-aid, may result in a higher than expected health status. It is important for decision-makers to be aware of the different methodologies and surveys used to produce the poverty data or maps, and include such considerations in their reports and recommendations.

One particular issue that should be addressed in regional analyses, is that of comparability of indicators across countries (CGIAR, 1998). Usually, the definitions, computation or estimation methods, data sources and time periods are not consistent across countries. While this is not a problem for in-country applications, it might limit cross-country comparisons and regional analyses of the causes of poverty and the potential effects of interventions strategies.

The comparability of indicators depends largely on the extent to which they have been standardised in their collection. Income and expenditure data have a conceptually straightforward interpretation, and appear relatively simple to standardize globally (CGIAR, 1998; World Bank, 2003). In reality though, this is far from the case: they are collected from household surveys that vary in the type of module included, use different questionnaires, different sampling techniques and so on. Another problem is that the poverty lines may be derived quite differently from one country to another. The consistency of non-monetary or basic needs indicators varies and they are highly sensitive to the inclusion or omission of important factors (CGIAR, 1998).

Other measures of poverty (e.g. child mortality, under-nutrition) can be more easily standardized regionally if collected through comparable surveys and standardized questionnaires (such as the DHS, the LSMS and the MICS). As there is not a single, standardized approach to the estimation and mapping of poverty indicators, a detailed analysis of the questionnaires and the data collection process should always be provided to policy-makers.

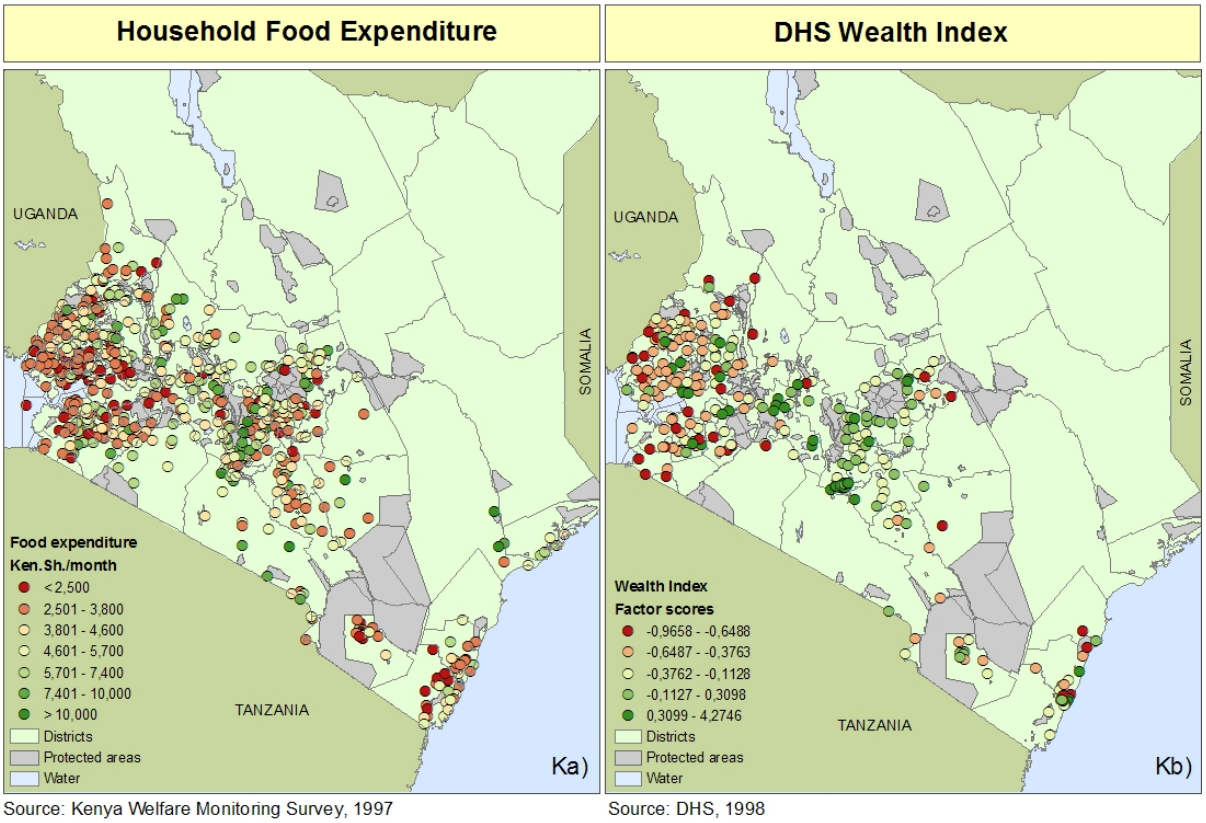
In this section we compare some of the different surveys and approaches to poverty analysis that have been undertaken in Kenya and Uganda.

We first compare different sources of poverty measure (expenditure and the wealth index) that can be used to model the distribution of poverty. Then, we compare different maps that have been produced for Kenya and Uganda, to analyze the differences in measured inequality.

Figure 7 shows two sources of poverty measure in Kenya and Uganda. In the case of Kenya, we compare food expenditure from the 1997 Welfare Monitoring Survey and the wealth index from the 1998 DHS, whilst for Uganda we compare monthly expenditures from the 2002/2003 National Household Survey and the wealth index from the 2000/2001 DHS. The figure is intended only for visual comparison of the distribution of the poverty indicators: the two measures are not directly comparable because they measure different variables and are based on different sampling procedures.

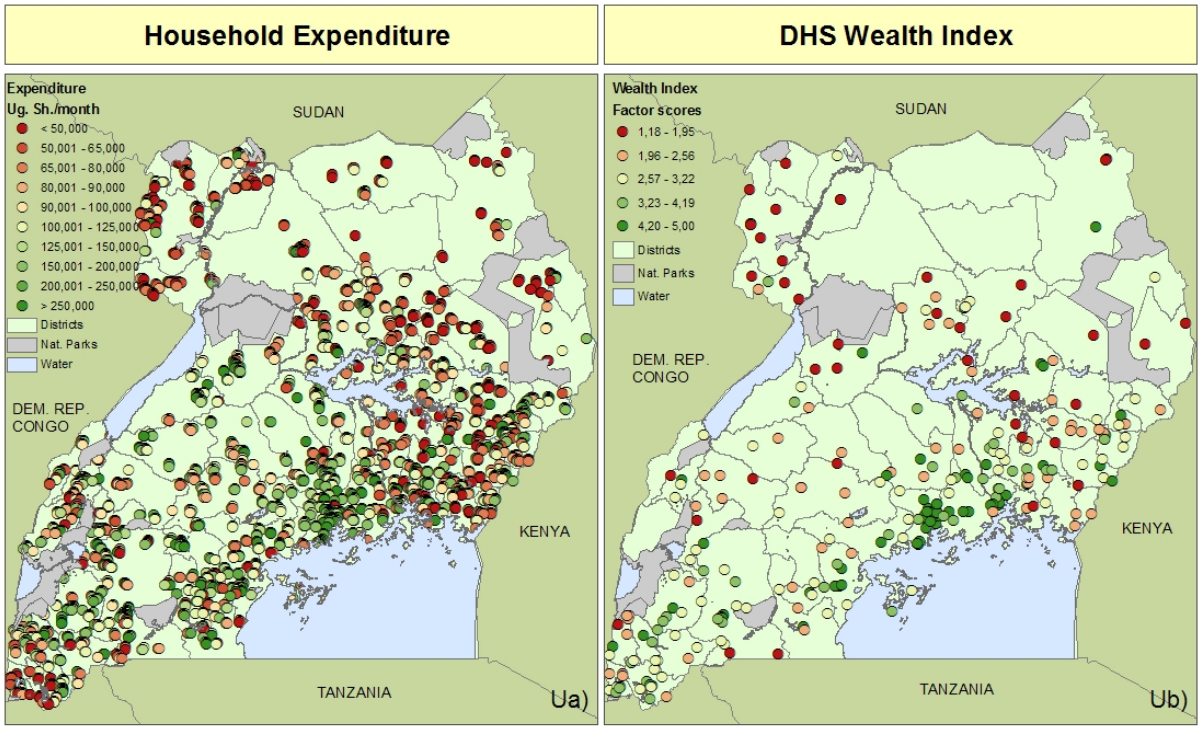
The top left-hand panel (Ka) shows the distribution of monthly food expenditures (in Kenya shillings) from the 1997 Welfare Monitoring Survey, for 664 clusters of households in Kenya, while the top right-hand panel (Kb) shows the wealth index (factor scores) from the 1998 DHS, for the 271 georeferenced DHS clusters. The maps broadly indicate similar patterns of poverty distribution: the districts around Nairobi (the central highlands) show greater wealth while the areas to the west show higher levels of poverty. In the case of Uganda, the bottom left-hand panel (Ua) shows the distribution of monthly expenditures (in Uganda shillings), from the 2002/2003 National Household Survey for 2,781 clusters of households, and the bottom right-hand panel (Ub) shows the wealth index (factor scores), from the 2000/2001 DHS, for the 298 georeferenced DHS clusters. Again, broad similarities are evident, though less clearly than in Kenya: poverty is generally greater in the north, and less prevalent in the vicinity of Lake Victoria and the main cities of Kampala, Entebbe and Jinja.

Figure 7: Sources of the poverty measure in Kenya and Uganda. Ka) shows household food expenditure, in Kenya Shillings per month, Ua) shows total household expenditure, in Uganda Shillings per month, and Kb) and Ub) show the DHS wealth index factor scores. The points represent clusters of households definied by the respective surveys, except in the case of the Uganda expenditure, where the points represent aggregation of households at 1 km-resolution. Both the original household expenditure and wealth index have been averaged for the clusters.



Source: Kenya Welfare Monitoring Survey, 1997

Source: DHS, 1998

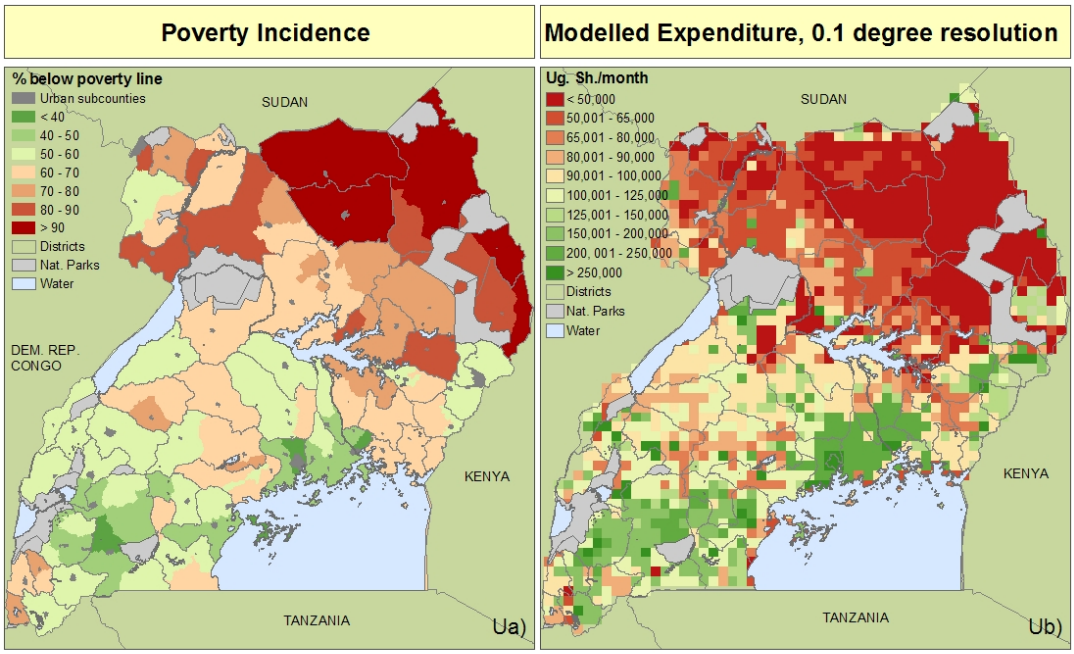


Source: Uganda National Household Survey, 2002/2003

Source: DHS, 2000/2001

The sampling frame in all of the above cases was designed to be representative only at regional levels of disaggregation. Aggregation at such coarse resolution is not very useful to identify priority areas for targetting and interventions, but the underlying georeferenced household data are extremely valuable as inputs to poverty mapping models at much smaller scales. Expenditure data from household surveys have been used to produce spatially disaggregated poverty maps both in Kenya and Uganda. Since in the case of Uganda, poverty maps have also been produced based on the environmental approach (Section 2.3.2), we examine the results of the two approaches in Figure 8. The left-hand panel shows the poverty map produced using the more traditional small area estimates (Emwanu *et al.*, 2003) and the right-hand panel shows the results of the environmental approach (Rogers *et al.* 2006; Robinson *et al*. 2007), shown at 0.1 degree resolution. These maps are not directly comparable because the two analyses are based on different surveys (of the same type but from different periods), and present different estimates of welfare (the small area method estimates poverty rate, the head count index, whilst the environmental approach measures household expenditure). However, they show broadly similar patterns in the distribution of poverty in Uganda and indicate the level of spatial disaggregation that is feasible using each approach. From the point of view of targeting, the environmental approach has the advantage that poverty is estimated at pixel-level resolution, and has the further advantage that we can draw conclusions as to the environmental correlates of poverty.

Figure 8: Small area estimates of poverty incidence in 1992, at county-level (left-hand panel), and modelled household expenditure, at 0.1 degree resolution (right-hand panel) in Uganda.



Adapted from Emwanu et al. (2003)

Adapted from Rogers et al. (2006)

In order to analyse the correlation between different poverty measures in Kenya, variables were aggregated by province: the level at which most surveys were designed to be representative. Figure 9 shows a comparison of four measures of poverty in Kenya: (i) household food expenditure from the 1997 Welfare Monitoring Survey; (ii) the poverty incidence from the 1997/1999 poverty maps; iii) the 1998 DHS wealth index and (iv) the prevalence of chronic under-nutrition in children under-five – all mapped out at the first administrative level (provincial). Tables 5 and 6 present the actual values for the provinces and the correlations among them, while Figure 10 shows the distributions of their z-scores. Z-scores are a way to standardise the original distribution of data into one with a mean of zero and a standard deviation of one, and they are particularly useful to compare scores from different distributions. The bars in the figure indicate how much the score deviates from the mean, so that positive scores mean above average values (as in the case of expenditure or the wealth index, higher scores correspond to relatively higher levels of wealth). Thus, negative scores indicate higher levels of poverty. For ease of interpretation the z-scores of poverty rates and stunting were calculated as the percentage above the poverty line and the percentage of non-stunted children, so that for all the variables higher values mean lower levels of poverty.

Figure 9: Comparisons of some poverty measures available for Kenya, aggregated at the first administrative level (province).

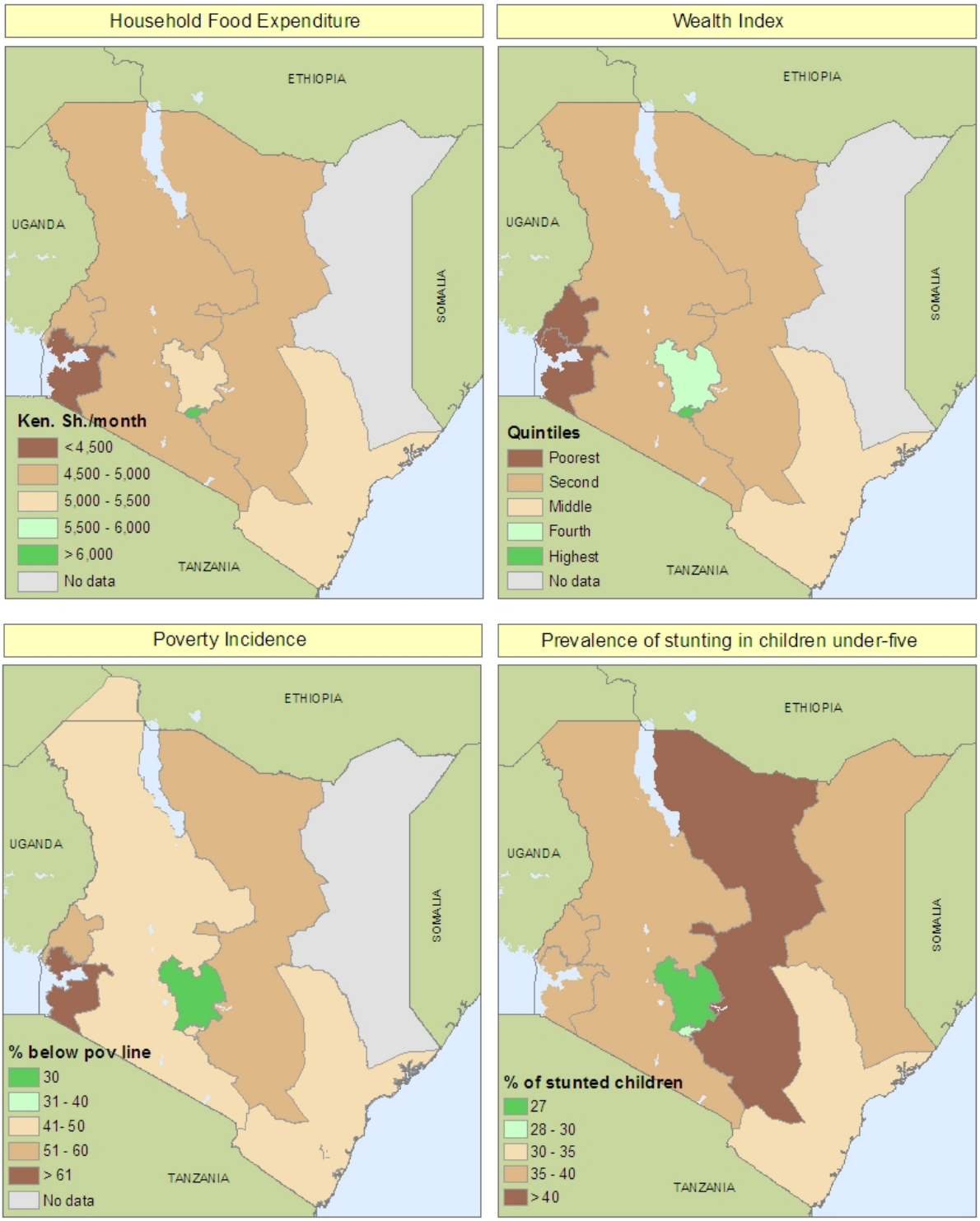


Table 5: Poverty measures in Kenya

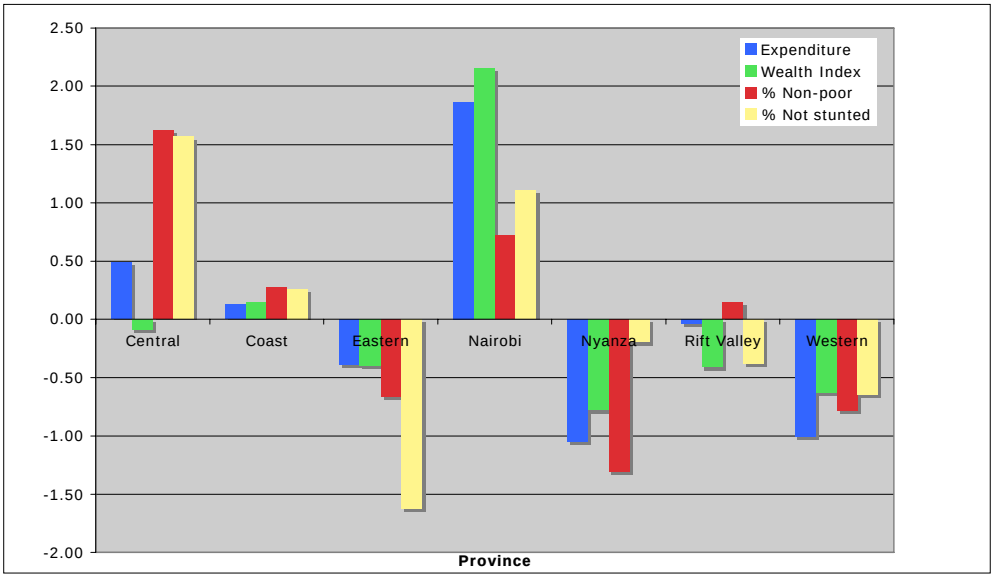
Province	Household food expenditure (KSh/month)	Wealth index (factor scores)	Poverty incidence (% below poverty line)	Stunting in children under 5 yrs (%)
Central	5,318.96	0.08	30.48	27.4
Coast	5,058.87	0.23	46.17	33.7
Eastern	4,684.83	-0.12	57.13	42.8
Nairobi	6,320.06	1.54	40.94	29.6
North Eastern				35.4
Nyanza	4,206.26	-0.37	64.59	35.9
Rift Valley	4,939.13	-0.13	47.67	36.8
Western	4,239.80	-0.27	58.47	38.1

Table 6: Correlations among selected poverty measures in Kenya ('Correlation' is the Pearson correlation coefficient; 'Significance' indicates significance in a two-tailed test; the number of observations in each comparison is 7).

		Household food expenditure (KSh/month)	Wealth index (factor scores)	Poverty incidence (% below poverty line)	Stunting in children under 5 yrs (%)
Household food expenditure (KSh/month)	Correlation	1	.936**	-.763*	-.675
	Significance		.002	.046	.096
Wealth index (factor scores)	Correlation		1	-.527	-.563
	Significance			.224	.188
Poverty incidence (% below poverty line)	Correlation			1	.802*
	Significance				.030
Stunting in children under 5 yrs (%)	Correlation				1
	Significance				

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Figure 10: Z-scores of the poverty measures in Kenya, by province.



Note: The North Eastern province is not reported in this figure because of missing data for three of the four poverty measures considered.

The maps in Figure 9 and the graph in Figure 10 show the general pattern of poverty distribution to be similar: Nairobi and Central provinces tending to have lower levels of poverty; Nyanza and Western provinces tending to have higher levels. Closer inspection and the analysis of the correlations among the different measures, however, reveal some differences. Food expenditure and the wealth index are most closely correlated; poverty rate estimates are also correlated to food expenditure - not surprising as they are closely related econometric estimates. The estimate of stunting, even though fairly correlated highly with poverty rate estimates, appears quite different because Nyanza Province, the poorest by all other estimates, apparently fares better by this measure (for which the Eastern Province comes out worst).

Furthermore, we specifically analyzed the relationship between expenditure and the wealth index in Kenya and Uganda, aggregating the data at the level at which the surveys are representative – the province. Results indicated a strong correlation both for Kenya (.936) and Uganda (.938). Tables 7 and 8 show the aggregated expenditure and wealth index factor scores for Kenya and Uganda, respectively.

Table 7: Kenya: household food expenditure and wealth index by province

Province	Household food expenditure (KSh/month)	DHS wealth index (factor scores)
Central	5,318.96	0.08
Coast	5,058.87	0.23
Eastern	4,684.83	-0.12
Nairobi	6,320.06	1.54
Nyanza	4,206.26	-0.37
Rift Valley	4,939.13	-0.13
Western	4,239.80	-0.27

Table 8: Uganda: household expenditure and wealth index by province

Province	Household expenditure (USh/month)	DHS wealth index (factor scores)
Central	195,910.2	0.43
Eastern	146,908.6	-0.12
Northern	109,679.6	-0.44
Western	157,344.4	-0.22

This type of exploratory analysis is useful to compare different measures of poverty at regional level, to identify crude patterns of poverty distribution within a country and to generate national poverty statistics. It is clear, however, that in order to define poverty reduction strategies and to target interventions a higher spatial resolution would be needed, such as that provided by the small area estimation technique (Ndeng'e *et al*. 2003; Emwanu *et al*., 2003) or the environmental approach (Rogers *et al.,* 2006; Robinson *et al*., 2007).

These results seem to confirm previous findings (World Bank, 2003) that the choice of poverty indicator can make a difference to measured inequality. Even though correlation can be relatively high at regional levels, the poverty indices discussed above indeed measure different things. Since we may reach different conclusions depending on how we define socio-economic status, it is important to define the measure of poverty that is appropriate to the task at hand.

4. RELEVANCE FOR LIVESTOCK SECTOR

In the IGAD region, despite a decreasing proportion of the population being dependant on agriculture for their livelihoods, agriculture is central to the economies of the region (IGAD, 2003; Knips, 2004). For example, in Kenya agriculture contributes between 25 and 30 percent to overall GPD (Government of Kenya, 2000) and in Ethiopia the contribution is as high as 50 percent (Knips, 2004). Within the agricultural sector in the IGAD region 57 percent of GDP, on average, comes from livestock (Knips, 2004). The importance of livestock can be explained in part by the fact that the 60 percent of the land in the region land is classified as arid, and thus unsuitable for crop production. Where the climate can sustain crop production, this is usually practised in mixed systems with livestock providing important inputs into the farming system (Knips, 2004).

Livestock plays an important role in contributing to rural livelihoods, employment and poverty relief. Increases in domestic livestock production contribute to improved livelihoods and poverty alleviation in rural areas and, at a national level, to growth in national income and reduced dependency on imports (ICRC, 2005). In the IGAD region, the poor depend heavily on livestock for income so the performance of this sector is a major determinant of year-to-year changes in levels of poverty and food security. Data from the International Livestock Research Institute (ILRI) indicates that 41 percent of pastoralists in the Greater Horn of Africa fall below the poverty line of US$ 1 per day (ICRC, 2005).

Given the rapidly growing demand for livestock products and in particular the important contribution of livestock to the incomes and welfare of the rural poor, development of the livestock sector holds much potential for poverty alleviation (Upton, 2004). Increased performance of the livestock sector can be achieved through livestock policy and institutional reform: improved control of animal disease and the provision of animal health services; improvement of market institutions and trade legislation; and research and development of new technologies for livestock production, to mention a few. In most developing countries, national policy documents only briefly discuss the potential contribution of livestock to economic development, and even when such plans include strategies to improve the performance of the livestock sector, they rarely examine its potential in relation to reducing poverty and increasing food security (Pica-Ciamarra, 2005). Most policy documents focus on improving livestock production, rather than on poverty reduction through livestock development: they do not fully account for the different roles of livestock for smallholders (source of food and income, but also social status, a buffer to risk from extreme events and a form of savings), and they do not take consider how best to secure access to basic production inputs (land, water and feed) and reduced vulnerability (Wilson *et al.*, 1995; Kristianson *et al.*, 2004, Pica-Ciamarra, 2005).

Poverty maps could play an important role in this by providing information on where the poor are, more specifically on where the livestock-dependent poor are, and by helping to target livestock interventions and to evaluate the impacts of such interventions.

4.1 Targeting and impact assessment

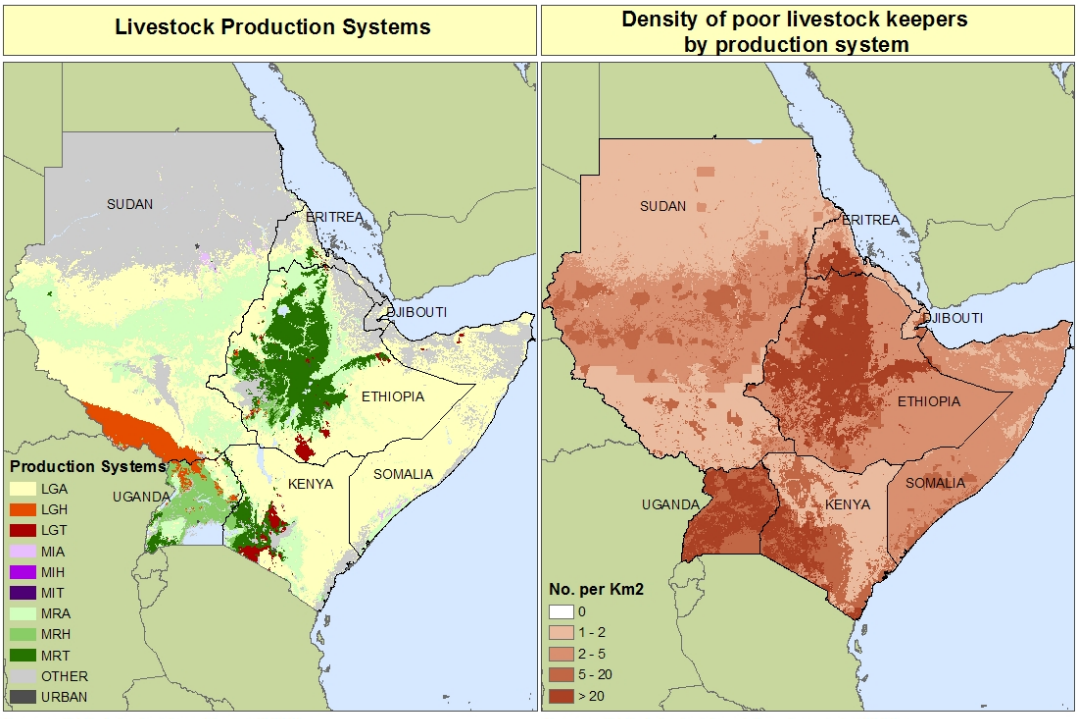
Effective livestock interventions in the context of poverty alleviation would require detailed information on the distribution of poor people. Poverty maps could therefore be extremely useful to address two key questions: i) where are the poor livestock keepers and ii) how many poor livestock keepers are at risk of and will be affected by certain events (e.g. risk from disease, drought, etc); and how many will benefit from interventions.

4.1.1 Targeting livestock interventions

To address where the livestock-dependent poor are, first requires an appropriate measure to define poor people, and then a suitable definition of the livestock-dependent – usually livestock keepers. Measuring and mapping poverty could be a relatively easy task, as data are generally available and the methodology, especially to determine the economic dimension of poverty, widely accepted. In the previous sections such measures and maps have been reviewed. Defining a livestock keeper, however, might be less straightforward, as there are far fewer data available, in terms of livestock ownership, use and role (e.g. contribution to household income).

Thornton *et al*. (2002) developed a methodology to estimate numbers of poor livestock keepers by livestock production system, and mapped the results for the developing world. The methodology involved the following steps. The authors first defined and mapped the different livestock production systems (Kruska *et al*. 2003), based on a classification by Seré and Steinfeld (1996). They then used a variety of sources to map human population density, and thus to assign population densities by country and by production system. They then converted these population estimates into estimates of the numbers of poor by country and by production system, by applying the World Bank's rural poverty rates (World Bank, 2000). For countries where no welfare survey data were available a regional population weighted average was used. In a final step, they estimated the numbers of 'poor livestock keepers' by country and by production system, by crudely assigning differential proportions of poor livestock keepers, estimated for each livestock production system, using data from Livestock in Development (1999). This last step was proposed as an illustration of what could be done to refine the global poverty maps for maximum utility in the livestock sector, but was rather limited by the lack of global data on the contribution made by livestock to peoples' livelihoods.

Figure 11: Livestock production systems (left-hand panel) and density of poor livestock keepers by livestock production system (right-hand panel) in the IGAD region.



Source: ILRI. Adapted from Kuska (2006)

Source: ILRI. Adapted from Thornton et al. (2002)

Table 9: Illustrative number of poor livestock keepers by livestock production system in the IGAD region: World Bank poverty and Livestock in Development system rates. Adapted from Thornton et al., 2002

Country	Grassland-based Systems (LG)			Mixed Farming Systems (M)						Other	Total
				Mixed Irrigated (MI)			Mixed Rainfed (MR)				
	Arid/semi-arid subtropics (LGA)	Humid/sub-humid subtropics (LGH)	Temperate and Highlands (LGT)	Arid/semi-arid subtropics (MIA)	Humid/sub-humid subtropics (MIH)	Temperate and Highlands (MIT)	Arid/semi-arid subtropics (MRA)	Humid/sub-humid subtropics (MRH)	Temperate and Highlands (MRT)	Other	Total
Djibouti	118,380									16,481	134,861
Eritrea	195,226		1,715				722,754		133,334	50,490	1,103,520
Ethiopia	1,115,098	250,136	325,278	27	14,573	108,443	1,974,626	2,047,015	11,050,915	698,624	17,584,734
Kenya	350,774	69,440	120,341				1,172,435	1,707,074	3,026,592	772,605	7,219,262
Somalia	2,472,973		2,843				531,995	30,265		53,044	3,091,081
Sudan	2,280,924	454,630	1,906	270,903			2,902,864	539,222	2,657	864,779	7,317,886
Uganda	113	283,198	3,705				34	4,909,013	815,216	862,398	6,873676

Global poverty maps of this kind have been an enormous step forward, and indeed could be reproduced now using much higher-resolution data, but only poorly represent the distribution of poverty among livestock keepers – and this becomes very evident if one 'zooms in' to individual countries or even smaller areas.

There is a number of important reasons for this:

a) Applying national rural poverty rates assumes rural poverty to be evenly spread across each country, which is obviously not the case. The use of regional, spatially-disaggregated poverty maps would be a way to improve on this.

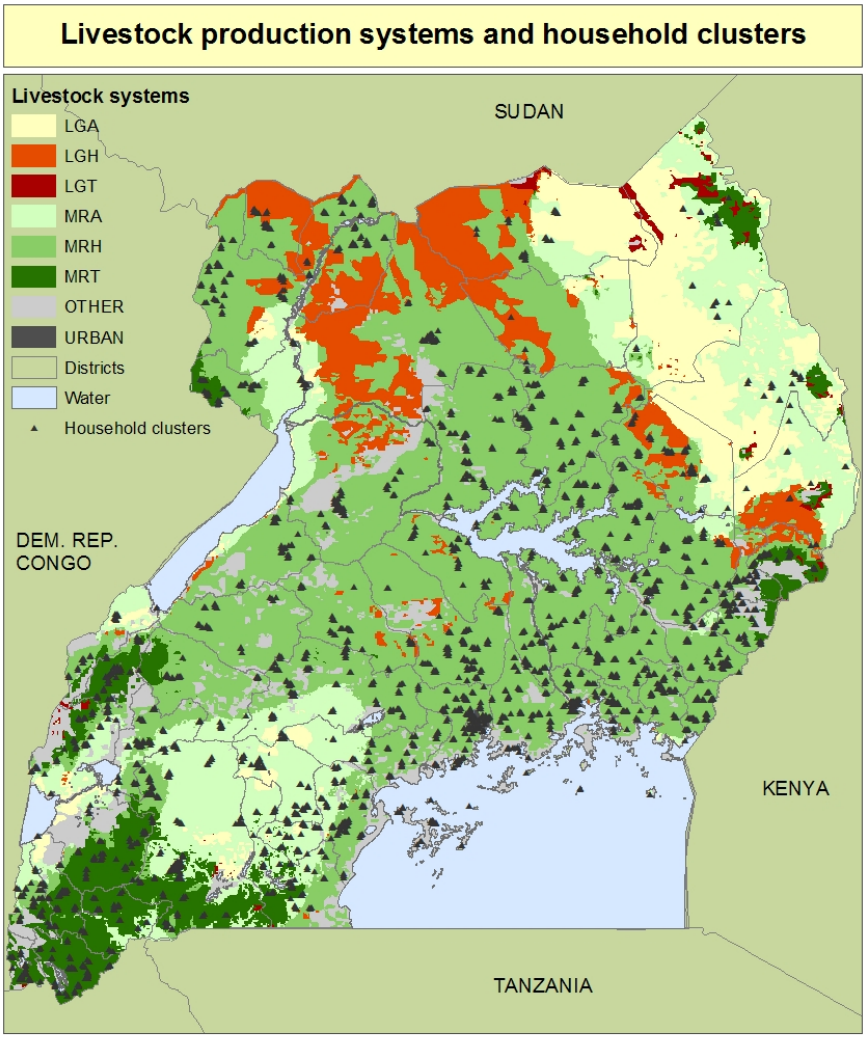
b) It is assumed that the probability of being poor is the same regardless of whether people keep livestock or not, and that the probability of keeping livestock is the same whether people are poor or not.

c) All livestock keepers are considered equal and no differentiation is made among the types of livestock keepers or the role of livestock at household level. In reality, the proportional importance of livestock to household income or welfare differs from one culture to another and within production systems.

What is certain is that to develop a consistent framework that can be used to set priorities for poverty alleviation, much more detailed data are needed. By (i) specifying increasingly small areas, in which people are more likely to have similar livelihoods, thus reducing the effect of the above and (ii) better distinguishing the types of livestock keeper and the roles of livestock at household level, it would be possible to produce more accurate maps of the distribution of poor livestock keepers. Thornton *et al.* (2002) demonstrate this to some extent for Kenya using the Kenya Welfare Monitoring Survey data from 1997 (Government of Kenya, 2000) to examine livestock production systems and the characteristics of the poor at the district level, and to map the contribution of livestock to total household income for households above and below the poverty line. Even though the maps do not seem to show consistent patterns of poverty distribution among the different livestock systems, they do represent the first step towards analysing the distribution of poor livestock keepers at smaller scales.

In a similar effort, and by using expenditure data from the National Household Survey, we explored the distribution of poverty across the different livestock production systems in Uganda. Figure 12 shows the livestock production systems (Kruska, 2006), along with the location of clustered household data (Rogers *et al.*, 2006), in Uganda. For each system we calculated the mean monthly household expenditure from the 2000/2001 Uganda National Household Survey, as shown in Table 10 and Figure 13.

Figure 12: Livestock production systems and location of household data in Uganda.

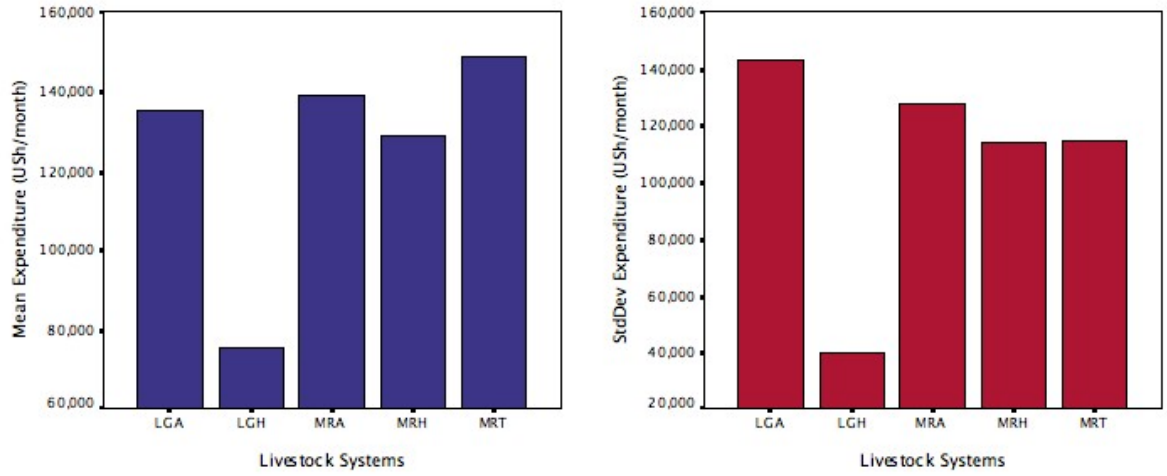


Source of the livestock production system data: ILRI. Adapted from Kruska (2006). Source of household data: Uganda Bureau of Statistics, aggregated at 1 km-resolution (Rogers *et al.*, 2006).

Table 10: Monthly household expenditure by livestock production system in Uganda

Livestock Systems	N of household clusters	Minimum	Maximum	Mean	Std. Deviation
LGA	27	31,919	646,882	135,180.18	143,616.729
LGH	58	22,070	229,665	75,868.11	39,860.876
MRA	347	6,968	1,073,699	139,127.88	127,891.438
MRH	1,815	9,046	2,521,928	128,802.92	114,208.832
MRT	371	13,262	1,139,548	149,200.06	114,924.836
Total	2,618	6,968	2,521,928	131,954.97	115,915.540

Figure 13: Mean and standard deviation of monthly household expenditure by livestock production system in Uganda.



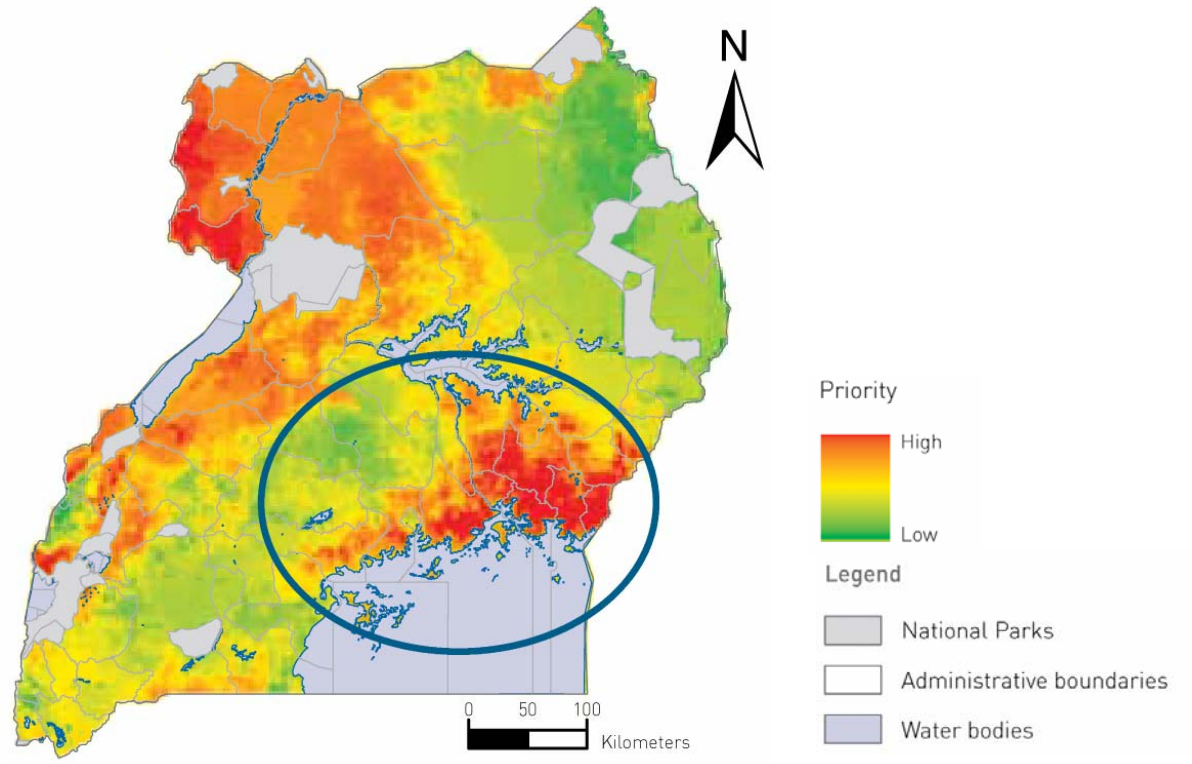
Average monthly household expenditure is lowest in the humid, sub-tropical grassland-based system, which is mostly found in the north-western portion of the country. The standard deviation is also the lowest in this system indicating it to be characterized by consistently low household expenditure. Expenditure values are relatively similar across the other systems, and the large standard deviations suggest that it may be difficult to find consistent relationships between livestock production systems and poverty. However, by exploring the distribution of wealth in the different systems, preferably at smaller scales and in combination with other variables, we may be able to identify some of the driving factors, or at least correlates of poverty and food insecurity.

4.1.2 Evaluating the impacts of livestock interventions

Of the different methods to target poverty reduction, geographical targeting has proven to be the most cost-effective option (Bigman and Fofack, 2000), and its accuracy is better than that of generalized food subsidy programs (Baker and Grosh, 1994). However, the effectiveness of the programs depends greatly on the level of geographical detail at which targeting decisions are made.

An example is provided by Robinson *et al.*, (in preparation) where a precursor to the map in Figure 14 was used to help target interventions of the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) in Uganda. The priority map was produced by a wide group of stakeholders in the livestock sector, who used the technique of weighted linear combination (Malczewski, 2000) to combine, within a decision model, information on livestock distribution, trypanosomiasis risk, poverty rate, length of growing period and agricultural activity. The high priority areas (coloured red) contained within the blue ellipse were selected as the zone where the initial activities would be implemented. Further GIS analysis of livestock, population and poverty maps revealed that this area contains some 754,000 head of cattle and an estimated a rural human population of 5 million, of which about 2.6 million live below the US$ 1 per day threshold. Hence one can start to use these data to estimate the types and magnitude of impacts that might be achieved by targeted interventions.

Figure 14: Trypanosomiasis control priority map of Uganda.



4.2 Understanding the role of livestock

Understanding the role of livestock at the household level and the linkages between livestock and poverty is extremely important to help design interventions that could make use of livestock to a) bring people out of poverty, b) reduce their vulnerability, c) increase their food-security, or d) protect people from falling into poverty. An example is provided by the International Committee of the Red Cross (ICRC), whereby a livelihoods approach is adopted to determine the best interventions for livestock development (ICRC, 2005). Interventions include livelihood diversification, integrated emergency response, cross-border interventions, improving water points and water distribution to livestock and market development (which is also important for animal marketing support during periods of crisis).

To devise and target such interventions requires reliable information on the number and distribution of the livestock-dependent poor. Information on the role of livestock in those households would provide insights as to the linkages between livestock ownership/use and poverty, by estimating for example the proportion of the population that is engaged in the livestock sector, exactly how they are engaged in the sector (e.g. are they livestock producers, consumers, or involved at some other part of the livestock marketing chain), the proportion of the livestock-dependent that are poor and the proportion of their income that is derived from livestock-related activities.

A major issue in this regard is that data from poverty surveys do not always contain sufficiently useful or detailed information on livestock ownership, or on income derived from livestock compared to other sources. For reasons discussed in Section 2.1 household expenditure is the preferred measure of poverty, so it is quite unusual for household surveys to collect detailed data on household income, and how it is

derived. Examples of how valuable detailed data on income breakdown can be for elucidating the role of livestock can be seen from studies in other parts of the world. The Nepal Living Standards Measurement Survey (1996/97), for example, contained such information, and this allowed detailed household typologies to be determined, based on sources of income (Maltsoglou and Taniguchi, 2004). A further example is described by Epprecht (2005) in which data from the 1997/98 Vietnam Living Standards Survey enabled a detailed analysis of household incomes. Analysis of the contribution made by different livestock species to household incomes in different parts of the country and amongst different income quantiles demonstrated, for example, the importance of incomes derived from pig and poultry amongst poor households in the northern mountainous regions.

The only survey in the Horn of Africa that collected information on income was the Kenya Welfare Monitoring Survey (Government of Kenya, 2000). Using these data Thornton *et al.* (2002) showed that livestock were an important source of income for households in all districts of Kenya and in 40 percent of Kenya's districts, income from livestock contributed more than one-quarter of the total income. The contribution livestock made to total household incomes was at least as important to households falling below the poverty line as it was to those above it in 78 percent of the districts. Not surprisingly, in the arid pastoral areas, the contribution to household incomes made by livestock was greater among poorer households, compared to those above the poverty line.

Some of the surveys in the Horn of Africa, such as the 1999/2000 Uganda National Household Survey, do contain data on consumption of, and expenditure on livestock products. An analysis of these data by Maltsoglou (2007) showed that expenditure on livestock products increased as income increased, with large differences between urban and rural households - urban households spending more than three times the amount on livestock products compared to rural households. Expenditure on food derived from livestock accounted for 14.4 percent of food expenditure in the urban areas and for 9.5 percent of food expenditure in rural areas. Differences in levels of meat consumption between urban and rural households were not as large as the respective differences in expenditure on livestock products, which Maltsoglou (2007) suggests may be one or a combination of relatively lower prices for meat in rural areas, and rural households consuming lower quality cuts.

The environmental approach to disaggregated poverty mapping (Rogers *et al.*, 2006; Robinson *et al.*, 2007) has the advantage that it may in itself help us to understand some of the correlates or causes of poverty. Models may be developed that include variables directly related to the livestock sector (e.g. livestock densities or livestock disease risk), or indirectly related (e.g. primary production or market access) to see to what extent these are correlated with and possibly contributing to observed patterns of welfare. This approach further opens up the possibility to estimate how changing conditions may give rise to changes in poverty distributions and levels. For example, the impact of climate change on primary production or disease distributions, or changes in demographics or infrastructure that may impact on accessibility to services or markets.

5. CONCLUSIONS

This paper reviews the available poverty measures in the IGAD region, and discusses the use of poverty maps to target livestock interventions for poverty alleviation. The more traditional poverty measures are based on economic indicators, collected through household surveys that are usually representative at spatial scales which make them inappropriate for targetting interventions at anything below a regional level (e.g. the four regions of Uganda), with a distinction between rural and urban households. Poverty mapping methods have been developed to disaggregate poverty estimates to finer-resolution sub-national levels. The small area estimation technique combines census and survey data to provide welfare measures at province or district levels. The environmental approaches combine household survey data with a suite of environmental and other spatial variables to produce "pixel-level" estimates of poverty, as determined by the spatial resolution of the predictor variables. In both approaches, the accuracy of the estimates, based on standard error measurement, decreases with increasing spatial resolution. As well as providing poverty estimates at a higher spatial resolution, compared to small area estimates, the environmental approach presents the possibility to explain and thus ultimately to predict the distribution of poverty.

This review has shown that for countries like Kenya and Uganda a number of indicators and maps has been produced, while other countries in the region, such as Djibouti, Somalia and Sudan are poorly covered. A comparative analysis of the different poverty measure in Kenya and Uganda shows that, though useful to identify very broad patterns of poverty distribution within a country, aggregated data are limited in their potential to help define more effective poverty reduction strategies. This underlines the intrinsic limitations of survey data in the analysis of the spatial distribution of poverty.

Livestock contribute significantly to the livelihoods of the rural poor by generating income, providing food, reducing vulnerability and creating employment, as well as serving a number of social functions and important roles as part of mixed farming systems (manure, draft power, effective use of crop residues, etc.). Therefore understanding the relationship between the livestock production systems and the characteristics of the poor, and analyzing the contribution of livestock to household incomes of the poor at different spatial scales can provide useful insights for governments and development agencies to prioritize livestock interventions in the context of poverty alleviation. Furthermore, given the physical and developmental constraints that many poor livestock keepers face, it is important to analyze poverty-livestock interactions in a broad context that includes access to resources and to markets, and institutional development.

Thornton *et al.* (2002) have attempted to analyze the role of livestock and map the distribution of poor livestock keepers in the developing world, but a lack of data on livestock ownership and on income derived from livestock, and the crude spatial resolution of the poverty estimates available have made it difficult to analyze the livestock-poverty linkages at spatially disaggregated scales. If these data limitations can be addressed then the approaches described in this paper hold much potential to assist in developing livestock-related interventions and policies that will benefit the poor.

A wealth of information is available already through the numerous household surveys that have been conducted in the region, be they related to monetary estimates of welfare, demographics and health, livelihoods analyses or whatever. Firstly, a great deal can be done using existing data to improve the coverage and quality of poverty maps for the region using, for example, the small area estimation techniques and environmental approaches. Secondly, the existing survey data have not been exploited fully in terms of gleaning relevant information on livestock ownership and household-level analyses of the role of livestock.

Particularly in the Horn of Africa, where cross-border trade and migrations are so much a part of the culture and the prevalent livestock production systems, it is important to find suitable poverty indicators that could be used for regional analysis and to produce regional poverty maps. Even though the asset-based wealth index from the Demographic and Health Survey is not directly comparable across countries, the use of standardized questionnaires does suggest that it may be possible to extract a number of common variables and re-create the wealth index regionally or for groups of countries.

Beyond existing data, much could be done to improve the collection of survey and census data in terms of their relevance to pro-poor livestock policy development. There are four main areas in which improvements could be made to this end. The first of these may be difficult to achieve, at least in the short term, and is to do with regional standardisation of welfare measures. In some cases only a relatively small amount of revision and coordination of questionnaires would be needed. For example the DHS surveys, which are already highly standardised and would require minimum modification in order to become truly compatible regionally, for example using an identical set of questions in deriving the wealth index. For other types of survey, in particular those that create econometric measures of poverty based on poverty lines and estimates of household income or expenditure, regional standardisation would be more complex, but would have the obvious advantage that regional dollar-a-day-type poverty maps could be produced using small area or environmental approaches. A second area for improvement would be to design of sampling frames that would facilitate spatial disaggregation of the results. Welfare surveys should be implemented specifically with poverty mapping in mind and sampling schemes should be designed so as to optimise the disaggregation of results, whether by integration with census or environmental data, or both. A third and related improvement would be to better coordinate household surveys and censuses. These need to be coordinated both in terms of timing and in terms of including questions that are common both to household surveys and to censuses. A fourth and final area for improvement, relating more specifically to the livestock sector, would be to include livestock-relevant modules in survey questionnaires, for example information on livestock ownership, use (pertaining to production systems) and livestock-related income and expenditure. Such information would be vastly helpful in developing pro-poor livestock interventions, policies and development strategies. If government departments and development agencies are to make the required investments to make their surveys more livestock-relevant, however, they will first need to be convinced of the importance of livestock in economic development and poverty alleviation.

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