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Living Standards Measurement Study – Integrated Surveys on Agriculture
United Republic of Tanzania

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SECTION A: Introduction and Overview
Tanzania Prototype for the Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA)

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Organization of the Report

This report presents estimates and summary statistics from the recently released Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) for Tanzania (see *Appendix A* for summary demographic information on Tanzania). The LSMS-ISA data were collected over a twelve month period from October 2008 through September 2009. The sample design was constructed to produce nationally representative estimates and consists of 3,265[1] households from eight administrative zones, each with a rural/urban cluster, for a total of sixteen sampling strata.

The LSMS-ISA survey instrument consists of three separate modules: a community questionnaire, a household and individual questionnaire, and a farm questionnaire for agricultural households. Agricultural households consist of the 2,474 respondents who report involvement in any crop, fishing or livestock cultivation. This initial report focuses on a subset of the available topics and survey questions within each section, mostly from the agricultural module (see *Appendix B* for details on the survey and its three modules). A fuller listing of the questions that populate each section within the three questionnaires is available in the National Bureau of Statistics Basic Information Document, or the survey instruments, both available for download from the World Bank website.

This report is divided into eight sections to allow users to more easily access data of interest. Section A offers an introduction and overview of the entire report, including an executive summary of initial observations across all sections. Section B provides a quick profile of the median farming household in Tanzania, including the median household by administration zone and by male- and female-headed farming household. Sections C through H contain the detailed estimates from the LSMS-ISA for six categories: household demographics and education; crops and production; livestock and livestock by-products; inputs; food consumption and expenditure; and nutrition.

Each section can be used as a "stand alone" analysis and contains its own table of contents, section highlights (also compiled here in *Appendix C*), and charts highlighting the main findings of the section. Where relevant, the sections also contain selected comparative analysis by agricultural and non-agricultural households, male- and female-head of household, gender of the individual deciding what to plant on a plot, administrative zone, and a priority crop. Where more in-depth crop analysis is warranted, we have thus far limited the report to maize, and in some cases paddy and cassava. Basic descriptive analysis was conducted for the ten BMGF priority crops in Tanzania as well as mangoes, which were cultivated by 33% of agricultural households. The ten BMGF priority crops included are: maize, paddy (rice), sorghum, millet, beans, cowpeas, sweet potatoes, yams, groundnuts, and cassava. In addition, each section includes an appendix with the detailed numbers and confidence intervals for the charts, and an appendix with data issues and decisions distinct to the survey and data for the section.

The idea of this report is to understand what information, and in what form, is most useful to the Agricultural Development team in its country work. With that understanding, additional crops or additional questions on any topic found in the survey instruments can be analyzed. Thus far, expected future work plans include bivariate analysis (cutting data by zone, gender, etc.) of:

[1] The National Bureau of Statistics Basic Information Document listed 3,280 households, however, there are in fact only 3,265 households in the survey data.

- additional BMGF priority crops;[2]
- labor hours within the household;
- access to and use of extension services;
- type and prevalence of market engagement;
- initial results by available poverty proxies and intensity of agricultural activity.

The LSMS sample was based on the eight administrative zones in Tanzania, rather than on agro-ecological zones or farming systems. As a result, both agricultural zones and farming systems within the sample extend across the zonal boundaries and representative statistics for particular systems or agricultural zones cannot be drawn from the sample.

As a first step in thinking about farming systems in Tanzania, EPAR is preparing a series of Farmer Profile briefs based on fieldwork conducted in Tanzania in July-August of 2011. These three briefs (Northern Highlands #172, Coastal Cassava Regions #173, and Mixed Maize #174) take a farming systems approach and examine in more detail the farm management strategies employed by farm households in these systems. These farming systems conform broadly to the categories used by the Ministry of Agriculture in Tanzania (shown in more detail in *Appendix D).*

Future LSMS analysis could seek to identify specific farm segments of interest to the foundation, for example we could identify mixed maize farmers with landholdings of less than three hectares. In some cases, this could be restricted to particular administrative zones or regions, but in many case the sample size in this more restricted areas may be too small to permit analysis.

We have also begun some multivariate analysis of variation in:

1. Crop yields
2. Land and labor productivity
3. The probability of a farm household adopting an improved technology

For those interested in conducting their own analysis or replicating results, the question numbers from the survey used to create each chart appear in the chart notes. Because the agricultural module repeats most questions for each agricultural season (long and short rains), the long rainy season is denoted with an "a" and the short rainy season with a "b" within sections 3, 4, and 5. For example, s3aq7 reads as section 3, long rainy season, question 7. In sections 6 and 7, "a" represents fruit trees and "b" permanent crops. In section 10, "a" is data on livestock and "b" is on livestock by-products. For charts that contain simple summary statistics of a single variable or question from the survey, we have included the question text in the report (e.g. *What was the soil type of this plot*?). For calculated variables that rely on multiple measures, the question numbers, but not each question text, are included. Data cleaning and manipulation were often required, including removing outliers, creating new combined variables, creating dummy variables, and collapsing data sets. Information on cleaning and other data issues are provided in footnotes and appendices.[3]

[2] Our crop information is at the plot and household level. To aggregate up to a "farming system," generally defined by geographically contiguous areas, would not account for within area (household) variation that the LSMS contains.

[3] Most variables analyzed required data cleaning. In this process, certain outliers were eliminated from analysis. The general rule followed was to either eliminate the top 1% of observations, or to look at each observation and only eliminate the improbably high outliers. Where feasible, only improbably high outliers were eliminated in order to maintain as many observations as possible. However, in the case of yields, productivity, and inputs, the top 1% of observations were eliminated. Details regarding outliers eliminated are found in the footnotes of each section.

All proportions in the report are estimated proportions that are calculated to be nationally representative using weights that reflect the survey sampling strategy. Therefore the actual number of observations out of a total may not calculate to the same proportion as what is listed in the text. The term "significant" in this report always refers to statistical significance, and not necessarily to the magnitude of a difference. For example the average number of chickens owned by female- and male-headed households differs by 2.7 (13.8 for male-headed households and 11.1 for female-headed households). This difference is significant at the 95% confidence level, meaning it can be determined with 95% confidence that the average number of chickens owned by male-headed households is not the same as the average number owned by female-headed households.

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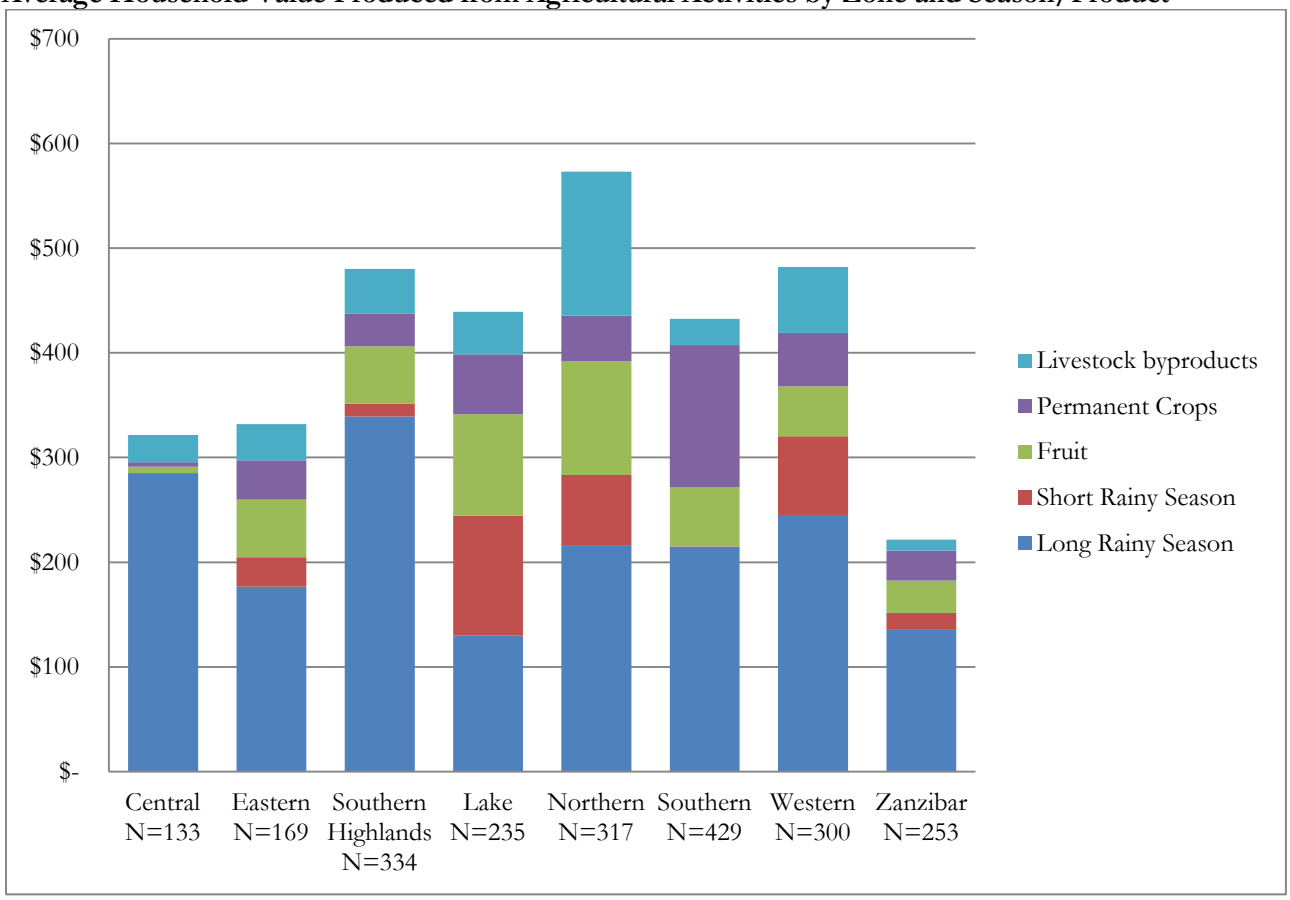
Executive Summary

The goal of this initial analysis is to explore how the LSMS data might usefully inform the Tanzania country strategy. The observations relate to three components of the BMGF strategy: identifying crop and livestock priorities; identifying constraints to productivity potential in those commodities; and identifying the consequences of those productivity gaps. The comments below generally refer only to findings for farming households.

As evident from the figure below, long rainy season crops tended to contribute the most to household value from agricultural products across all zones, though fruit crops in the Lake and Northern zones, livestock by-products in the Northern zone, and permanent crops in the Southern zone were significant contributors.

Average Household Value Produced from Agricultural Activities by Zone and Season/Product



Our initial analysis does not compare across all crops, but thus far we can offer the following observations: Maize was grown by the greatest number of households, including those with landholdings of 3 acres or less. Paddy revealed the greatest average yield gap, defined as the difference between the median farmer and the most productive 10% of farmers, which may reflect a few highly productive farming operations. Most of the mean values of crops sold were more than twice as much as the medians, indicating that a small group of households earned disproportionately more from sales of each of these crops. Paddy also had the largest difference between quantity consumed by households producing paddy versus households purchasing paddy in the last week. Paddy, groundnut and millet were the crops sold by the highest proportion of farm

households with paddy generating the highest median value of crop sold. Sweet potatoes had the smallest yield gap, and were the only priority crop where more female-headed households than male-headed households sold the crop, though not significantly so. A significantly higher percentage of male-headed households grew millet, cassava and mango. Slightly more female-headed households grew beans, sorghum and cowpeas, although the difference was not statistically significant. To varying degrees, cultivation of a diverse set of commodities including fruit and other permanent crops and livestock appears to be associated with higher labor productivity.

Gibbon, Dixon and Flores (2007) estimate that for maize mixed farming systems in Africa, which covers a major part of Tanzania, low soil fertility, drought and low soil nitrogen are the top constraints to reaching yield potential.[4] They estimate that abiotic stresses (drought, low soil fertility, etc.) account for 43% of the reduced yield, biotic stresses (weeds and pests) account for 22%, crop management (late planting, low plant population, low fertilizer use, poor weed management and post harvest losses) account for 15%, and the remaining 20% is attributable to socio-economic constraints including poor grain, seed, credit and labor markets. The LSMS-ISA data support the view that water is a major constraint, but most farmers do not appear to view soil fertility as a major constraint. Soil quality is perceived as good or average by most farmers, perhaps because farmers may rank their soil quality relative to others in the village, rather than against the external standard of agronomists. Soil quality and the use of organic and inorganic fertilizer are, however, positively associated with maize yield in initial multivariate regressions. Farmers cited agricultural tools and equipment as the major constraint impeding the planting of the entire plot, and lack of seed was cited for beans, cassava and groundnuts.

Pre-harvest losses affected one third to one half of all plots, affecting considerably more plots than post-harvest losses. Pre-harvest losses were most commonly attributed to birds and animals. Exceptions were insects (beans, cowpeas and groundnut), disease (cassava), and theft (mangos). Post-harvest losses were attributed to rodents, pests, and insects, with a few crops (cassava, sweet potatoes, mango) ranking rotting as affecting more plots.

Differences between male- and female-headed households were often significant. On average, female-headed households had fewer plots, less acreage, grew fewer crops, were less likely to own livestock, and used fewer inputs. They were less likely to sell crops (except sweet potatoes), and earned less value from doing so.

Summary points by commodity, constraint, and outcome (productivity and nutrition thus far) follow. We note where crop comparatives are based only across maize, rice and cassava. Two thirds of households list one of these crops as the main crop on at least one of their plots; 16% of agricultural households do not cultivate any of these three crops.

[4] David Gibbon, John Dixon and Dagoberto Flores, "Beyond Drought Tolerant Maize: Study of Additional Prioirties in Maize, Report to Generation Challenge. CIMMYT: August, 2007.

Summary of Crops and Livestock

Most households grew multiple crops and maize was by far the most commonly grown crop

Of households that owned or cultivated at least one plot, most grew between two and five different crops; the exception was the Lake zone with a mean of six crops. Fewer than 10% of farm households specialized in a single crop.

Of the BMGF priority crops[5] maize was the most commonly (including farms with three or fewer acres) cultivated, by over 80% of households, followed by cassava, beans and mango, all cultivated by about a third of the farming households. Zanzibar was an exception to this national ranking, with fewer than 10% of households growing maize, 50% of households growing rice, and over 80% of households growing cassava.

Significant gender differences were limited to a few crops

A slightly higher percentage of female-headed households grew beans, cowpeas, and sorghum than male-headed households, but not significantly so. A statistically significant higher proportion of male-headed households grew cassava, mango, and millet than female-headed households.

Maize accounted for the largest share of total value from any single crop, followed by paddy

Maize accounted for 32% of the total value of all crops in the long and short rainy season (excluding fruit and permanent crops) just under twice as much as paddy at 17%. Maize generated US$391 million of $1.16 billion total value in the long rainy season, and $64 million of $258 million total value in the short rainy season. Paddy accounted for the second highest share of value generating $175 million in the long rainy season and $72 million in the short rainy season.

On average, however, paddy-selling households earned the highest average value for their paddy sales.

Rice was purchased more than maize or cassava among households consuming these crops

Seventy-five percent of agricultural households who consumed rice in the past week purchased it, while about half of the agricultural households that consumed maize flour in the past week produced it and about half purchased it. Sixty-five percent of households that consumed dry or cassava flour in the past week produced it. Generally people who produced a given food did not also purchase that food in the same week and vice versa. Most producers of food products consumed more of that particular food in one week than households that purchased it. The exceptions to this trend were rice and fresh milk. Households that purchased rice consumed more (17kg) than households that produced rice (5.9kg) and households that purchased fresh milk consumed more (3L) than households that produced fresh milk (1.7L). By contrast, households that consumed maize flour from own production consumed an average of 12 kg, while households that purchased maize flour consumed an average of 10 kg.

[5] As identified by the Agricultural Development Strategy Refresh Memo II dated 5.11.2011, p.12

Paddy had the highest land and labor productivity

Average land and labor productivity was considerably higher for plots cultivated with paddy as the primary crop than other priority crops, and the differences were most pronounced in the short rainy season. Since paddy was least likely to be intercropped, it is not clear how much of its measured productivity is driven by a higher seed planting density than would occur if multiple crops were being grown. The productivity estimate for a single crop cultivated on an intercropped plot is confounded by the need to attribute the yield of multiple crops to the same plot of land, which can be done, and to control for planting density, which was not measured. Plots with maize as the primary crop had the second highest average long rainy season land and labor productivity of priority crops with sufficient observations.[6]

Sweet potatoes, cassava, and paddy had the highest estimated yields

Among BMGF priority crops, sweet potatoes, cassava, and paddy had the highest estimated long rainy season yields (kg/acre). The average short rainy season paddy yield was more than twice the long rainy season yield, and the highest yield of all priority crops – which may be driven by a few very high yielding farms. Beans, cowpeas, sorghum, and groundnuts had the lowest estimated yields, with maize and millet in the middle.

Cowpeas, beans and groundnuts were most likely to be intercropped

Across all crops, 63% of plots were intercropped. In the long rainy season, 65% of plots grown with maize were intercropped, 46% of plots growing cassava, but fewer than 20% of plots growing paddy.

Input use was low, but varied across crops

Plots with maize as the main crop were the most frequently treated with fertilizer: roughly 16% plots were treated with organic fertilizer during the long rainy season, a rate three times greater than paddy or cassava plots. Sixteen percent of maize plots were treated with inorganic fertilizer, versus 9% for paddy and only 1% for cassava.

Pesticides, herbicides, and fungicides were almost never used on cassava plots, but 11% of paddy plots and 11% of maize plots were treated with at least one of these inputs during the long rainy season.

Livestock by-products contributed to household value produced in every zone, but their value was lower than crops

Though some livestock by-products contributed to households across Tanzania, their total reported value was lower than crops. Chickens were the most common livestock owned by 68% of agricultural households. Goats were owned by slightly more households (30%) than cattle (23%) and ownership was spread across all zones.

[6] Note, these rankings exclude priority crops for which there were less than 30 observations of that crop as the main crop planted on plots. Plots with yams as the primary crop had the highest average land productivity in the long rainy season, but there were only 15 observations. Plots with cowpeas as the main crop planted in the long rainy season had the second highest average labor productivity, but there were also only 15 observations.

Summary of Constraints to Productivity

The LSMS-ISA data offer several avenues for considering possible constraints to higher yields and productivity in Tanzania, particularly constraints related to land use and crop losses. Three categories of possible losses can be considered through the survey data:

1. Productivity was low because the entire plot was not planted;
2. The planting area and density was reasonable, but yields were affected by pre-harvest losses from abiotic or biotic stresses, or poor management practices;
3. Loss occurred post-harvest.

Information relevant to each of these from the LSMS-ISA follows.

Underutilized Land

Between 8% and 26% of plots were not entirely planted

Beans, groundnuts, cowpeas and millet were the most likely crops where less than the entire plot was planted because of a constraint. Lack of tools and equipment was the most commonly cited cause, with the exception of long rainy season groundnut and cassava where seed shortages ranked higher.[7]

A lack of tools and equipment was overwhelmingly cited as the primary constraint

Ninety-two percent of farmers owned hoes, but only 8% owned ploughs. Fewer than 1% owned a water pump, trailer, hand milling machine, tractor, harrow, reaper, harvesting or threshing machine or a fertilizer distributor.

While lack of seeds was not a large constraint for maize or paddy (affecting 1% and 2% of plots respectively), it was a much larger problem for beans—9% of plots were not fully planted with beans due to a lack of seeds.

For maize plots, for example, over 80% of plots had a lack of equipment cited as the reason for under planted plots. Drought was cited for 5.3%, floods for 2.2%, and lack of loans for 1.1%.

Higher productivity tends to be associated with smaller plot sizes

The relationship between smaller plots and higher yields was significant for maize, paddy, yams[8] and cassava in the long rainy season. Sweet potatoes were the exception, with a positive and significant relationship between plot size and yield.

[7] Respondent choices were: drought, lack of tools, equip, seeds, floods, loans, and other
[8] Note: Yams only had 22 observations.

Pre-Harvest Losses

Pre-harvest losses affected a third to one half of all plots planted with priority crops

Millet, cassava and paddy suffered the highest proportion of pre-harvest losses in the long rainy season, with over 50% of plots reporting some losses prior to harvest. The lowest percentage of beans, maize and groundnut plots suffered losses, but approximately one third of plots were still affected.

Damage from birds (paddy, millet, and sorghum) and animals (cassava, maize, and sweet potatoes) were the most frequently cited causes. Disease was common for cassava. Insects made the top three reasons for most crops, and were the top reason for beans, cowpeas and groundnuts. Theft numbered two for maize and number one for mango.[9]

Generally, pre-harvest losses were more common in the short rainy season than in the long rainy season.

Twenty to forty percent priority crops were not harvested on the full area planted

A unique aspect of the LSMS-ISA is that it collects information on both area harvested and area planted, giving another measure of the magnitude of pre-harvest losses. The difference varies by season and crop, but for maize, for example, 30% of plots harvested a smaller area than the area planted in the long rainy season and 48% of plots were not fully harvested in the short rainy season.

For this measure of crop loss, damage due to drought and insects were the most frequently cited reasons for harvesting a smaller area than planted. Rains were cited for about 9% of crops that had smaller areas harvested than areas planted in the long rainy season and animals were cited for approximately 6% of crops. Lack of casual labor was almost never cited, suggesting that post-planting damage, rather than labor constraints, were a key reason for partial harvests.

About 7.3% of the population did not harvest a particular crop on a plot where they specified planting that crop during the long rainy season. Within this group, 37% gave "destruction" as the reason for having no harvest.

Farmers did not appear to consider soil fertility a primary constraint to productivity

The majority of long rainy season plots were characterized as having loam soil (a mix of clay, silt and sand), and were most commonly considered by farmers to be of good quality with flat bottoms.

A minority of households used any fertilizer, herbicide or pesticide

Organic fertilizer was used most frequently, and was applied on 12-13% of plots cultivated in both the short and long rainy seasons. Eleven percent of long rainy season plots and only 4% of short rainy season plots were treated with inorganic fertilizers. Pesticides were used on an estimated 2% of plots (83 plots in the sample), and roughly 80% of plots treated with pesticides received 1 kg/acre or less. Herbicides were used on 8% of plots. Nearly half of herbicide-treated plots were maize plots. However, certain cash crops were by far the most likely crops to be cultivated using herbicides, including cotton (27 out of 28 plots with cotton as the

[9] Respondent choices were birds, animals, insects, disease, theft, and other.

main crop in the long rainy season) and tomatoes (9 out of 10 plots with tomatoes as the main crop in the long rainy season).

The percentage of households using inorganic fertilizer was highest in the Southern Highlands zone, while usage of organic fertilizer by households was highest in the Central and Northern zones.

Only 1.2% of plots were treated with inputs purchased on credit.

Gender differences appeared in input use

Plots where decision-making was exclusively male were significantly more likely to be treated with at least one kind of input than either female or shared decision-making plots. Some of this difference may arise from differences in crops cultivated by male versus female plot-owners.

Post-Harvest Losses

Post-harvest losses affected five to fifteen per cent of crops from all households

Paddy, maize and sorghum suffered the greatest reported post-harvest losses with the most common cause due to rodents, pests (paddy and maize) and insects (sorghum).

Chickens were the most commonly lost livestock due to disease

Sixty-six percent of households who owned chickens lost one or more to disease, with a mean loss of 12 (close to the mean number of chickens owned). The mean value of this loss, however, was the lowest of all livestock. Cattle were the least likely to be lost to disease, but with the highest mean value lost.

Approximately half the households with cattle vaccinate their animals, while fewer than 20% of households vaccinate their goats or chickens.

Almost a quarter of households with chickens also lost an animal to theft.

Summary of Outcomes – Productivity and Nutrition

There are at least two ways to get a sense of Tanzanian agricultural productivity and how much of a yield gap might exist. One is to compare against other countries in the region, and the other is to compare across farmers within the country. Both methods suffer from the problem of making comparisons across different social and agro-ecological farming contexts, but each offers insight into the levels of productivity that are possible.

As LSMS-ISA data are not yet available for other Sub-Saharan countries, we report on some cross-country productivity measures using data from the World Bank and FAOSTAT.

Comparison across Countries

Tanzanian labor productivity is somewhat average and land productivity is in the lower ranks

World Bank data suggest that Tanzanian land productivity is in the lower rank among other BMGF priority countries for which data are available: much lower than Uganda, India, Ghana, and Bangladesh and above Ethiopia and Burkina Faso. Among those same countries, World Bank data suggest that Tanzanian labor productivity is in the middle ranks: higher than Uganda, Ethiopia and Burkina Faso and below Ghana, Bangladesh and India. See *Appendix E* for a table showing the land and labor productivity estimates for each of these countries.

Tanzanian crop yields are relatively low; livestock and livestock product yields are higher

FAO estimates also suggest that Tanzanian crop yields are relatively low across the priority crops compared to crop yields within this same cohort. Tanzania has the lowest maize yield of all the priority countries. Livestock and livestock product yields perform relatively better. See *Appendix E* for a table of priority crop yield estimates for each of the priority countries.

It is unclear how much of this relatively poor performance is a measurement issue, relative to a production issue. With the exception of paddy, all LSMS-ISA yield estimates are below the FAO yield estimates for Tanzania reported in the tables above. Nonetheless, even the LSMS-ISA estimates indicate that many agricultural households have low productivity relative to other Tanzanian farmers.

Comparison within Tanzania

There were considerable yield gaps between the median and the most productive Tanzanian farmer

The largest yield gap for priority crops occurred with paddy plots. The 90th percentile harvested 500% more kilograms per acre than the yields on the median plot. Groundnut plots had the second largest yield gap, with the 90th percentile plots yielding 350% more kilograms per acre than median plots. The most productive plots of cowpeas, millet, maize, sorghum, and beans all produced between 200% and 300% more than the median yields. Sweet potatoes had the smallest yield gap, with the most productive plots producing 48% more than the median plot yields.

Yield variability across households and zones was high

Sixty-percent of households reported a maize yield of 320kg/acre or less in the long rainy season; approximately 40% of households reported in this same range for paddy. But for maize, paddy and cassava, even after trimming the top 1% of observations there were reports of yields above 2000 kg/acre. Average yields mask these considerable differences in yields distributed across households.

Across all crops, long rainy season (approximately March through May) average land productivity was $45.50 USD/acre country-wide, though the range extended to more than $500/acre for individual households. Likewise there was considerable variation in labor productivity, averaging U.S.$1.52/day country-wide but ranging above $10/day worked for some households.

Zonal differences were more varied. Land productivity that includes all crops and livestock was highest in the Northern zone; more than twice the estimated value of the Central, Eastern, Southern (not Southern Highlands) and Western zones. The Western zone, with the second lowest land productivity, had the highest labor productivity. The Southern Highlands and Lake zones tended to be in the mid-range for both land and labor productivity (thought the Southern Highlands had the highest average household value produced from all crops).[10]

Nutrition

Malnutrition was greater in agricultural households than non-agricultural households

An estimated 44% of under-five year olds in agricultural households suffer from stunting and 17% are underweight (compared to 33% and 11% in non-agricultural households). Wasting, low BMI for age, and overweight is less prevalent and not statistically different between agricultural and non-agricultural households.

Children in female-headed households fared slightly less well, though not significantly so

A higher proportion of children from female-headed households exhibited indicators of malnutrition as compared to male-headed households. However, none of these differences were statistically significant.

Malnutrition was not consistently higher in any one zone

Indicators of malnutrition varied across zones with no one zone having consistently high levels of malnutrition across the available indicators. Of all the zones, Southern zone had relatively higher levels of malnutrition across the indicators. Any zonal differences, however, may be drive by differences in the proportion of agricultural households, so additional analysis is necessary.

[10] Value is estimated using local prices, which may be higher in the Southern Highlands. Otherwise this higher value is due to relatively higher output. Once again, not fully accounting for intercropping may underestimate land productivity in zones like the Southern Highlands that grow a lot of maize.

Appendix A Summary statistics on Tanzania

The United Republic of Tanzania, most commonly referred to simply as Tanzania, is located in Eastern Sub-Saharan Africa, and is comprised primarily of poor, rural, smallholders whose livelihoods are reliant on agriculture. The table below provides general facts on geography, population, income, and the economy.

Tanzania At-A-Glance

Geography	
Total Area	947,300 kilometers*
Land Area	885,800 kilometers*
Population	
Total Population (2008)	42 million*
Urban	25%*
Rural	75%*
Annual Population Growth Rate (2010)	2.032%*
Percentage of labor force employed in agriculture	
Male	80%**
Female	84%**
Incomes	
Average Income per capita	$280***
Poverty Line	$0.65/person+
Population below	17 million+
Poverty Distribution (% of the poor)	
Urban	20%*
Rural	80%*
Economy	
GDP (2010 estimate)	$22.43 billion*
Exports	$3.8 billion*
Agricultural share of GDP	41.6%*
Average Annual GDP Growth Rate (1990-2003)	3.5%++
Average Annual Agricultural GDP Growth Rate (1996-2003)	4%++

*Sources: *CIA World Factbook;** Fischer 2003, p 4*; ***Conforti & Sarris 2009, p 3;* +*Government of Tanzania 2006, p 4;* ++*Gordon 2008, p 97*

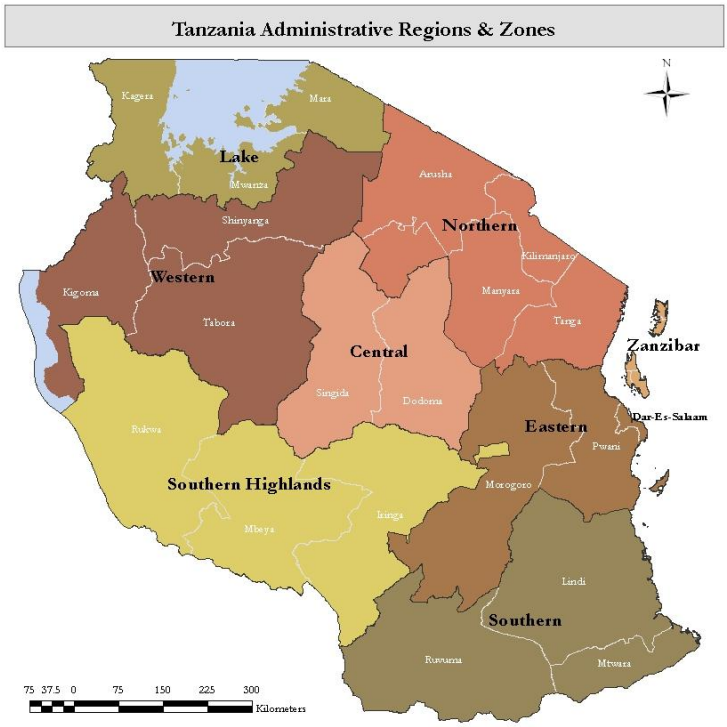
Tanzania has two major rainfall regions. The majority of the country has one long rainy season that typically lasts from December through April. The North and Northeastern parts of the country are bimodal; in addition to the long rainy season lasting from March through May, they also have a short rainy season characterized by lighter rainfall that lasts from October to December.[11] The main export crops are sugar, coffee, cotton, tobacco, and tea. The most prevalent staple crops include maize, cassava, rice, sorghum, and millet.

EPAR Brief 133: *Tanzania: Agricultural Sector Overview* and EPAR Brief 134: *Gender and Agriculture in Tanzania* provide additional background information on Tanzania.

[11] Minot, N. (2010). *Staple food prices in Tanzania*. Washington, D.C. International Food Policy Research Institute

Appendix B Background on LSMS-ISA Survey

This report provides descriptive statistics and initial analysis from the Tanzania National Panel Survey (TZNPS) that the Tanzania National Bureau of Statistics (NBS) conducted from October 2008 to October 2009. The TZNPS survey was the first in a series of nationally representative household panel surveys that will revisit the same households each year. The TZNPS is part of the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) which supports governments in seven Sub-Saharan African countries to collect panel data focusing on agriculture and rural development.[12]



The TZNPS is a national stratified panel survey. Local enumerators sampled 3,280 households using a multi-stage cluster design. The principal strata were the seven zones shown in the map to the right, with Zanzibar added as an eighth. These zones were then divided into rural and urban, creating 16 total strata. Within strata clusters were chosen randomly, and represent census enumeration areas in urban areas and entire villages in rural areas.[13] The sample gives slightly greater weight to urban areas (due to the higher levels of variability in these areas) and to Zanzibar (in order to allow for separate Zanzibar-specific estimates).[14] The resulting data can produce nationally representative estimates of poverty, agricultural production, and other key indicators. Representative estimates of key variables can also be generated for the eight zones shown above. Sample size limitations preclude reliable statistics at the regional or district level.

Within the sample, 2,064 households came from rural areas and 1,216 came from urban areas. 2,474 respondents indicated that they owned and/or cultivated a plot in the 12 months preceding the survey, owned livestock, and/or fished. These households completed the agricultural questionnaire in addition to the household survey.

[12] National Bureau of Statistics, 2010, p.1

[13] The 140 rural villages from the 2007 Household Budget Survey were also used as the enumeration area (EA) for the NBS sample used in the LSMS-ISA in order to create links to the 2007 HBS. The population of households in each EA was defined in 2008 by a household listing by enumerators. The household sampling was then done in two strata: those present for the HBS sample in 2006 and newly formed arrivals or split households. The HBS households were re-sampled for the first group, and a new random sample was taken for the second. Reported in Tanzania National Bureau of Statistics, "Sample Design for National Panel Survey," Justin Sandefur, August 2009.

[14] Tanzania National Panel Survey Report, 2010, p.6

Outline of Survey Modules

Agricultural Questionnaire:

1. Household roster
2. Plot roster
3. Plot characteristics
4. Crops by plot
5. Crop production and sales
6. Fruit trees/permanent crops by plot
7. Fruit trees/permanent crop totals
8. Outgrower schemes and contract farming
9. Processed agricultural products and agricultural by-products
10. Livestock & livestock by-products
11. Farm implements and machinery
12. Fishery and aquaculture
13. Extension

Household and Individual Questionnaire:

1. Household identification
2. Survey staff details
3. Household member roster
4. Education
5. Heath
6. Labour
7. Food outside the household
8. Children living elsewhere
9. Governance
10. Violence against women
11. Housing, water and sanitation
12. Consumption of food over past one week
13. Non-food expenditures (past one week and one month)
14. Non-food expenditures (past 12 months)
15. Household assets
16. Assistance and groups
17. Credit
18. Crime and justice
19. Recent shocks to household welfare
20. Deaths in household
21. Household re-contact information
22. Anthropometry

Community Questionnaire:

1. Community identification
2. Survey staff details
3. Access to basic services
4. Investment projects
5. Land use
6. Agriculture
7. Governance
8. Roster of community leaders
9. Crime and policing
10. Market prices

Appendix C Summary of Section Highlights

SECTION B: Profile of the Median Farming Household

The median agricultural household in Tanzania:

- Has five members, two of whom are under 12. Nearly half (44%) of those under five show signs of stunting.
- Is male-headed and cultivates four crops on two plots on a landholding of four acres.
- Is likely to grow maize, with a yield of 270 kg/acre (288 kg/acre for male-headed households and 240 kg/acre for female-headed households).

Among zones:

- Median landholding is highest in Western zone.
- Households in the Lake zone cultivate the largest number of crops.
- Southern Highlands farmers have the highest maize and paddy yields.
- Zanzibar farmers have the highest cassava yield.
- Among cattle-owning households, herd size is the largest in the Lake zone.
- Of farming households that apply organic fertilizer, the highest rate of application is in the Northern zone.

SECTION C: Household Characteristics and Education

- Females are more likely to head non-agricultural households (29%) compared to agricultural households (25%).
- Agricultural households are larger (5.4 individuals) on average than non-agricultural households (3.9).
- Agricultural households contain more children on average (3) than do non-agricultural households (2).
- Adult males in agricultural households were significantly less likely to have attended any school (17%) than those in non-agricultural households (3%).
- 35% of women in agricultural households have not attended school, as compared to 9% in non-agricultural households.
- Adult males in agricultural households completed, on average, 6 years of education compared to 4.7 of adult females in agricultural households.
- An estimated 89% of all school-aged boys and girls living in agricultural households were enrolled in school.

SECTION D: Farm Characteristics, Crops and Productivity

- Mean household landholding size is 5.2 acres, the median is 3 acres; 70% of households own less than 5 acres total.
- Landholding size varies significantly by zone, with Western having the largest landholdings at 8.5 acres, and Zanzibar the lowest at 2 acres.
- The average number of plots cultivated is 2.3 per household, for those households that cultivated land.
- The most commonly cultivated crop was maize, with 83% of households cultivating at least one plot of maize. Cassava (35%) and beans (34%) were the next most commonly cultivated crops.

- The number of crops grown by households also varies by zone, with Lake zone having the most crops grown per household (an average of six) and Zanzibar and Central the fewest (just over three).
- 17% of households in the sample reported cultivating rice.
- 57% of households cultivated in the long rainy season only; 39% of households cultivated in both the short and long rains.
- 92% of household reported owning a hoe, but just under 8% owned a plough.
- Crops cultivated were relatively similar between male and female-headed households, although male-headed households were more likely to grow cassava, millet and mangos than female-headed households
- Average labor productivity at the national level in the long rainy season was $1.52 per day of work, while average land productivity was $45.50 per acre.
- Paddy had the highest land and labor productivity.
- Land productivity and yields for maize, paddy and cassava tended to be higher in households with smaller landholdings and on smaller plots.
- Intercropping is common: 63% of all plots are intercropped. Labor productivity tends to be higher on intercropped plots.
- Roughly 40% of plots reported some pre-harvest losses, with damage by animals being the most common reason for losses.
- Lack of agricultural equipment and tools were the most commonly cited reasons why farmers did not plant the full area of a plot. 12% of maize farmers and 13% of paddy farmers reported this constraint in the long rainy season.

SECTION E: Livestock and Livestock By-Products

- Twenty-three percent of all agricultural households owned some type of cattle (bulls, cows, steers, heifers, male calves, and/or female calves), compared to 30% of households that owned goats and 68% of households that owned chickens.
- Of those households that own cattle, the mean is 10.25 cattle per household.
- Relatively few households reported selling live animals: 19% of bull owning households sold bulls, 11% of cow owning households sold cows, 34% of goat owning households sold goats, and 41% of chicken owning households sold chickens.
- For all livestock varieties, male-headed households were more likely to own animals than female-headed households, and owned a higher mean number of animals.
- The Northern zone reported the highest ownership levels of cattle, with 47% of agricultural households owning cattle, and of those households, the mean was 9.7 cattle per household.
- The Northern zone also reported the highest ownership levels of goats, with 48% of agricultural households owning goats, and the mean for those households was 9.3 goats per household.
- The Eastern zone had the lowest cattle ownership (2%) and goat ownership (7%), however the sample sizes are insufficient (less than 30) to provide means.
- The Western zone reported the highest ownership levels of chickens, with 75% of households owning chickens, and the mean for those households was 10.8 chickens per household.
- Zanzibar reported the lowest chicken ownership, only 30% of households owned chickens, but of those households, the mean was the highest, at 24.8 chickens per household.
- Chicken owning households were most likely to lose one or more chickens to disease (66%, compared to 15% of bull owning households).
- However, the average value lost per year for households losing chickens to disease was $23.91, compared to $299.19 for households losing bulls to disease.

- Fifty-two percent of households owning bulls vaccinated some or all of their bulls, compared to 14% of households owning chickens that vaccinated some or all of their chickens.
- For livestock by-products, 52% of agricultural households reported producing traditional eggs, while 13% reported producing traditional cow milk, 2% reported producing improved cow milk and 0.5% reported producing improved eggs.
- Of households that produced each particular by-product, only 21% reported selling traditional cow milk, compared to 56% that reported selling improved cow milk. The median value of sales was higher for improved cow milk ($240/year) than it was for traditional cow milk ($150/year).
- A higher proportion of male-headed households than female-headed households produced both traditional cow milk and eggs, while a slightly higher (though not statistically significant) proportion of female-headed households produced improved cow milk and eggs.
- The Northern zone had the highest proportion of traditional and improved cow milk producing households (28% and 9% respectively).

SECTION F: Inputs

Soil and Water

- A majority of long rainy season plots have loam soil (a mix of clay, silt and sand), most common response was that plots are of good quality and have flat bottoms.
- 15% of plots reported suffering from erosion, the majority of which was caused by rain (94%).
- 19% of plots used some form of erosion control in the long rainy season. Terraces were the most common form (38%).
- Fewer than 5% of plots were irrigated in either the long or short rainy season, and of those, flooding from a river or stream was the main source of water.

Inputs

- An estimated 26% of plots were treated with some form of agricultural input (fertilizer, pesticides, herbicides, or fungicides) at some point during one or both rainy seasons in 2008, but only 1.2% of plots were treated with inputs purchased on credit.
- Organic fertilizer was used most frequently, and was applied on 12-13% of plots cultivated in both the short and long rainy seasons. 11% of long rainy season plots and only 4% of short rainy season plots were treated with inorganic fertilizers.
- Pesticides were used on an estimated 2% of plots in 2008 (83 plots in the sample), and roughly 80% of plots treated with pesticides received 1 kg/acre or less.
- Herbicides were used on 7.86% of plots. Nearly half of herbicide-treated plots were maize plots. However, cash crops were by far the most likely crops to be cultivated using herbicides, including cotton (27 out of 28 plots with cotton as the main crop in the long rainy season) and tomatoes (9 out of 10 plots with tomatoes as the main crop in the long rainy season).
- Pesticides, herbicides, and fungicides were almost never used on cassava plots, but 11% of paddy plots and 11% of maize plots were treated with at least one of these inputs during the long rainy season.
- Maize plots were the most frequently treated with fertilizer: roughly 16% plots were treated with organic fertilizer during the long rainy season, a rate three times greater than paddy or cassava plots. 16% of maize plots were treated with inorganic fertilizer, versus 9% for paddy and only 1% for cassava plots.
- Plots where decision-making was exclusively male were significantly more likely to be treated with at least one kind of input than either female or shared decision-making plots. Some of this difference may arise from differences in crops cultivated by male versus female plot-owners.
- The percentage of households using inorganic fertilizer was highest in the Southern Highlands zone, while usage of organic fertilizer by households was highest in the Central and Northern zones.

SECTION G: Food Consumption and Expenditures

- The mean total value of household consumption was higher for agricultural households (US$27.28) compared to non-agricultural households (US$26.59), but the mean per capita value of household consumption was higher for non-agricultural households (US$7.32) compared to agricultural households (US$5.24).
- Very few households purchased a food item that they also produced over the past one week. This does not imply households only purchase or produce all food items, just that within one particular food item category, they are likely to consume the majority of their food from either purchases or self-production over a one week period, but not both.
- Households that produced a particular food item tended to consume a higher mean quantity over the last seven days than households that purchased the food item. Two exceptions were rice and fresh milk. Households that purchased rice consumed more (17kg) than households that produced rice (5.9kg), and households that purchased fresh milk consumed more (3L) than households that produced fresh milk (1.7L).
- The Central zone had the lowest mean total weekly value of consumption at US$20.77 compared to the highest mean of US$34.20 in the Southern zone.
- The mean per capita value of weekly consumption for the Southern zone was only US$5.34, compared to the highest mean per capita value of US$6.63 in the Eastern zone. The Central zone still had the lowest per capita value of consumption at US$4.40.
- Across the majority of administrative zones and food groups, the weekly value of consumption is higher for households that produced the food group compared to households that purchased the food group.[15]

SECTION H: Nutrition

- Stunting (low height for age) was the most prevalent indicator of malnutrition, with 43% of the under-five population categorized in the moderate to severe range.
- Less than 17% children under the age of five were reported to be underweight (low weight for age).
- Boys under the age of five were more likely to experience stunting and be underweight than girls in this age group.
- A higher proportion of children in female-headed households experienced stunting (46% versus 42% in male-headed households) and were underweight (19% versus 16% in male-headed households).
- Children under the age of five in agricultural households were more likely to experience stunting and be underweight than children in non-agricultural households in the same age group.
- The proportion of under-five children suffering malnutrition differed by zone, with the proportion of stunted children ranging from 31% in Zanzibar to 52% in the Southern Highlands.

[15] Note: shadow prices were used to calculate the value of all food groups that were produced.

Appendix D Tanzanian Ministry of Agriculture Farming Systems

The farming systems below are those outlined by the Ministry of Agriculture of Tanzania.[16] Bolded and underlined regions shown below are those regions visited by EPAR in the summer of 2011. The first three farming systems are the subject of EPAR Farming Profile briefs # 172-174.

(1) Banana/Coffee/Horticulture System

Locations: Kagera, **Kilimanjaro,** **Arusha**, Kigoma and Mbeya regions

- Focus on tree crops
- Intensive land use
- Volcanic soils with high fertility
- Land is scarce

(2) Maize/Legume System

Locations: Rukwa, Ruvuma, Arusha, Kagera, **Shinyanga**, **Iringa**, Mbeya, Kigoma, Tabora, Tanga, Morogoro, Kahama, Biharamulo

- Land is not scarce
- Shifting cultivation
- Maize & legumes, beans & groundnuts intercropped, Arabic coffee

(3) Cashew/Coconut/Cassava System

Location: Coast region, eastern Lindi and Mtwara, **Zanzibar**

- Low rainfall
- Low soil fertility
- Cassava, coconut and cashew
- Land is not scarce
- Shifting cultivation

(4) **Sorghum/Bulrush millet/Livestock System**

Location: Sukumaland, Shinyanga and rural Mwanza

- Sorghum, millet, maize and cotton, oilseeds and rice
- Intense population pressure
- Declining soil fertility

(5) Cotton/Maize System

Location: Mwanza, Shinyanga Kagera, Mara, Singida, Tabora and Kigoma, Morogoro, Coast, Mbeya, Tanga, Kilimanjaro and Arusha.

- Cotton, sweet potatoes, maize, sorghum and groundnuts
- Intensive cultivation
- Livestock kept

(6) Horticulture based System

Location: Lushoto district, Tanga region, **Morogoro rural** in Morogoro Region and **Iringa rural** in Iringa region

[16] http://www.tanzania.go.tz/agriculture.html

- Vegetables (cabbages, tomatoes, sweet pepper, cauliflower lettuce and indigenous vegetables) and fruits (pears, apples, plums, passion fruits and avocado)
- Maize, coffee, Irish potatoes, tea and beans

(7) Tea/Maize/Pyrethrum System

Location: Njombe and Mufindi districts in Iringa region

- Tea, Maize, Irish potatoes, beans, wheat, pyrethrum, wattle trees and sunflower

(8) Wet – Rice and Irrigated System

Location: River valleys and alluvial plains, Kilombero, Wami Valleys, Kilosa, Lower Kilimanjaro, Ulanga, Kyela, Usangu and Rufiji

(9) Rice/Sugar Cane System

Location: Found in alluvial river valleys

- Rice and sugar cane

(10) Pastoralists and Agropastoralist System

Location: semi-arid areas including Dodoma, Singida, parts of Mara and Arusha; Chunya districts, Mbeya and Igunga district in Tabora

- Deep attachment to livestock and simple cropping system
- Shifting cultivation of sorghum millet
- Moderate population density
- Limited resource base and poor and variable rainfall

Appendix E Comparison of Tanzanian Productivity to other Priority Countries

Annual Land and Labor Productivity for Priority Countries (Constant 2000 US$)

	Uganda	Ethiopia	Tanzania	Ghana	Burkina Faso	Bangladesh	India
Annual Land Productivity, 2008*	775	343	394	1031	216	1765	792
Annual Labor Productivity, 2006**	191.88	187.99	326.19	391.18	180.57	386.00	526.60

* Based on 1995-2008 FAO data for total crop output (Total Production, Constant 2000 US$) and total arable land (Hectares) as of February 24, 2011.

**Based on 1995-2008 WDI data for agriculture value added per worker (Constant 2000 US$) as of February 24, 2011. Value added measures the output of the agricultural sector less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production. Data are in constant 2000 U.S. dollars. Blanks indicate no data available in this date range.

Average Yield of Major Crops in Priority Countries (2005-2009)

	Uganda	Ethiopia	Tanzania	Ghana	Burkina Faso	Bangladesh	India
Crops *(tonnes/hectare)*							
Beans, dry	0.51	0.96	0.70			0.78	0.37
Cassava	13.13		9.36	13.01	2.16		32.55
Cow peas, dry	1.04		0.40		0.47		
Groundnuts, with shell	0.70	1.16	0.72	1.14	0.70	1.37	1.12
Maize	1.49	2.20	1.14	1.61	1.65	5.72	2.12
Millet	1.69	1.22	0.82	0.98	0.86	0.68	0.92
Rice, paddy	1.37	1.85	1.79	2.16	2.17	3.91	3.20
Sorghum	1.48	1.55	0.96	1.05	1.03	1.45	0.90
Sweet potatoes	4.50	7.82	2.73	1.39	9.71	9.28	8.83
Livestock *(kilos/animal)*							
Cattle meat	149.9	108.4	107.6	125.0	110	70.22	102.7
Cow milk, whole	350	214.6	173.5	130	110	205.0	1139
Poultry Meat	1.3	0.8	0.91	0.98	0.8	0.70	0.9
Goat Meat	12	8.5	12	13.08	8.1	6.96	10

Note: Based on 2005-2009 FAO Data as of February 24, 2011. Average yield estimates are the unweighted average of country-level annual yields from 2005-2009. Blanks indicate no data available in this date range.