

## Appendix A: Confidential Information, Geospatial Variables

To maintain the confidentiality of our respondents, certain parts of the TZNPS database have not been made publicly available. The confidential variables pertain to (i) names of the respondents to the household and community questionnaires, (ii) village and constituency names, (iii) descriptions of household dwelling and agricultural plot locations, (iv) phone numbers of household members and their reference contacts, (v) GPS-based household and agricultural plot locations, (vi) names of the children of the head/spouse living elsewhere, (vii) names of the deceased household members, (viii) names of individuals listed in the network roster, and (ix) names of field staff.

To increase the use of the TZNPS data, a set of geospatial variables has been provided by using the georeferenced plot and household locations in conjunction with various geospatial databases that were available to the survey team. The table in Appendix A provides the name, type, source, reference period, resolution, description, and source of each variable.

The geovariables are stored in two data files, one at the household-plot-level, and the other at the household-level. The plot-level file, named **Plot.Geovariables**, contains one geospatial variable measuring plot distance to household and the observations are uniquely identified by the combination of **hhid plotnum**. The observations included in this file are rainy season plots that are owned and/or cultivated by the household and that have been visited for GPS-based land area measurement.

The rest of the geovariables are stored in **HH.Geovariables** and the observations are uniquely identified by **hhid**. To partially satisfy the demand for georeferenced household and community locations while preserving the confidentiality of sample household and communities, we have computed the average of household GPS coordinates in each EA, applied a random offset within a specified range to the average EA value (following the MeasureDHS methodology) and provided the off-set EA latitudes and longitudes are part of **EA.Offsets**.

More specifically, the coordinate modification strategy relies on random offset of cluster center-point coordinates (or average of household GPS locations by EA in TZNPS2) within a specified range determined by an urban/rural classification. For urban areas a range of 0-2 km is used. In rural areas, where communities are more dispersed and risk of disclosure may be higher, a range of 0-5 km offset is used. An additional 0-10 km offset for 1% of rural clusters effectively increases the known range for all rural points to 10 km while introducing only a small amount of noise. Offset points are constrained at the district level, so that they still fall within the correct district for spatial joins, or point-in-polygon overlays. The result is a set of coordinates, representative at the EA level, that fall within known limits of accuracy. Users should take into account the offset range when considering different types of spatial analysis or queries with the data. Analysis of the spatial relationships between locations in close proximity would not be reliable. However, spatial queries using medium or low resolution datasets should be minimally affected by the offsets.

All geospatial variables have been produced by using the unmodified GPS data. These include extensive measures of distance, climatology, soil and terrain and other environmental factors.

Time-series on rainfall and vegetation have also been used to describe the survey agricultural season relative to normal conditions. These variables are intended to provide some understanding of how geophysical characteristics vary at the landscape level.

**Table 5: Household Geovisible Description**

Theme	Source	Dataset Title	Variable Name	Variable Type	Reference Period	Resolution	Description	Web
Distance	LSMS-ISA	Plot Distance to Household	<b>dist_hh</b>	Continuous	N/A	N/A	Plot distance to household	
	OpenStreetMaps, TANROADS	Household Distance to Main Road	<b>dist01</b>	Continuous	N/A	N/A	Household distance to nearest trunk road (as defined by TANROADS)	
	City population	Household Distance to Towns	<b>dist02</b>	Continuous	N/A	N/A	Household distance to nearest town of > 20,000 pop	<a href="http://www.citypopulation.de">http://www.citypopulation.de</a>
	USAID FEWSNET	Household Distance to Key Market Centers	<b>dist03</b>	Continuous	N/A	N/A	Household distance to nearest major market (FEWSNET key market centers)	
	Tracks4Africa, roads, borders	Household Distance to Border Posts	<b>dist04</b>	Continuous	N/A	N/A	Household distance to nearest border post on main road	
	World Gazetteer Towns, Statoids	Household Distance to District Headquarters	<b>dist05</b>	Continuous	N/A	N/A	Household distance to the headquarters of the district of residence	<a href="http://www.statoids.com">www.statoids.com</a>

Theme	Source	Dataset Title	Variable Name	Variable Type	Reference Period	Resolution	Description	Web
Climatology	UC Berkeley	WorldClim Bioclimatic Variables	<b>clim01</b>	Continuous	1960-1990	0.008333 dd	Average annual temperature calculated from monthly climatology, multiplied by 10 (°C)	<a href="http://www.worldclim.org/bioclim">http://www.worldclim.org/bioclim</a>
	UC Berkeley	WorldClim Bioclimatic Variables	<b>clim02</b>	Continuous	1960-1990	0.008333 dd	Average temperature of the wettest quarter, from monthly climatology, multiplied by 10. (°C)	<a href="http://www.worldclim.org/bioclim">http://www.worldclim.org/bioclim</a>
	UC Berkeley	WorldClim Bioclimatic Variables	<b>clim03</b>	Continuous	1960-1990	0.008333 dd	Total annual precipitation, from monthly climatology (mm)	<a href="http://www.worldclim.org/bioclim">http://www.worldclim.org/bioclim</a>
	UC Berkeley	WorldClim Bioclimatic Variables	<b>clim04</b>	Continuous	1960-1990	0.008333 dd	Precipitation of wettest month, from monthly climatology (mm)	<a href="http://www.worldclim.org/bioclim">http://www.worldclim.org/bioclim</a>
	UC Berkeley	WorldClim Bioclimatic Variables	<b>clim05</b>	Continuous	1960-1990	0.008333 dd	Precipitation of wettest quarter, from monthly climatology (mm)	<a href="http://www.worldclim.org/bioclim">http://www.worldclim.org/bioclim</a>

Theme	Source	Dataset Title	Variable Name	Variable Type	Reference Period	Resolution	Description	Web
Landscape Typology	ESA and UC Louvain	GlobCover v 2.3	<b>land01</b>	Categorical	2009	0.002778 dd	Majority landcover class within approximately 1km buffer	<a href="http://ionial.esrin.esa.int/">http://ionial.esrin.esa.int/</a>
	ESA and UC Louvain	GlobCover v 2.3	<b>land02</b>	Continuous	2009	0.002778 dd	Percent under agriculture within approx 1 km buffer	<a href="http://ionial.esrin.esa.int/">http://ionial.esrin.esa.int/</a>
	IFPRI	IFPRI standardized AEZ based on elevation, climatology	<b>land03</b>	Categorical		0.008333 dd	Agro-ecological zones created using WorldClim climate data and 0.0833dd resolution LGP data from IIASA.	<a href="http://harvestchoice.org/production/biophysical/agroecology">http://harvestchoice.org/production/biophysical/agroecology</a>

Theme	Source	Dataset Title	Variable Name	Variable Type	Resolution	Description	Web
Soil & Terrain	NASA	SRTM 90m	<b>soil01</b>	Continuous	0.000833 dd	Elevation (m)	<a href="ftp://xftp.jrc.it/pub/srtmV4/arca/sci/">ftp://xftp.jrc.it/pub/srtmV4/arca/sci/</a>
	USGS	Slope (percent)	<b>soil02</b>	Continuous	0.008333 dd	Derived from 90m SRTM	<a href="http://pubs.usgs.gov/of/2007/1188/">http://pubs.usgs.gov/of/2007/1188/</a> , data provided USGS upon request
	AfSIS	Topographic Wetness Index	<b>soil03</b>	Continuous	0.000833 dd	Derived from modified 90m SRTM. Local upslope contributing area and slope are combined to determine the potential wetness index: WI = $\ln(A_s / \tan(b))$ where $A_s$ is flow accumulation or effective drainage area and $b$ is slope gradient.	<a href="http://www.ciesin.columbia.edu/afsis/bafsis_fullmap.htm#">http://www.ciesin.columbia.edu/afsis/bafsis_fullmap.htm#</a>
	LSMS-ISA	Terrain Roughness	<b>soil04</b>	Categorical	0.000833 dd	Derived from 90m SRTM using Meybeck relief classes and 5x5 pixel neighborhood	
	FAO	Harmonized World Soil Database	<b>soil05</b>	Categorical	0.083333 dd	Nutrient availability	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil06</b>	Categorical	0.083333 dd	Nutrient retention capacity	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil07</b>	Categorical	0.083333 dd	Rooting conditions	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil08</b>	Categorical	0.083333 dd	Oxygen availability to roots	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil09</b>	Categorical	0.083333 dd	Excess salts	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil10</b>	Categorical	0.083333 dd	Toxicity	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>
	FAO	Harmonized World Soil Database	<b>soil11</b>	Categorical	0.083333 dd	Workability (constraining field management)	<a href="http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/">http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/</a>

Theme	Source	Dataset Title	Variable Name	Variable Type	Reference Period	Resolution	Description	Web
Crop Season Parameters	NOAA CPC	Rainfall Estimates (RFE)	<b>crops01</b>	Continuous	2001-2009	0.1 dd	Average 12-month total rainfall (mm) for July-June	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops02</b>	Continuous	2001-2009	0.1 dd	Average total rainfall in wettest quarter (mm) within 12-month periods from July-June	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops03</b>	Continuous	2001-2009	0.1 dd	Average start of wettest quarter in dekads 1-36, where first dekad of July =1	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops04</b>	Continuous	2007-2008	0.1 dd	12-month total rainfall (mm) in July-June, starting July 2007	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops05</b>	Continuous	2007-2008	0.1 dd	Total rainfall in wettest quarter (mm) within 12-month periods starting July 2007	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops06</b>	Continuous	2007-2008	0.1 dd	Start of wettest quarter in dekads 1-36, where first dekad of July 2007 =1	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops07</b>	Continuous	2008-2009	0.1 dd	12-month total rainfall (mm) in July-June, starting July 2008	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops08</b>	Continuous	2008-2009	0.1 dd	Total rainfall in wettest quarter (mm) within 12-month periods starting July 2008	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>
	NOAA CPC	Rainfall Estimates (RFE)	<b>crops09</b>	Continuous	2008-2009	0.1 dd	Start of wettest quarter in dekads 1-36, where first dekad of July 2008 =1	<a href="ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/">ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est_dekad/</a>

BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops10</b>	Continuous	2001- 2009	0.004176 dd	Average total change in greenness (integral of daily EVI values) within primary growing season, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops11</b>	Continuous	2001- 2009	0.004176 dd	Average timing of onset of greenness increase in day of year 1-356, where Jul 1 = 1, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops12</b>	Continuous	2001- 2009	0.004176 dd	Average timing of onset of greenness decrease in day of year 1-356, where Jul 1 = 1, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops13</b>	Continuous	2007- 2008	0.004176 dd	Total change in greenness (integral of daily EVI values) within primary growing season for July 2007 - Jun 2008, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops14</b>	Continuous	2007- 2008	0.004176 dd	Onset of greenness increase in day of year 1-356, starting July 1 2007, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops15</b>	Continuous	2007- 2008	0.004176 dd	Onset of greenness decrease in day of year 1-356, starting July 1 2007, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University

BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops16</b>	Continuous	2008- 2009	0.004176 dd	Total change in greenness (integral of daily EVI values) within primary growing season for July 2008 - Jun 2009, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops17</b>	Continuous	2008- 2009	0.004176 dd	Onset of greenness increase in day of year 1-356, starting July 1 2008, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University
BU	MOD12Q2 (DOY 185) Land Cover Dynamics from MODIS	<b>crops18</b>	Continuous	2008- 2009	0.004176 dd	Onset of greenness decrease in day of year 1-356, starting July 1 2008, averaged by district	<a href="ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005">ftp://e4ftl01.cr.usgs.gov/MOTA/MCD12Q2.005</a> , DOY185 version provided upon request from MODIS Land Cover Group at Boston University