CCAFS site atlas

Makueni / Wote
Kenya

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Site Atlas

Correct citation:
Sijmons K., Kiplimo J., Förch W., Thornton P.K., Radeny, M. and Kinyangi, J. (2013). CCAFS Site Atlas – Makueni / Wote. CCAFS site atlas series. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

Titles in this series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

This document is published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) which is a strategic partnership between CGIAR and Future Earth. CCAFS is supported by the CGIAR Fund, the Danish International Development Agency (DANIDA), the Australian Government Overseas Aid Program (AusAid), Irish Aid, Environment Canada, the Ministry of Foreign Affairs for the Netherlands, the Swiss Agency for Development and Cooperation (SDC), Instituto de Investigação Científica Tropical (IICT), UK Aid, the Government of Russia, and the European Union (EU). The Program is carried out with technical support from the International Fund for Agricultural Development (IFAD)

Contact:
CCAFS Coordinating Unit - Faculty of Science, Department of Plant and Environmental Sciences, University of Copenhagen, Rolighedsvej 21, DK-1958 Frederiksberg C, Denmark. Tel: +45 35331046; Email: ccafs@cgiar.org

Contents

Introduction

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) seeks to promote a food-secure world through the provision of science-based efforts that support sustainable agriculture and enhance livelihoods while adapting to climate change and conserving natural resources and environmental services.

Climate change is an unprecedented threat to the food security of hundreds of millions of people who depend on small-scale agriculture for their livelihoods. Climate change affects agriculture and food security, and likewise, agriculture and natural resource management affect the climate system.

CCAFS has initially focused on three regions; East Africa (EA), West Africa (WA) and South Asia (SA) to carry out its research. The 15 CCAFS sites in these areas represent areas that are becoming both drier and wetter, and are focal locations that will generate results that can be applied and adapted to other regions worldwide. In this year, 2013, CCAFS is expanding its portfolio to additional sites in Latin America and South-East Asia.

These sites serve as the initial focus of CCAFS partnership-building and long-term research activities falling within the following CCAFS Research Themes; Adaptation to Progressive Climate Change, Adaptation through Managing Climate Risk, Pro-Poor Climate Change Mitigation and Integration for Decision Making. At all 15 CCAFS sites, baseline surveys have been conducted, including three levels of data collection and analysis at household, village and organizational levels (see: http://ccafs.cgiar.org/resources/baseline-surveys).

More information on CCAFS work in all the three regions can be accessed at www.ccafs.cgiar.org

To better understand the CCAFS sites' characteristics, a list of geospatial indicators for climate variability, bio-physical characteristics and socio-economic variables have been mapped into site atlases.

This Atlas was developed for the CCAFS site at Makueni / Wote in Kenya, in East Africa Region.

CCAFS Sites: East Africa

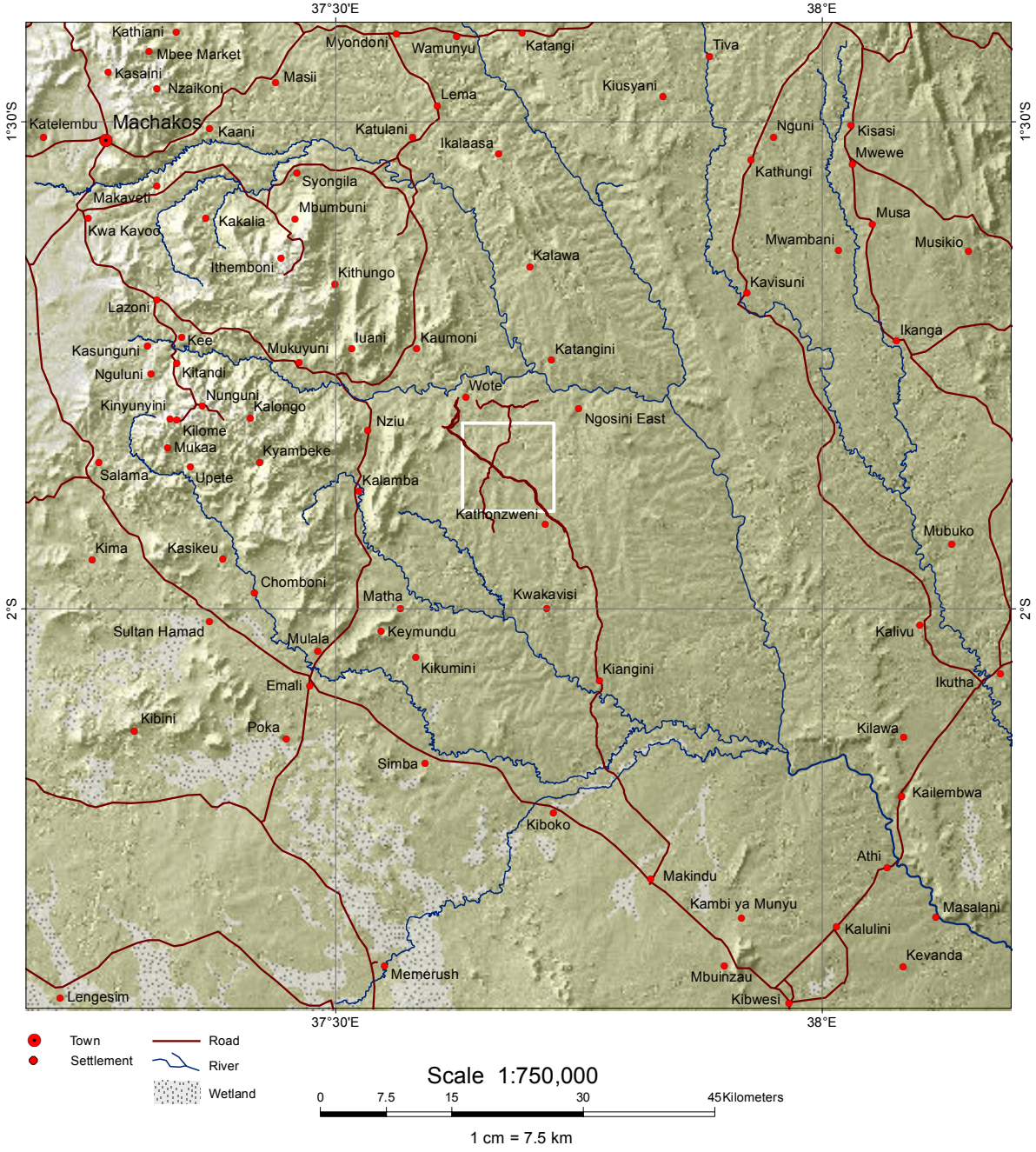
Ethiopia: Borana (ET01)
Kenya: Nyando (KE01)
Kenya: Makueni (KE02)
Uganda: Albertine Rift (UG01)
Uganda: Kagera Basin (UG02)
Tanzania: Usambara (TZ01)

CCAFS Country Sites

Citation: GeoMapa (2013a)

Topography Makueni

CCAFS Site KE02, Makueni / Wote, Kenya



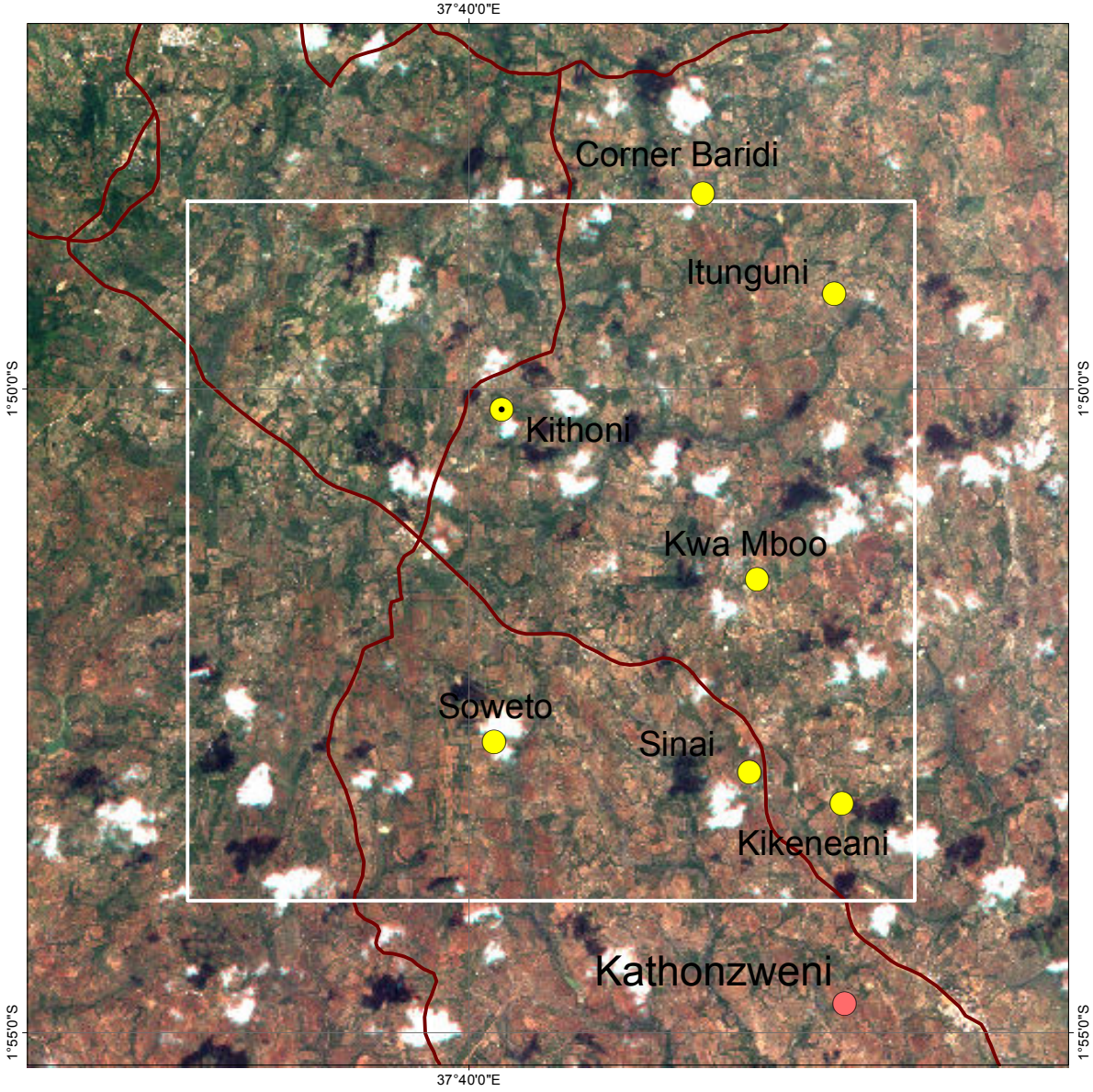
Coordinates of the CCAFS Baseline Sampling Frame

37.724E 1.809S
37.724E 1.900S
37.630E 1.900S
37.630E 1.809S

Sampling frame size: 10km x 10km

Citation: GeoMapa (2013b)

Satellite Image Wote



RapidEye imagery from 24-12-2010 at 5m ground resolution

HBS= Household Baseline Survey

VBS= Village Baseline Survey

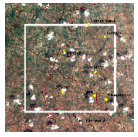
OBS= Organizational Baseline Survey

Road

Settlement

CCAFS VBS/OBS village

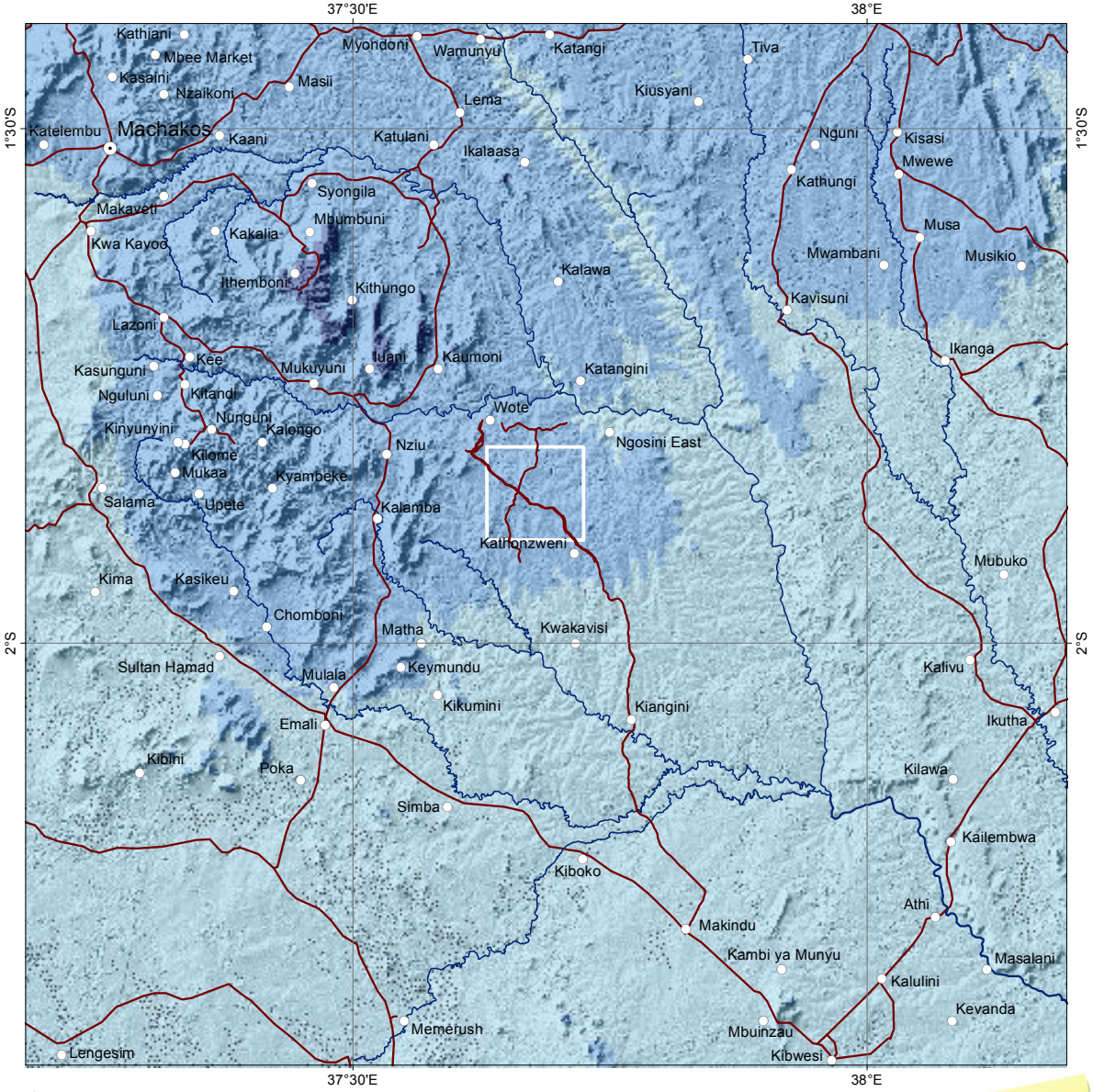
CCAFS HBS villages



CCAFS Baseline Sampling Frame

Citation: RapidEye (2010)

Annual Rainfall

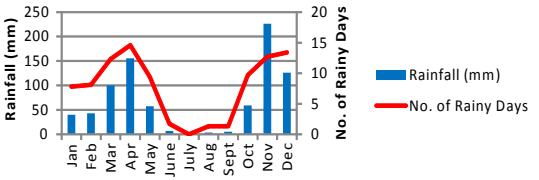


Annual Rainfall data of current interpolations of observed data, representative of 1950 - 2000

Rainfall (mm)

- < = 250
- 250 - 750
- 750 - 1,250
- 1,250 - 1,750
- > = 1,750

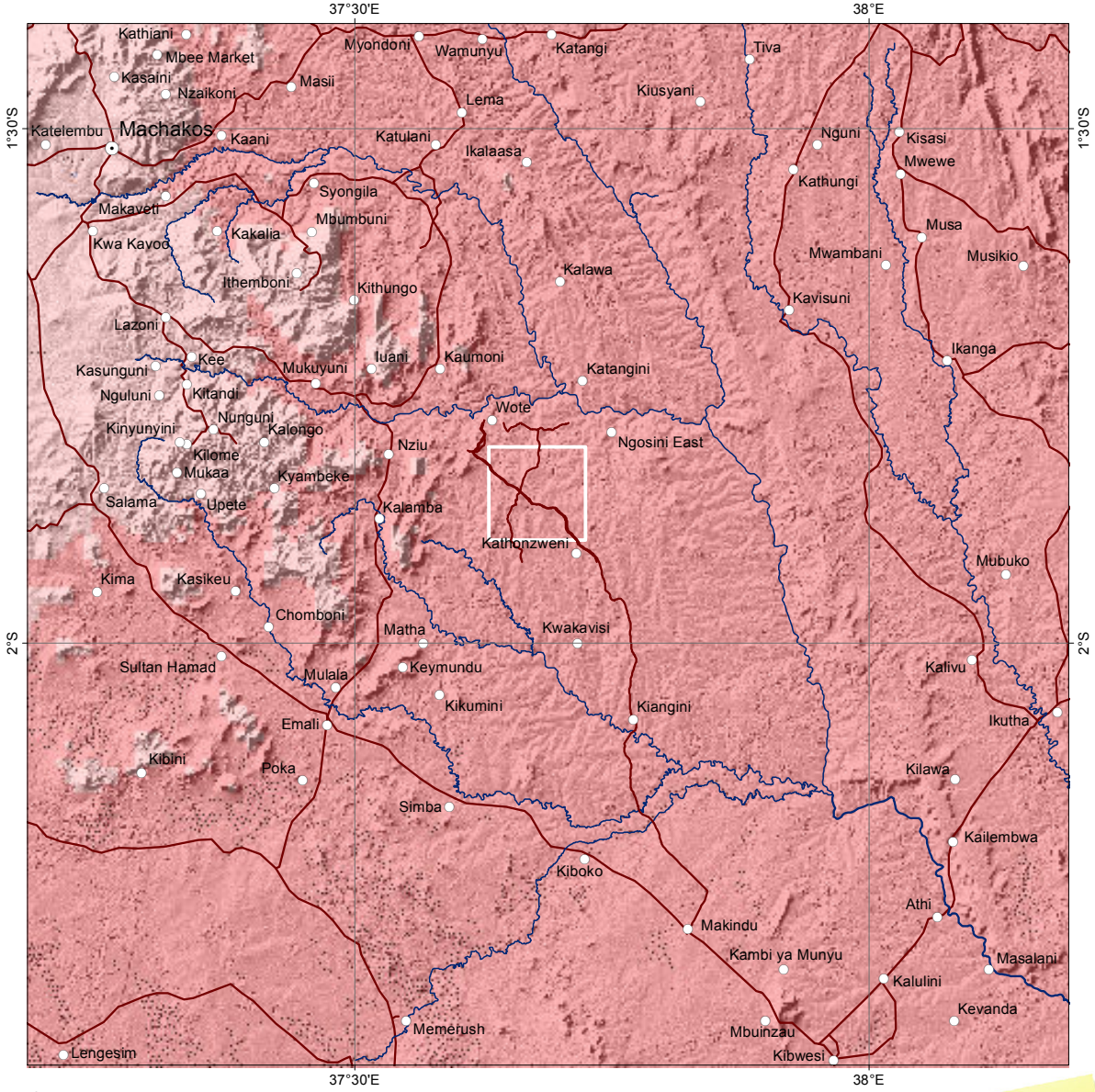
Wote Mean Monthly Rainfall Distribution



Citation: Jones et al (2002)

Citation: Hijmans et al (2005)

Annual Temperature

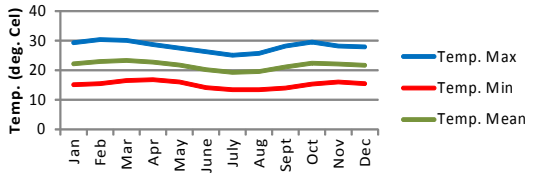


Wote
CCAFS sampling frame

Temperature (°C)

- < = 15
- 15 - 20
- 20 - 25
- 25 - 30
- > = 30

Wote Mean Monthly Temperature Distribution

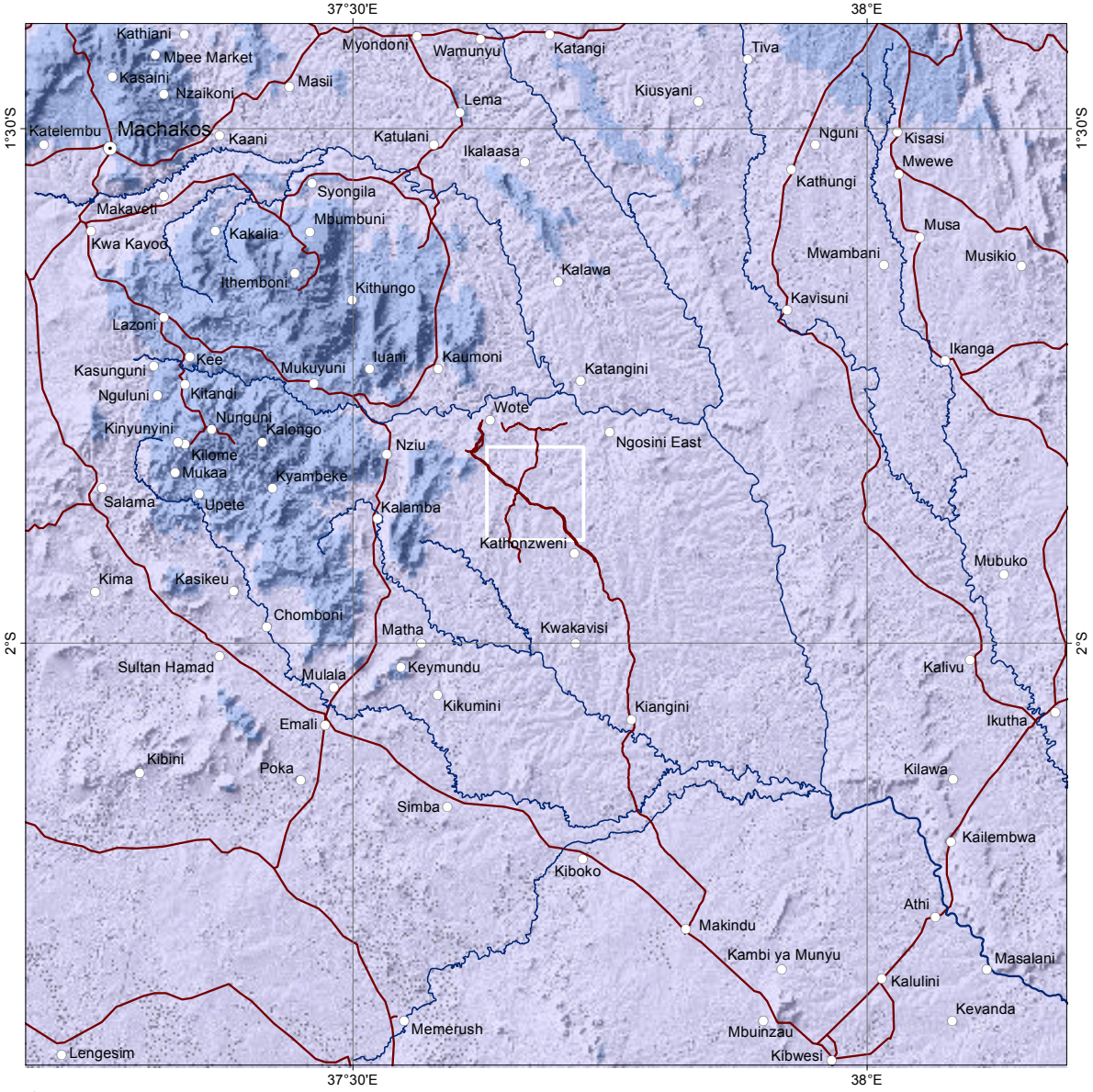


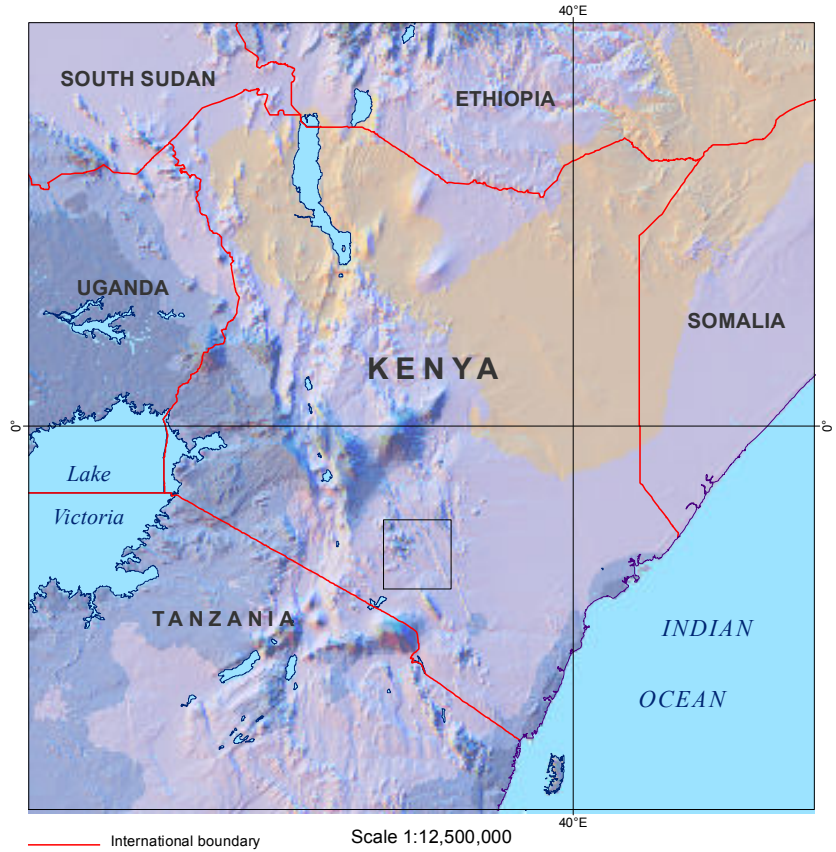
Citation: Jones et al (2002)

Annual Temperature represents annual temperature data of current interpolations of observed data, averaged for 1950 - 2000

Citation: Hijmans et al (2005)

Aridity Index





Aridity Index

- Hyper Arid
- Arid
- Semi Arid
- Dry sub-humid
- Humid

Aridity Index indicates the level of dryness, taking evapotranspiration into account, at a given location of known rainfall

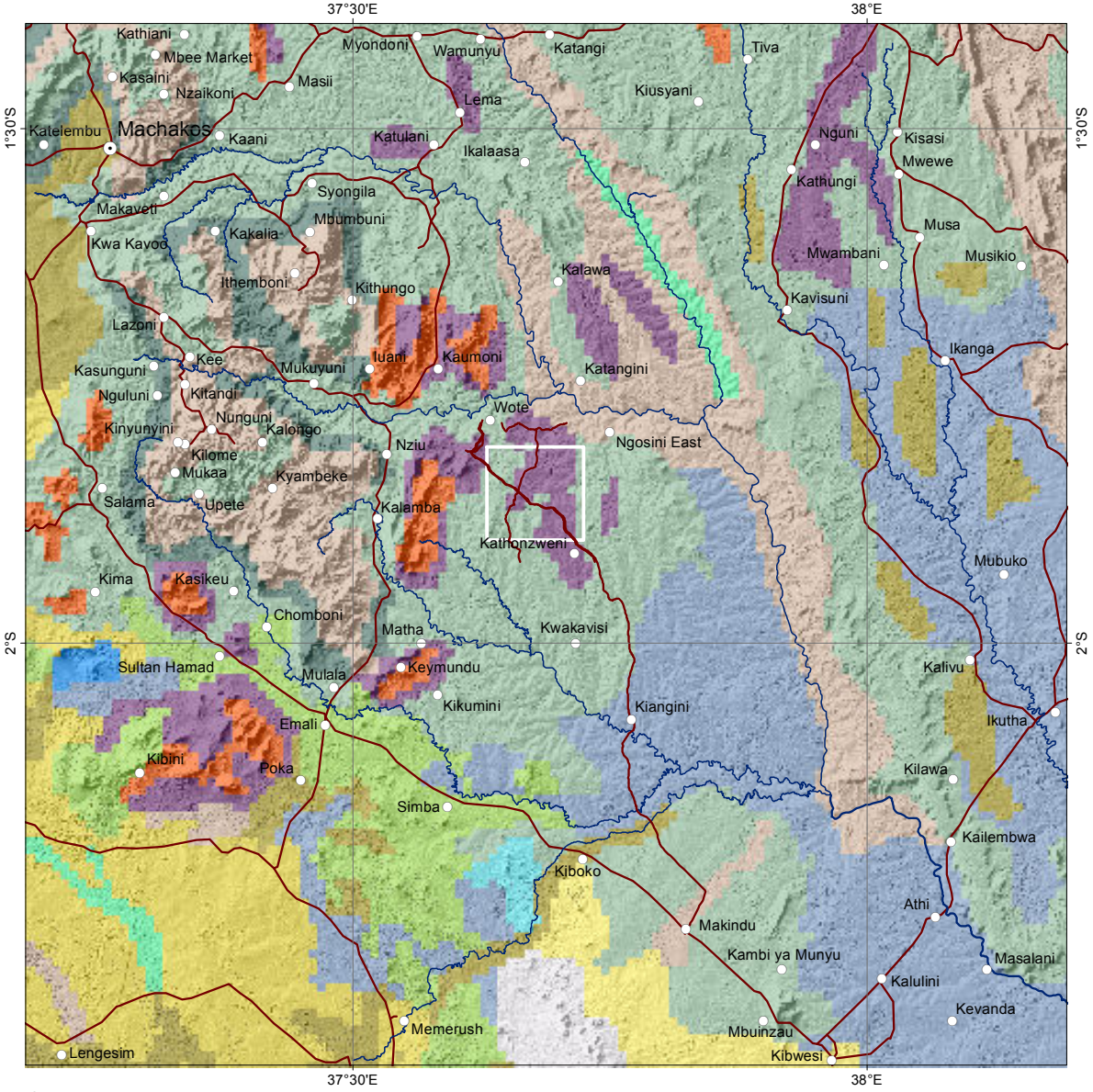
Citation: Trabucco et al (2009)

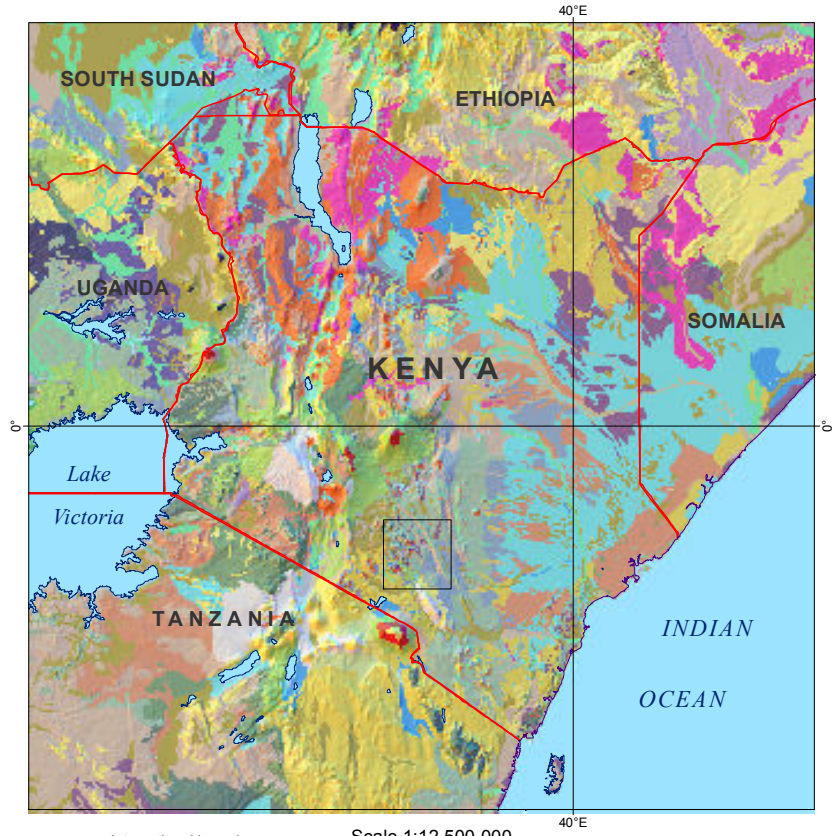
Altitude

Altitude indicates the height above sea level in meters

Citation: Jarvis et al (2008)

Soil Type





Soil Type *

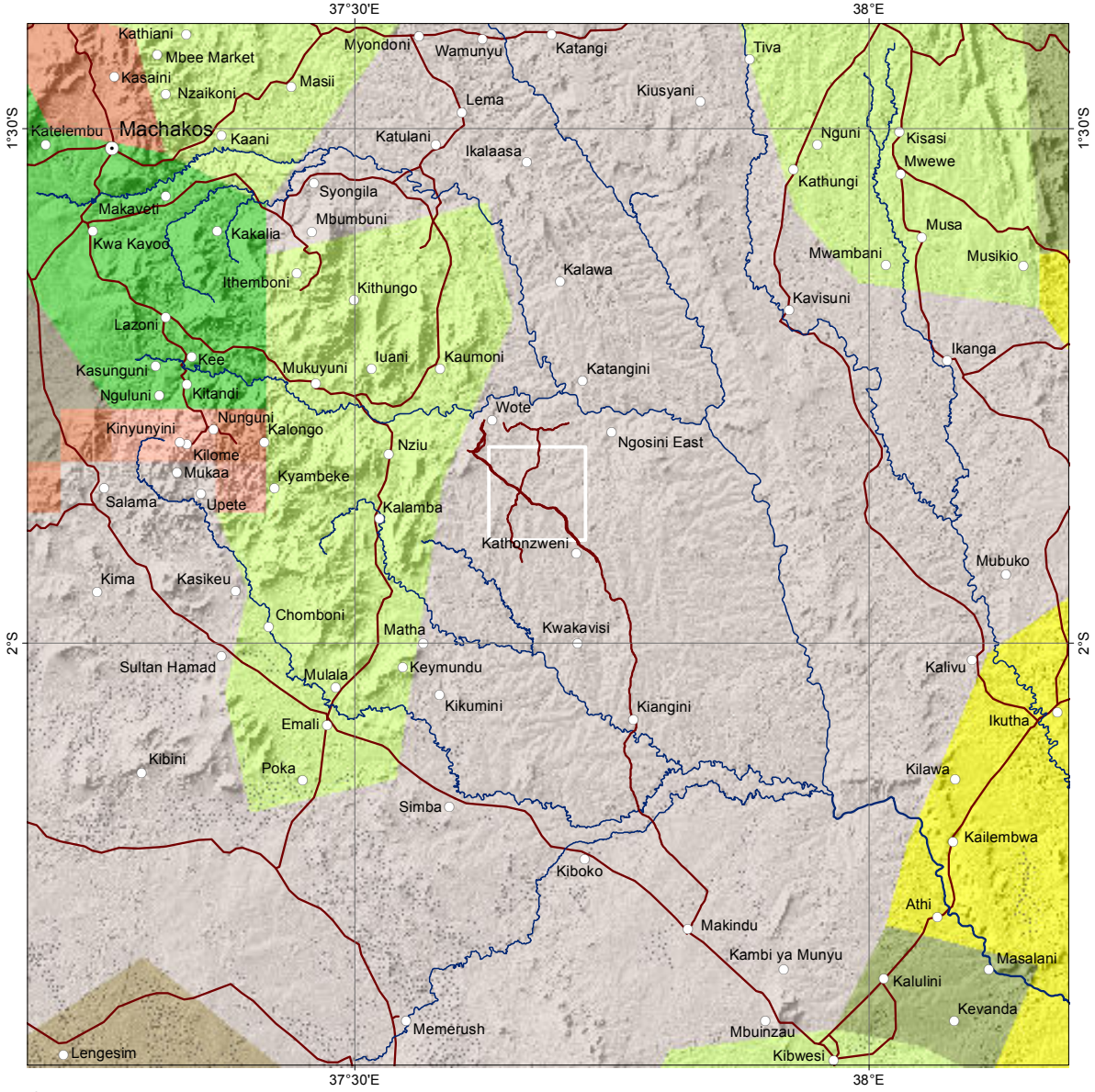
Acrisols	Lixisols
Andosols	Luvisols
Arenosols	Nitisols
Cambisols	Regosols
Ferralsols	Solonchaks
Fluvisols	Solonetz
Leptosols	Vertisols

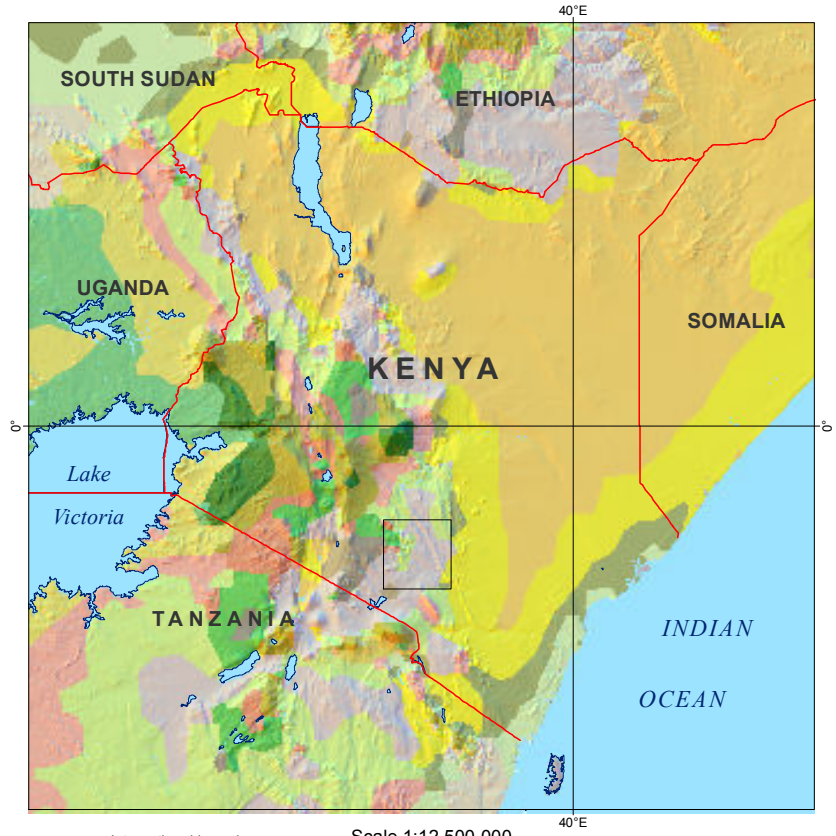
* Legend corresponds to left map

Soil Type refers to the soil group as per the FAO classification. Soil groups are defined by their parent material and morphogenetic characteristics in terms of structural properties and texture (sand, silt and clay content), as well as organic matter content.

Citation: FAO et al (2009)

Agro-Ecological Zones





Agro-Ecological Zones *

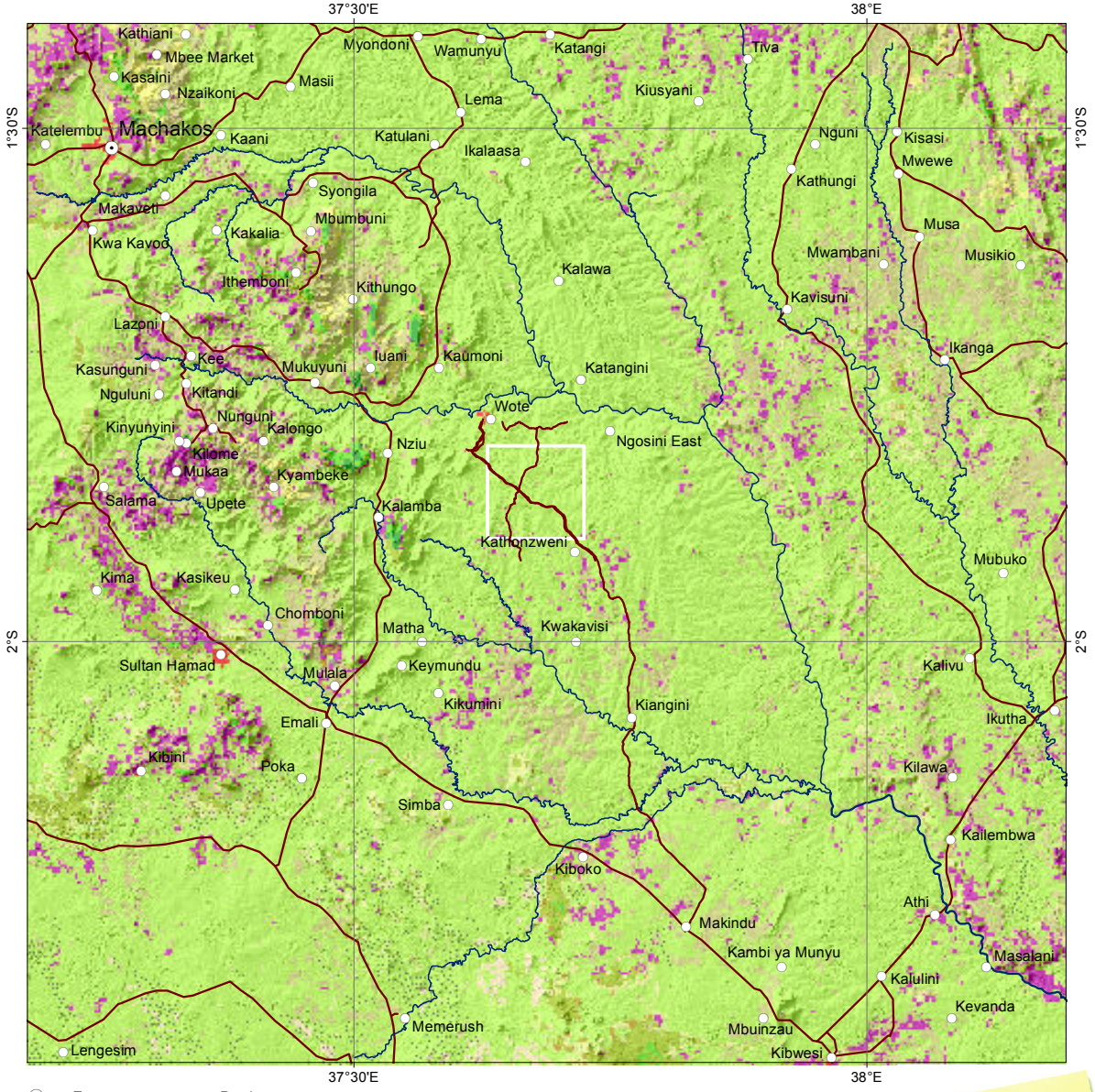
- Northern Guinea Savanna
- High Altitude Northern Guinea Savanna
- High Altitude Southern Guinea Sananna
- High Altitude Semi-Arid
- Mid Altitude Northern Guinea Savanna
- Mid Altitude Southern Guinea Savanna
- Mid Altitude Semi-Arid
- Semi-arid/Sudan Savanna

* Legend corresponds to left map

Agro-Ecological Zones indicate the division of land areas that have similar characteristics related to land suitability, potential agricultural production and environmental impact.

Citation: FAO (2008)

Landcover



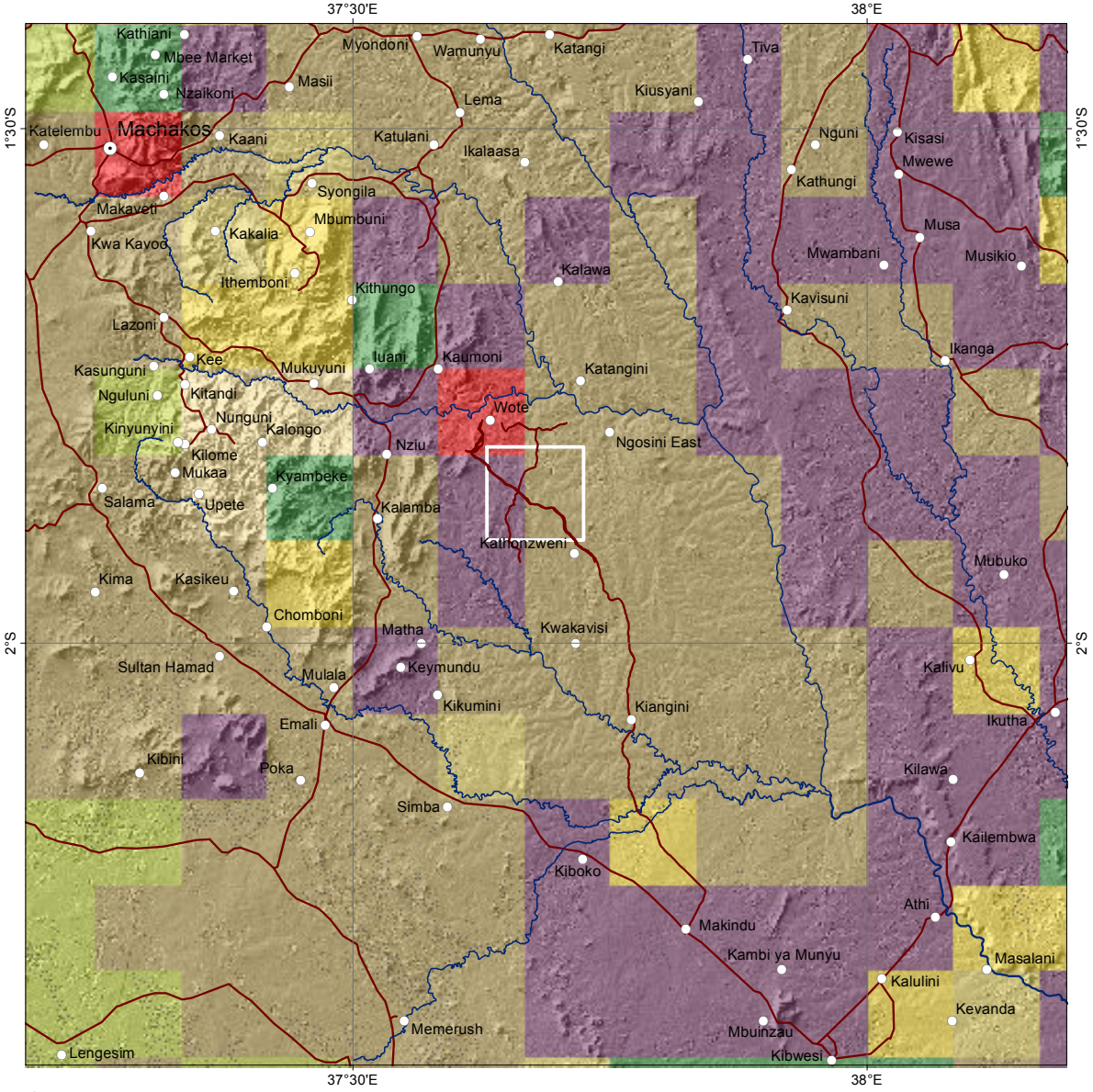
Landcover

- Rainfed croplands
- Mosaic Vegetation/Croplands
- Closed broadleaved deciduous forest
- Open broadleaved deciduous forest
- Open needleleaved deciduous or evergreen forest
- Closed to open broadleaved evergreen or semi-deciduous forest
- Closed to open mixed broadleaved, needleleaved forest
- Sparse vegetation
- Closed to open shrubland
- Closed to open grassland
- Mosaic Forest-Shrubland/Grassland
- Mosaic Grassland/Forest-Shrubland
- Urban area

Landcover shows the observed (bio)physical cover of the earth's surface, i.e. dominant vegetation, land use and man-made features.

Citation: Arino et al (2009)

Landuse



Wote
CCAFS sampling frame

International boundary

Corresponds to the map on the left

Scale 1:12,500,000
0 125 250 500 Kilometers

Landuse *

- Grasslands - high livestock density
- Crops and high livestock density
- Forest with moderate or higher livestock density
- Shrubs high livestock density
- Shrubs moderate livestock density
- Grasslands - unmanaged
- Grasslands - moderate livestock density
- Urban area

* Legend corresponds to left map

Landuse is a description of how people utilize the land.It involves socio-economic activity, i.e. the management and modification of the natural environment into built environment,such as agricultural fields and settlements. At any place, theremay be multiple land uses, the dominant one is presented here.

Citation: Natchtergaele et al (2010)

Length of Growing Period 2000

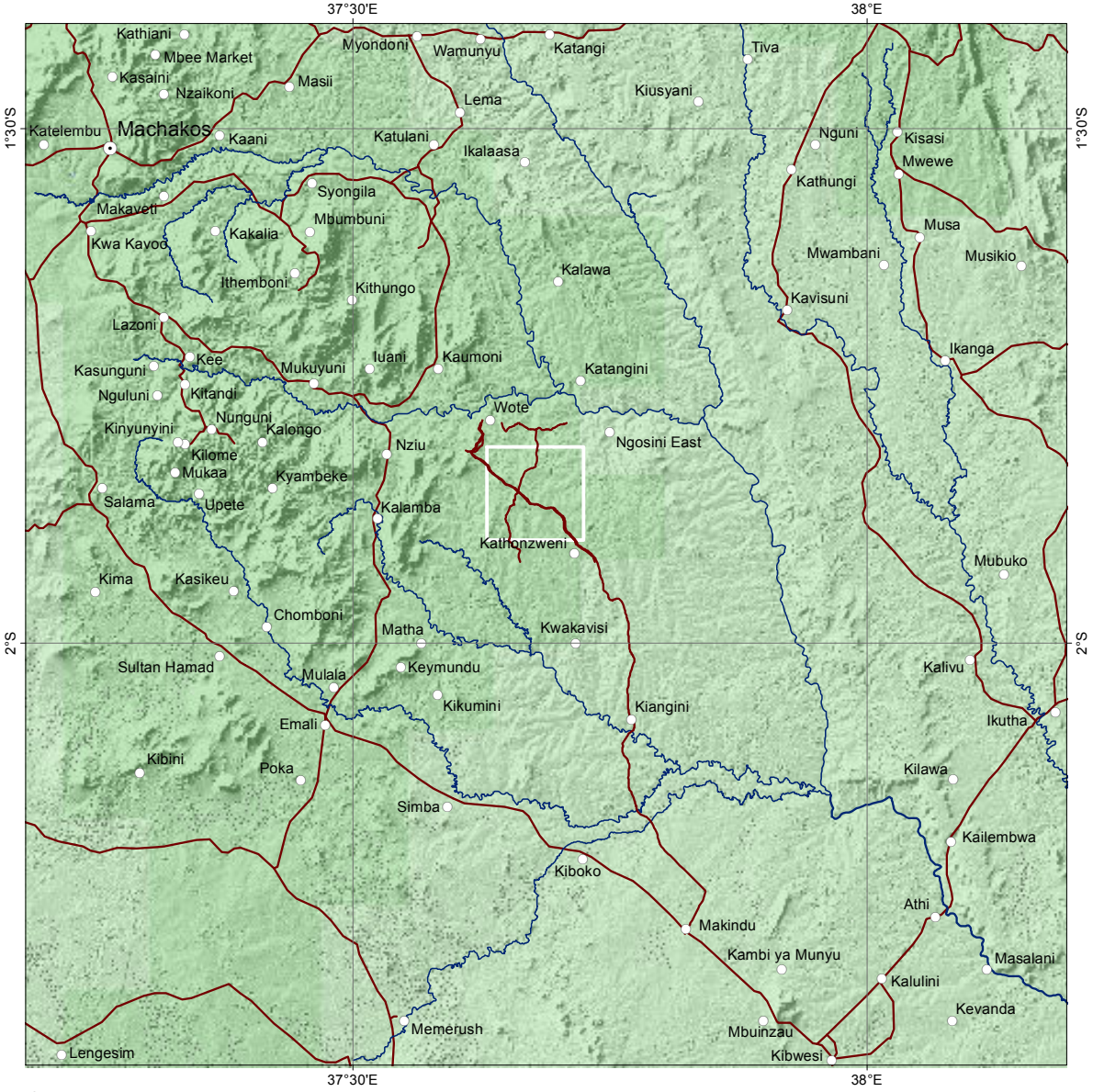
Length of Growing Period (Days)

- < = 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

The Length of Growing Period (LGP) is defined as the number of days in a year during which there is available rainfed soil moisture supply for plant growth.

Citation: Thornton et al (2006)

Length of Growing Period 2030



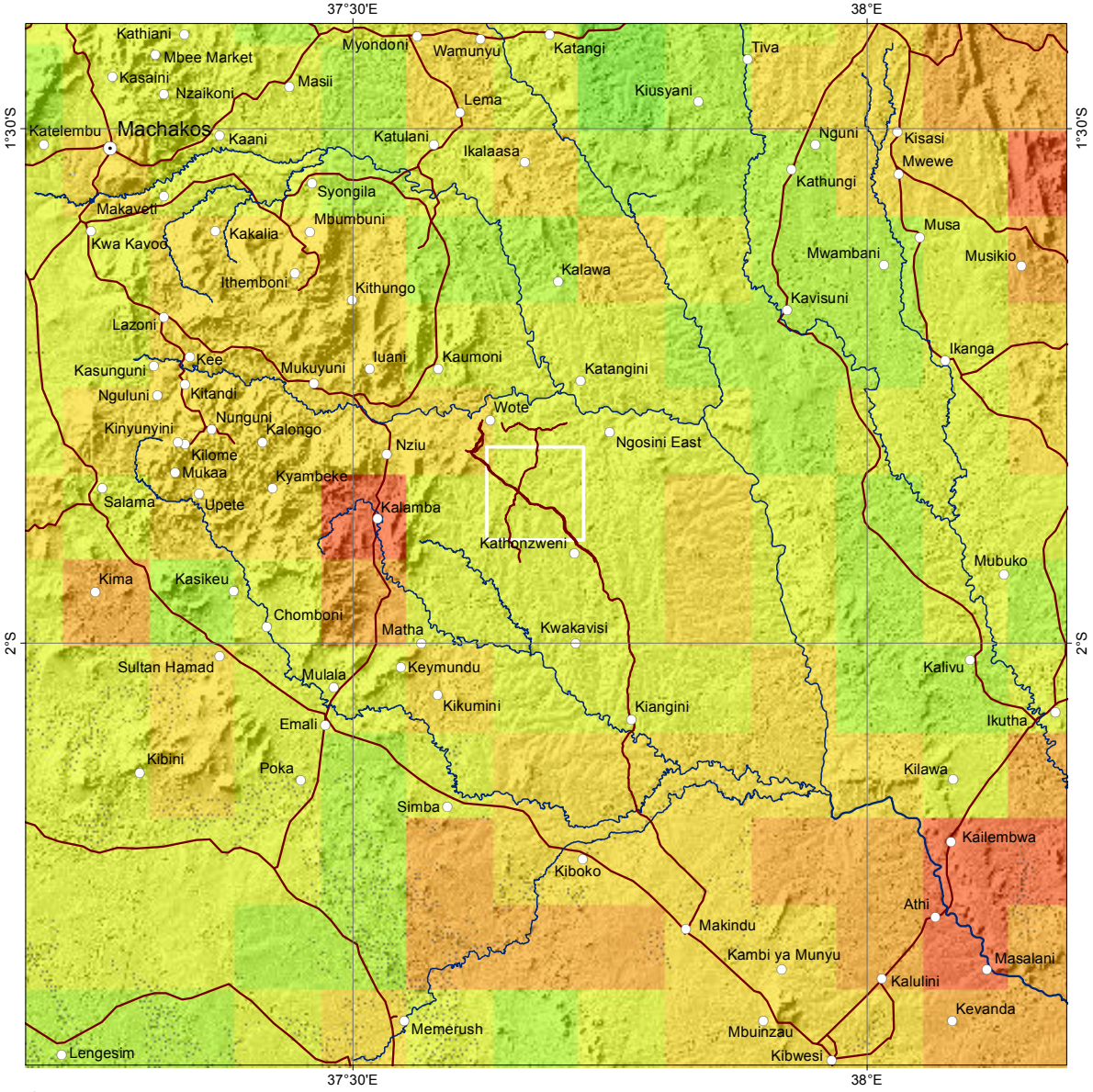
Length of Growing Period (Days)

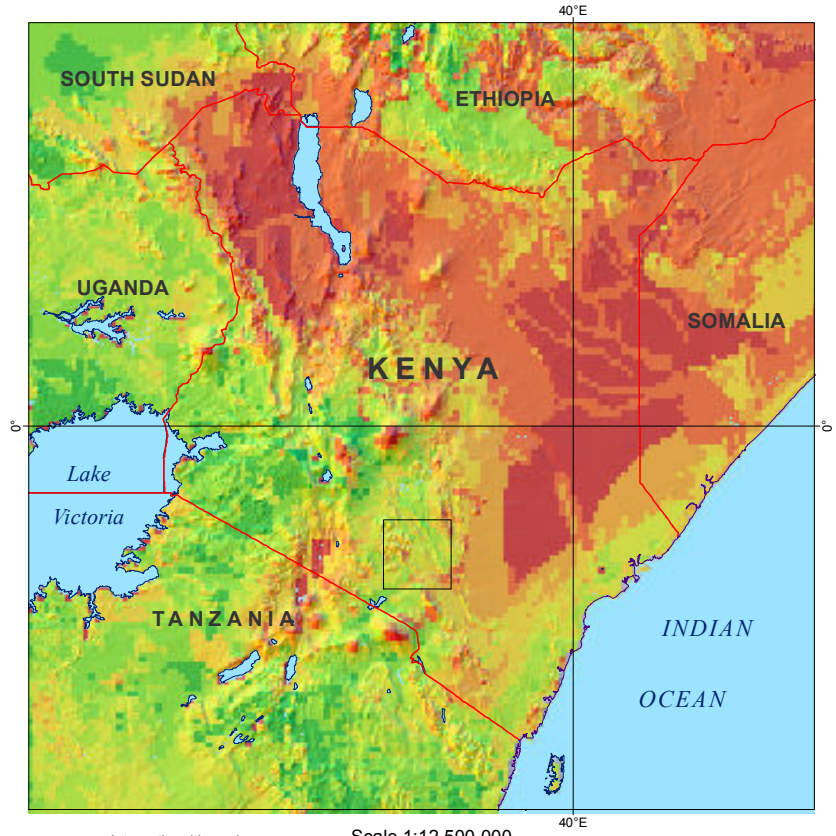
- < = 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

The Length of Growing Period (LGP) is defined as the number of days in a year during which there is available rainfed soil moisture supply for plant growth; here modeled for 2030.

Citation: Thornton et al (2006)

Crop Suitability

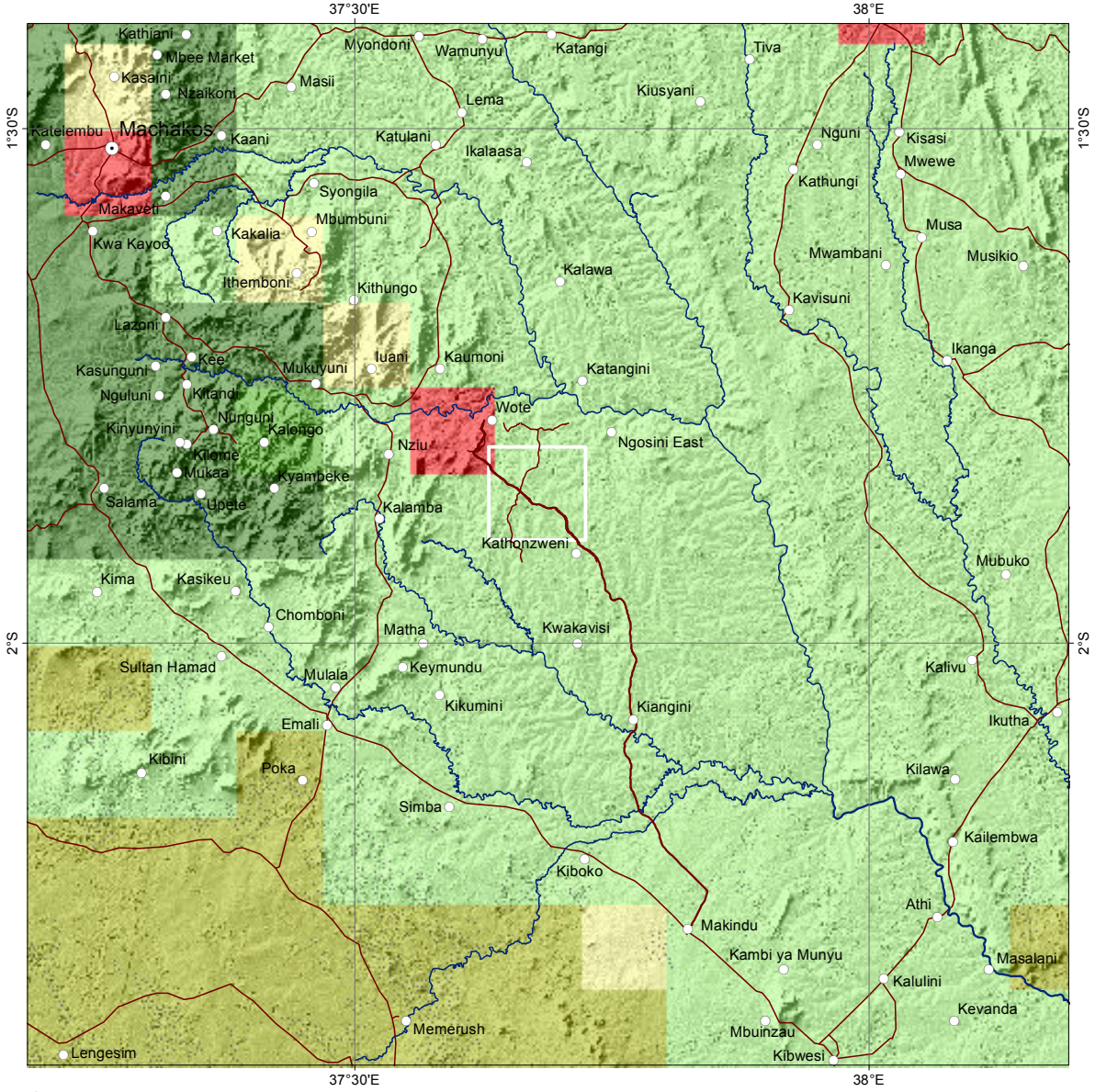




Crop Suitability refers to the land resource assessment that considers agricultural land use options with relevant agro-ecological condition to estimate expected cropping activities.

Citation: FAO and IIASA (2007)

Livestock Production Systems



Mixed Rainfed
- Arid / Semi-arid
- Humid / sub-humid
- Temperate / highland

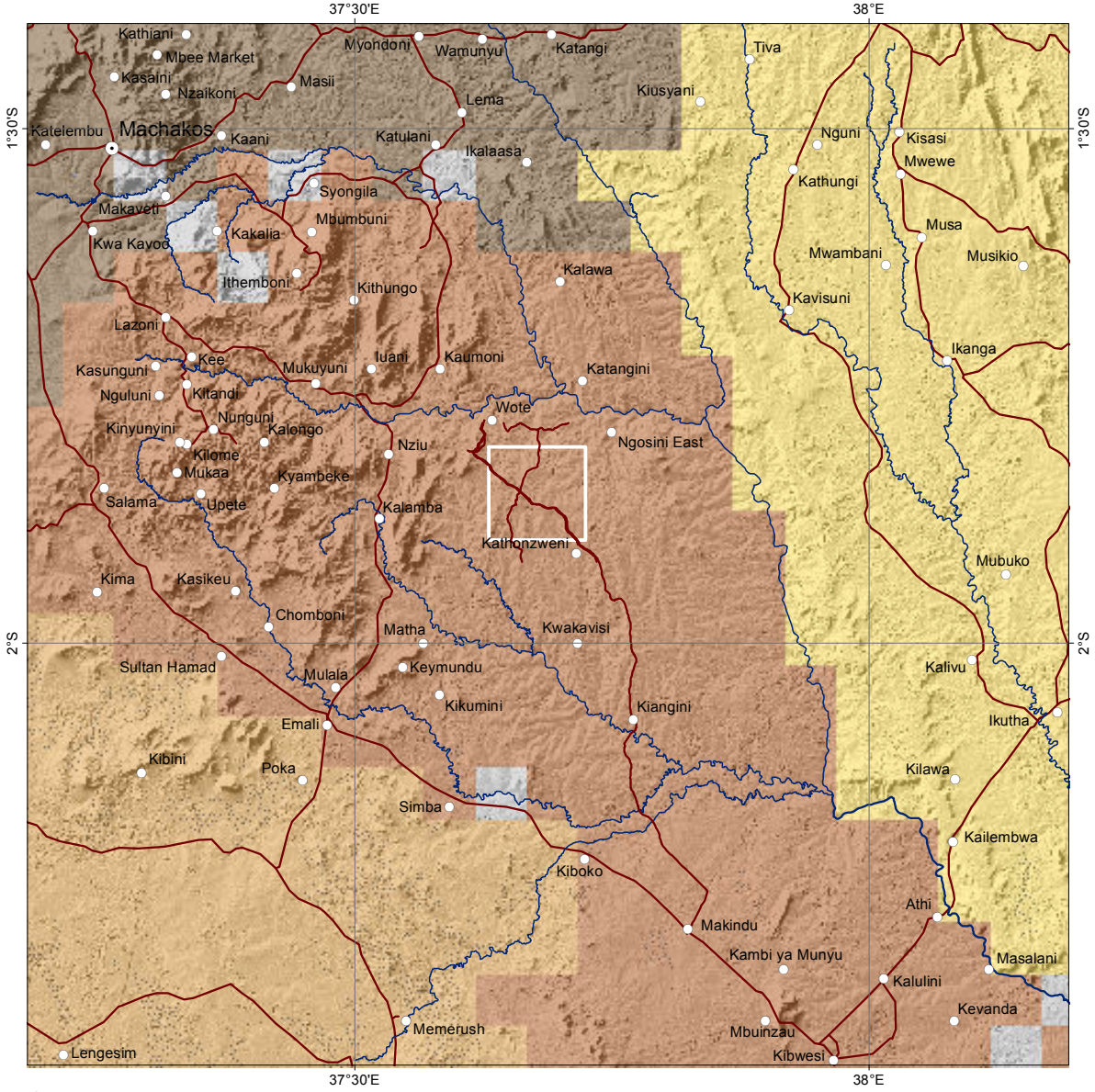
Mixed Irrigated
- Arid / semi-arid
- Humid / sub-humid
- Temperate / highland

Livestock only
- Arid /semi-arid
- Temperate / highland
- Closed to open shrubland
- Urban area
- Other

Livestock Production Systems as part of agricultural systems take agro-climatic conditions into account and are classified in terms of feed and livestock resources; livestock commodities produced; production technology; product use and livestock functions; area covered; geographic locations; and human populations supported.

Citation: FAO (2007)

Livestock Density



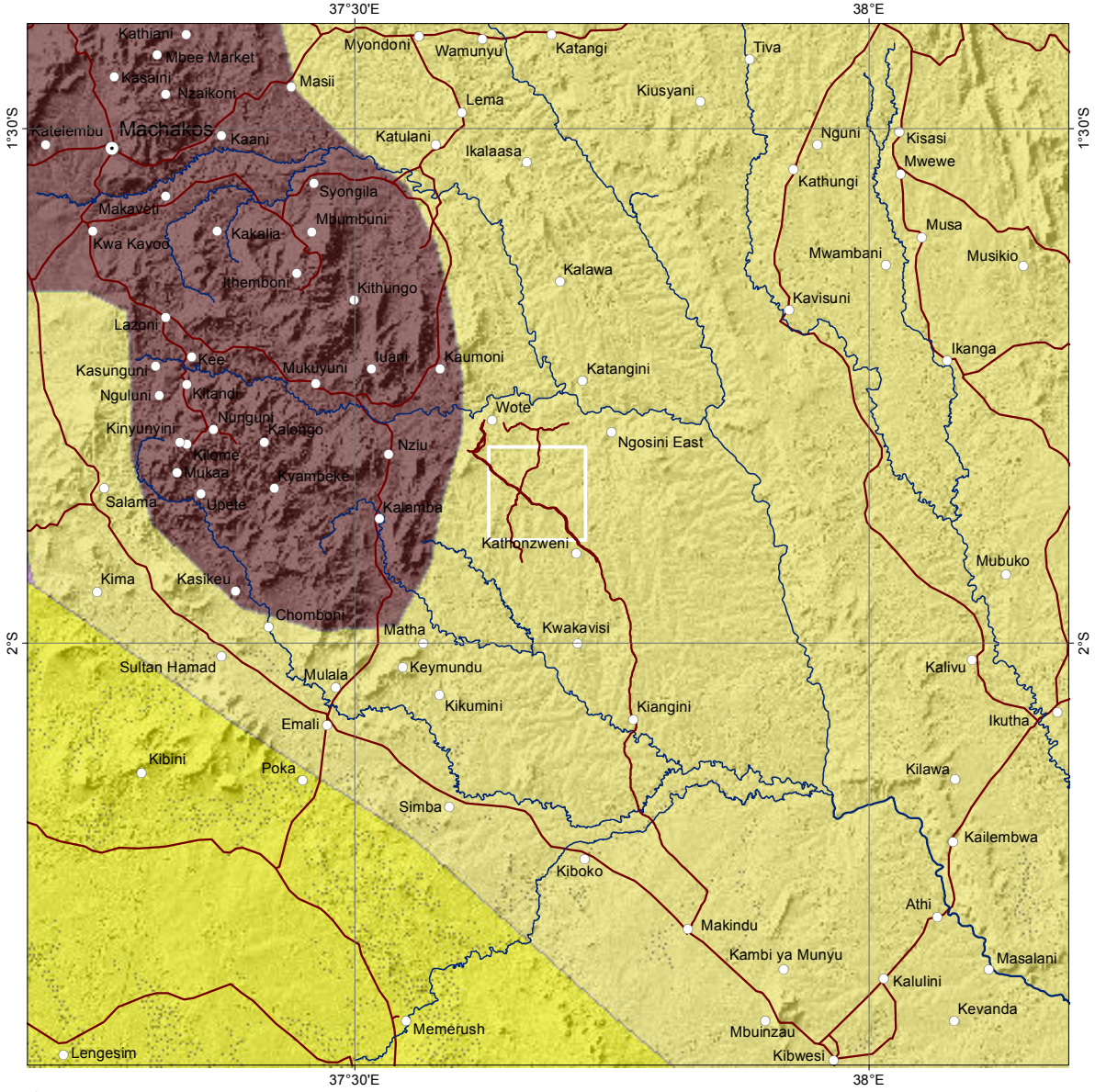
Number per km²

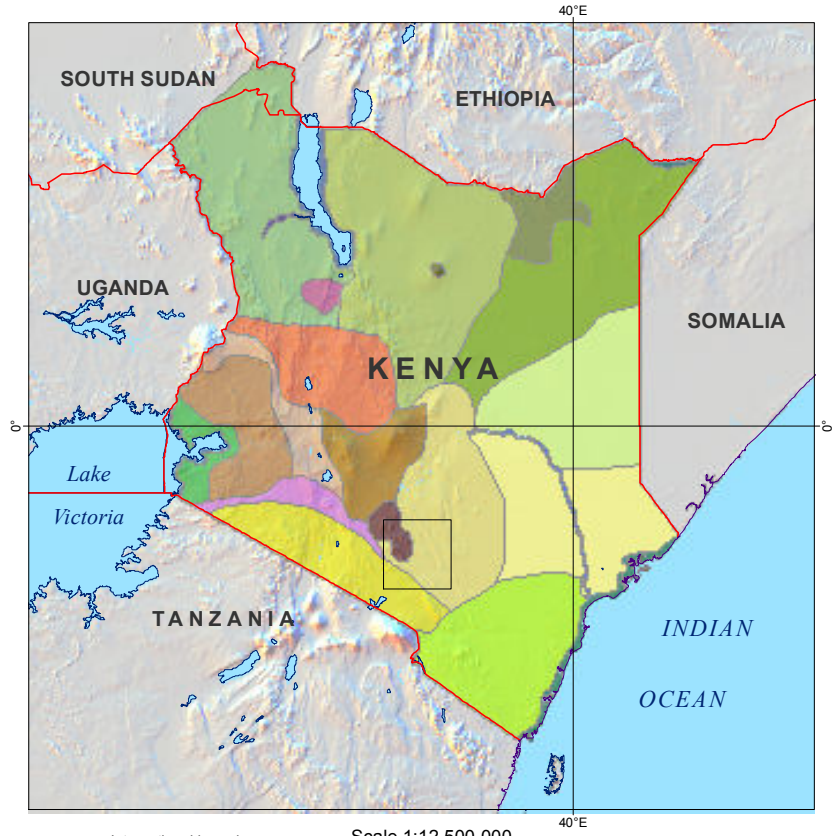
- No Observations
- <= 5
- 5 - 10
- 10 - 15
- 15 - 20
- >= 20

Livestock Density is measured in numbers of livestock, including cattle, goats and sheep, per km²

Citation: Wint et al (2007)

Livelihood Zones





Livelihood Zones *

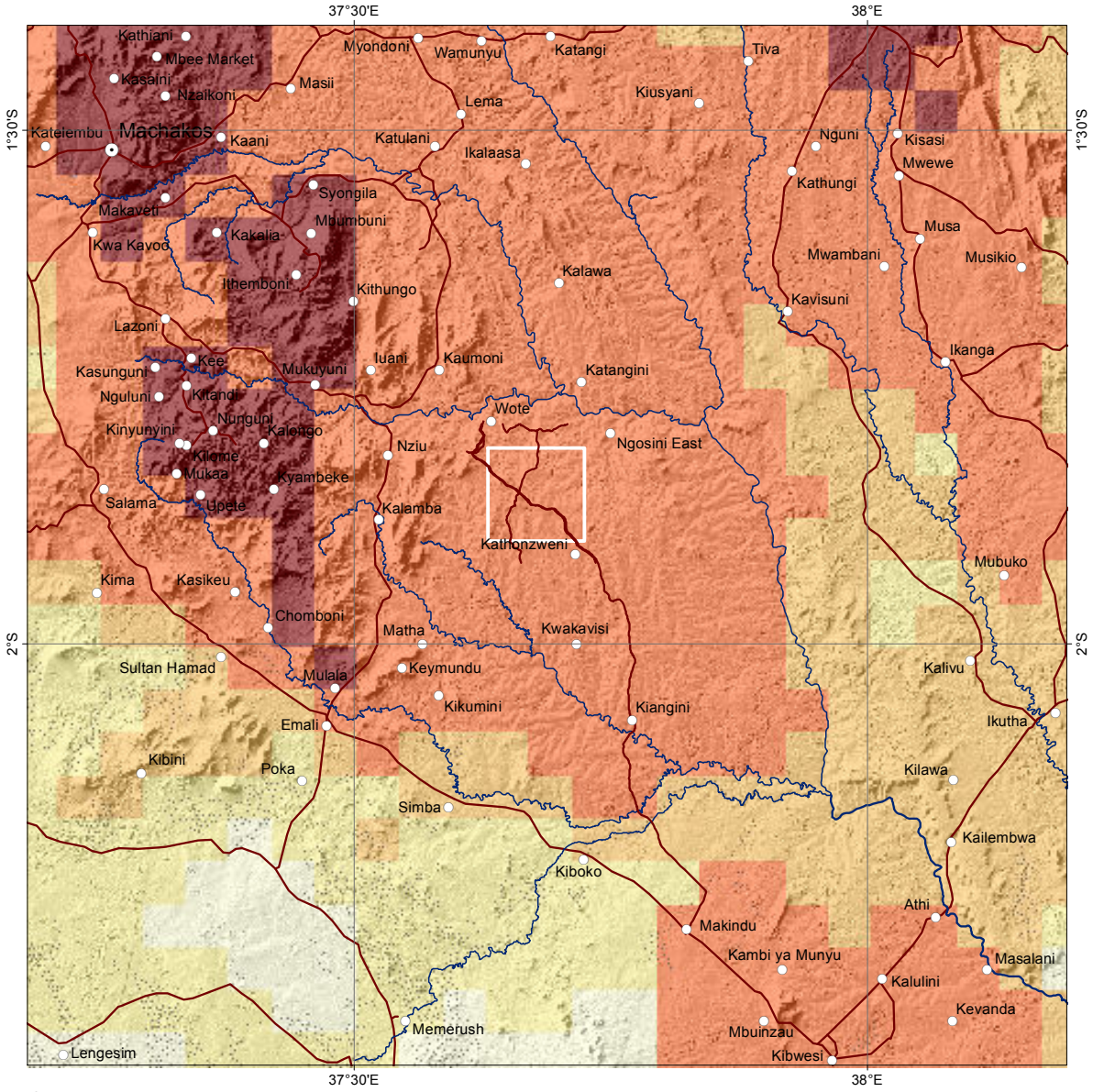
- Southeastern Medium Potential, Mixed Farming Zone
- Southeastern Marginal Mixed Farming Zone
- Southern Pastoral Zone

* Legend corresponds to left map

Livelihoods are complex and shaped by a variety of factors. These livelihood zone maps delineate geographic areas within which people broadly share the same livelihood patterns including access to food, income, and markets.

Citation: USAID (2011)

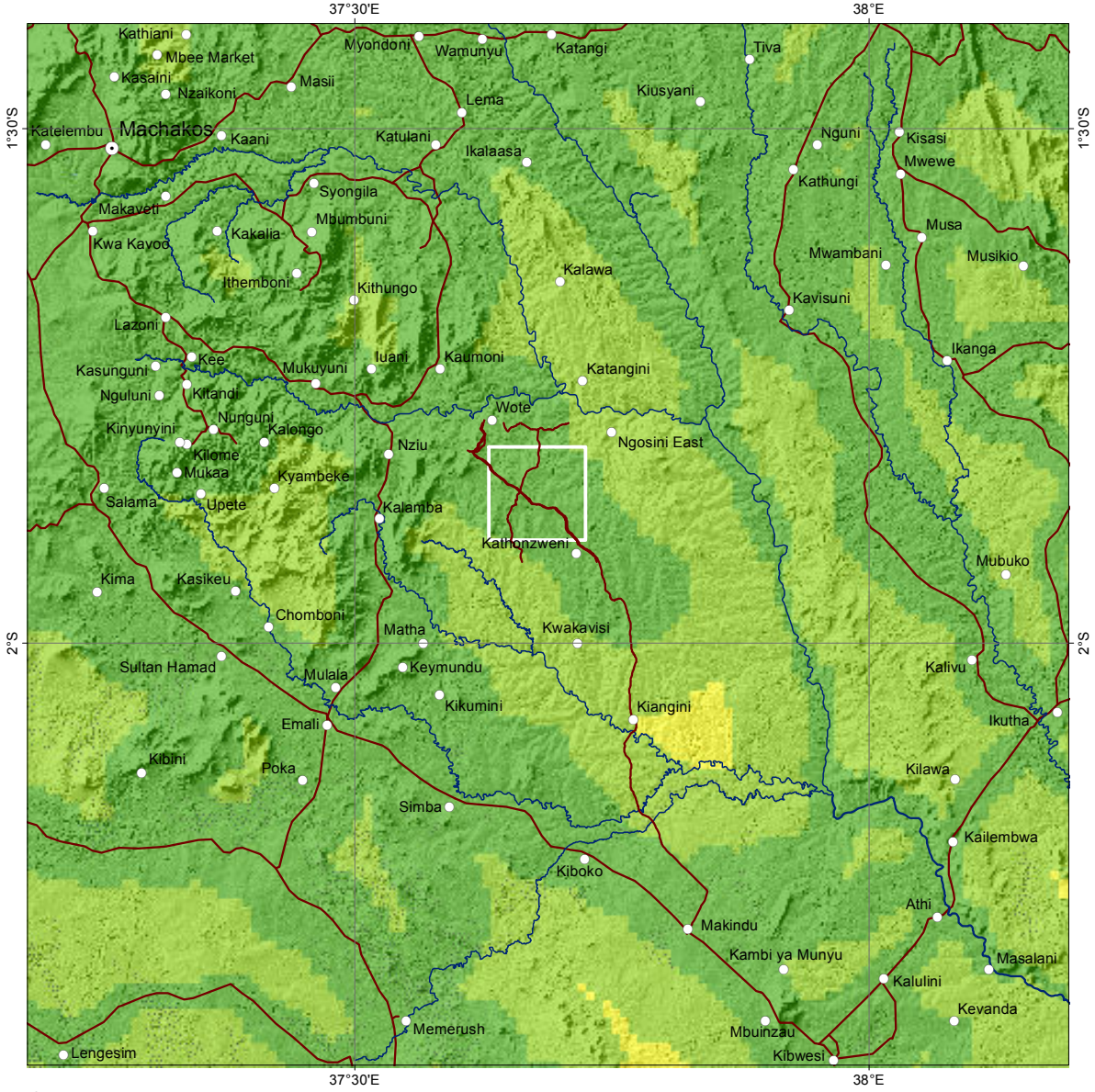
Human Population Density

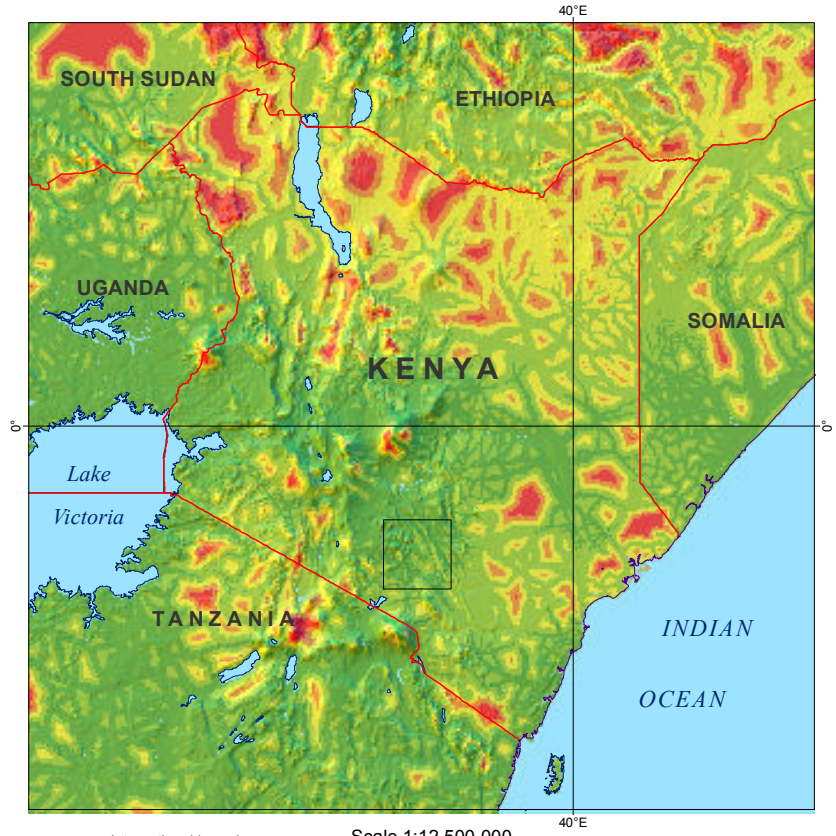


Human Population Density is the gridded number of persons per km² in 2005.

Citation: CIESIN (2005)

Market Access

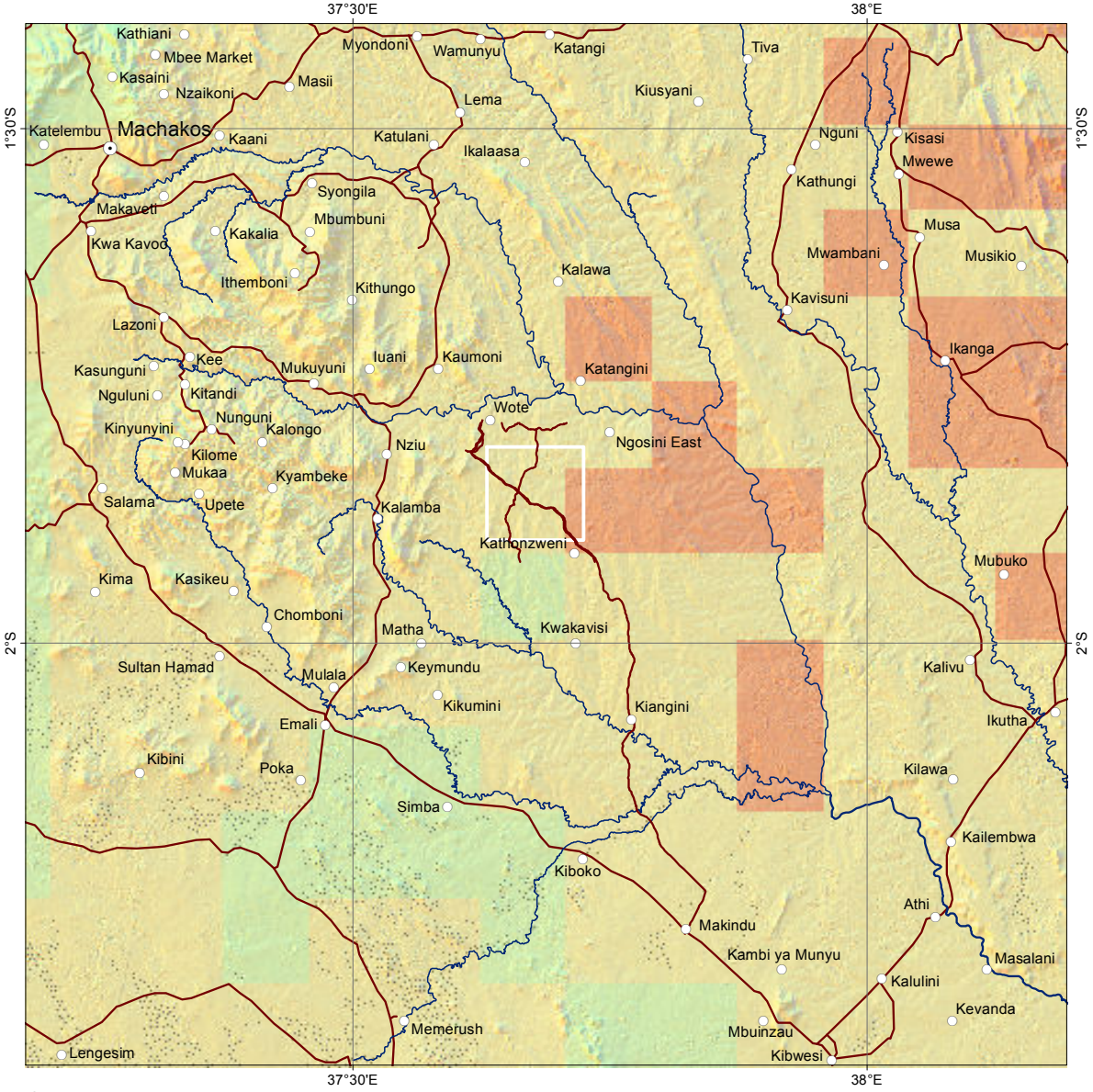




Travel time is a measure of accessibility determined in the time (hours) taken to the nearest urban centre, town or city of a population of 50,000 people or more (taking different means of transportation into account)

Citation: Nelson (2008)

Poverty



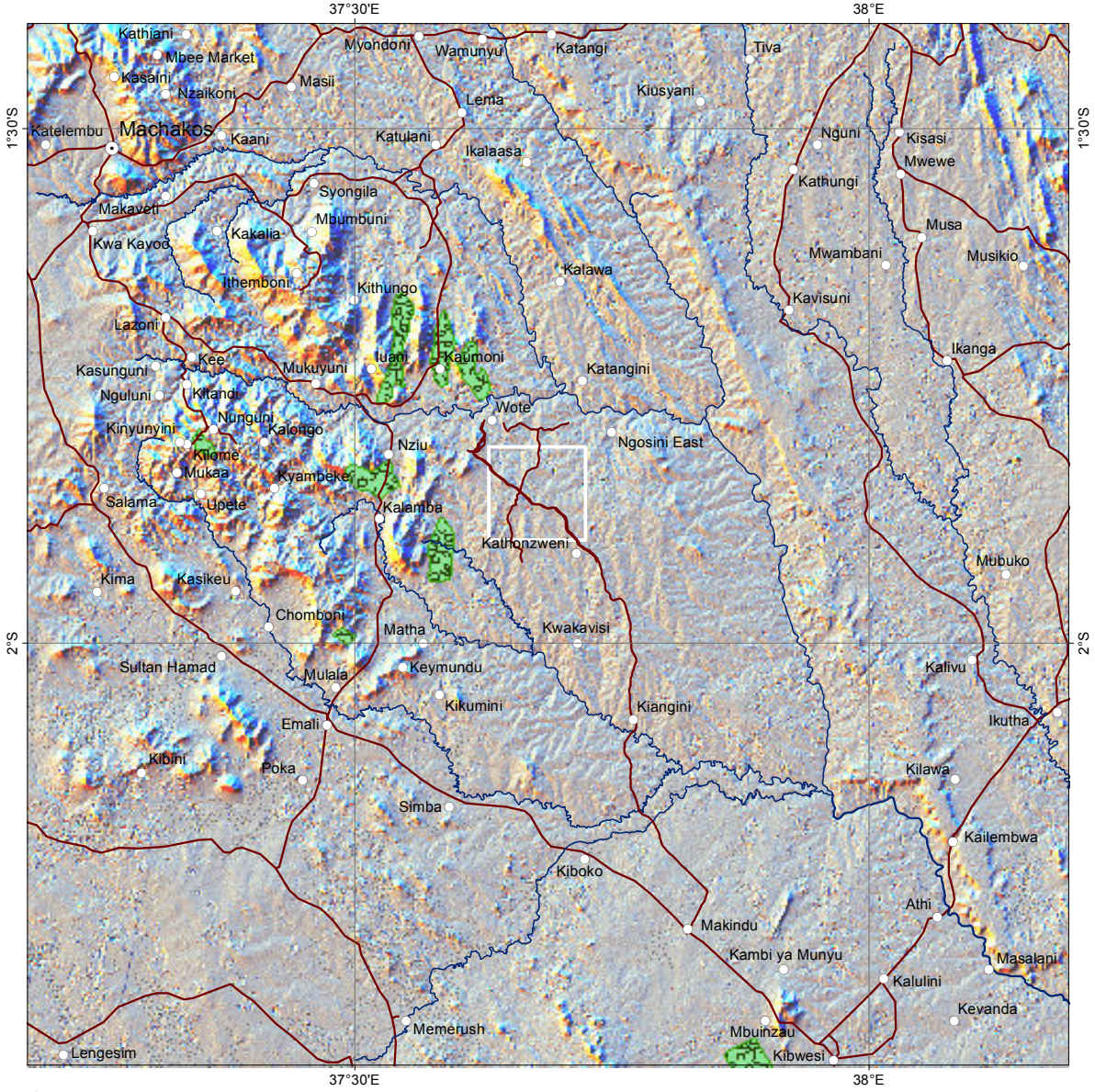
Percentage of People living on less than 2 US$ per day

- 0 or missing
- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

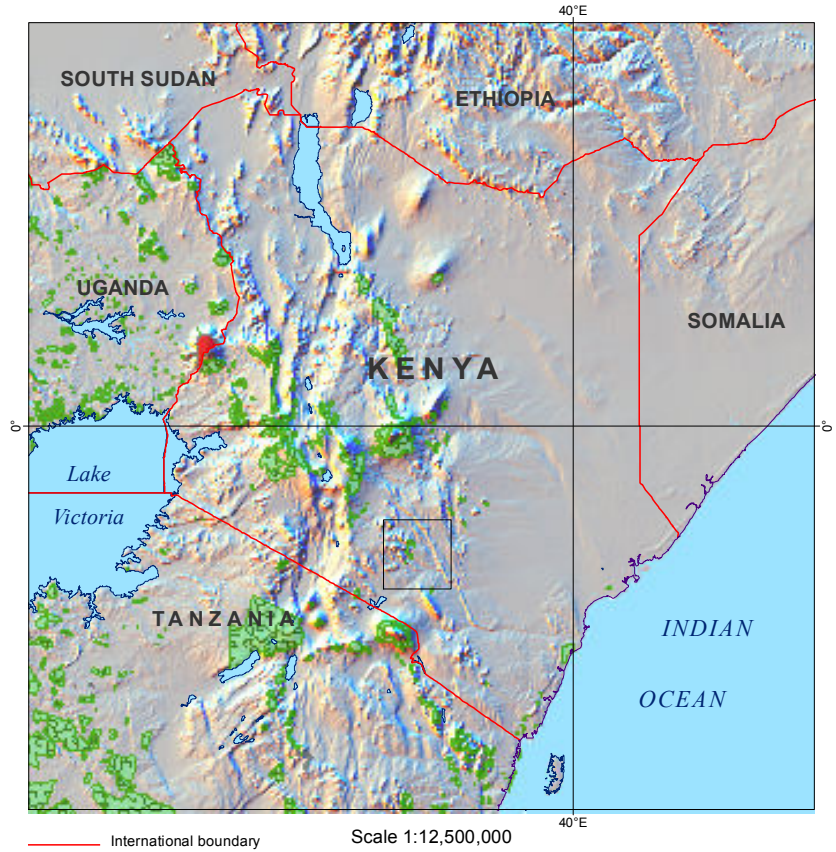
CIESIN constructed global data sets of poverty that are based on estimates of subnational infant mortality and child malnutrition data, recognizing that both are proxies for poverty and welfare rather than direct measures.

Citation: CIESIN (2005)

Conservation Areas



Wote
CCAFS sampling frame



International boundary

Corresponds to the map on the left

Scale 1:12,500,000
0 125 250 500 Kilometers

Conservation Areas

Forest Reserve

Nature Reserve

Conservation Areas represent protected areas that,according to IUCN, are clearly defined geographic spaces, recognized, dedicated and managed through legal or other effective means, to achieve long-term conservation of nature with associated ecosystem services and cultural value.

Citation: UNEP and WCMC (2012)

References and Data Sources

Regional Map
Sijmons K. 2013a. Digital Satellite Image based on, MODIS (Moderate Resolution Imaging Spectroradiometer) NASA, 2009, Ground resolution : 1 Kilometer. GTOPO30, (DEM) Global Digital Elevation Model U.S Geological Survey, Ground resolution: 1 Kilometer. Topographic Features derived from: Global GIS, U.S. Geological Survey and Google Earth. Projection: Geographic, Lat/Long, WGS84

Topographic Map
Sijmons K. 2013b. Relief represenation derived from Digital Elevation Model (DEM) of SRTM (Shuttle Radar Topographic Mission) 2000, Ground resolution 90 meter and ASTER GDEM, Ground resolution 30 meter, NASA. Topographic Features digitized from Google Earth
Projection: Geographic, Lat/Long, WGS84

Satellite Image
RapidEye Satellite Image, 5 meter ground resolution,
Image acquisition, 17-01-2011

Annual Rainfall
Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978.

Annual Rainfall Graph
Jones P G, Thornton P K, Diaz W and Wilkens P W. 2002.
MarkSim, a computer tool that generates simulated weather data for crop modeling and risk assessment. Version 1, 2002. CD-ROM and Users Manual. CIAT, AA6713, Cali, Colombia, 87 pp.

Annual Temperature
Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978.

Annual Temperature Graph
Jones P G, Thornton P K, Diaz W and Wilkens P W. 2002.
MarkSim, a computer tool that generates simulated weather data for crop modeling and risk assessment. Version 1, 2002. CD-ROM and User's Manual. CIAT, AA6713, Cali, Colombia, 87 pp.

Aridity Index
Trabucco, A., and Zomer, R.J. 2009. Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial Database. CGIAR Consortium for Spatial Information. Published online, available from the CGIAR-CSI GeoPortal at: http://www.csi.cgiar.org/

Altitude
Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database. Available at http://srtm.csi.cgiar.org

Landforms
FAO Africover, 2002. Available at http://www.africover.org/system/metadata.php?metadataid=65

Soil Type
FAO/IIASA/ISRIC/ISS-CAS/JRC. 2009. Harmonized World Soil Database (version 1.1). FAO, Rome, Italy and IIASA, Laxenburg, Austria.

Agro-Ecological Zones
Fischer, G., F. Nachtergaele, S. Prieler, H.T. van Velthuizen, L. Verelst, D. Wiberg, 2008. Global Agro-ecological Zones Assessment for Agriculture (GAEZ 2008). IIASA, Laxenburg, Austria and FAO, Rome, Italy

Landcover
Arino, O., Perez J. R., Kalgirou V., Defourny P., Achard F. 2009. GlobCover. Version 2.3 Global. Accessed at http://ionia1.esrin.esa.int/

Landuse
Natchtergaele F., Petri M., 2010. Mapping Land Use at global and Regional Scales for Land Degradation Assessment Analysis (LADA).Version 1.1.
LADA Project FAO/UNEP GEF/.
http://www.fao.org/geonetwork/srv/en/metadata.show?id=37139&currTab=simple

Length of Growing Period 2000
Thornton P K, Jones P G, Owiyo T, Kruska R L, Herrero M, Kristjanson P, Notenbaert A, Bekele N and Omolo A, with contributions from Orindi V, Adwerah A, Otiende B, Bhadwal S, Anantram K, Nair S and Kumar V. 2006. Mapping climate vulnerability and poverty in Africa. Report to the Department for International Development, International Livestock Research Institute, Nairobi, Kenya, 200 p.

Length of Growing Period 2030
Thornton P K, Jones P G, Owiyo T, Kruska R L, Herrero M, Kristjanson P, Notenbaert A, Bekele N and Omolo and Kumar V. 2006. Mapping climate vulnerability and poverty in Africa. Report to theDepartment for International Development, International Livestock Research Institute, Nairobi, Kenya, 200 p.

Crop Suitability
FAO-IIASA 2007. Mapping biophysical factors that influence agricultural production and rural vulnerability. Food and Agriculture Organization and International Institute for Applied Systems Analysis, Rome 2007.

Livestock Production Systems
FAO. 2007. Gridded livestock of the world 2007, by G.R.W. Wint and T.P. Robinson.Rome, pp 131.

Livestock Density
Wint W, Robinson T, 2007. Gridded Livestock of the World.
FAO, 131 pp.

Livelihood Zones
Livelihood Zone Products. Famine Early Warning Systems Network (FEWS NET). Accessed at http://www.fews.net/pages/livelihoods.aspx?loc=6&l=en.

Human Population Density
Center for International Earth Science Information Network (CIESIN)/Columbia University, and Centro Internacional de Agricultura Tropical (CIAT, 2005. Gridded Population of the World, Version 3 (GPWv3): Population Density Grid, Future Estimates, Edition: 3.0. NASA Socioeconomic Data and Applications Center (SEDAC. Online_Linkage: http://sedac.ciesin.columbia.edu/data/set/gpw-v3-population-density-future-estimates

Market Access
Nelson, A. (2008) Estimated travel time to the nearest city of 50,000 or more people in year 2000. Global Environment Monitoring Unit - Joint Research Centre of the European Commission, Ispra Italy. Available at http://www-tem.jrc.it/accessibility (accessed 06/03/2004)

Poverty
Center for International Earth Science Information Network (CIESIN), Columbia University, 2005. Small Area Estimates of Poverty and Inequality (SAEPI) database. Palisades, NY: CIESIN, University. Available at http://www.ciesin.columbia.edu/povmap. (Version 1.0) Available at http://sedac.ciesin.columbia.edu/theme/poverty

Conservation Areas
UNEP-WCMC (2012). Data Standards for the World Database on Protected Areas. UNEP-WCMC: Cambridge, UK.

June 2013

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) brings together the world's best researchers in agricultural science, development research, climate science and Earth System science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. CCAFS is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT).

For more information, visit *www.ccafs.cgiar.org* and *www.geomapa.nl*

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

GeoMapa GIS/Cartography

V.Atakos/CCAFS