

AVAILABLE OPENSOURCE GEOSPATIAL DATA FOR AFRICA : AFRICA-GEODEV INVENTORY AND DISSEMINATION POLICY

CREPEAU C.

AFRICA-GEODEV, CASTANET-TOLOSAN, FRANCE

The World Bank supported in 2009 the realization of a very rich opensource geographical data bank over the whole Africa called African Geospatial Databank (Afr_GeoData). This databank is composed of foundation geographical data (administrative limits level 1 to 3, roads, rivers, watersheds, populated places, land cover), DTM, NDVI products, geological, climatic, demographic, agro-economic data...), collected on Internet from the best and reliable sources for open data. This material has been checked, reprojected in WGS84 (geographic CRS), the file formats have been harmonized. The maintenance and update of this bank are carried out by a N.G.O. called Africa GéoDev. The geographical extension of Afr_GeoData is the African continent. The main part of the data is usable from the 1:500.000 to the 1:10.000.000 scale and less, for applications at continental, regional, or national scales. The data has been converted into a common reference coordinate system (GCS-WGS84) and in standardized formats of data (shp, tif...). The Afr_GeoData data can supplement other types of opensource data such as OpenStreetMap or Tracks4Africa.

Africa-Géodev can provide African ministries, projects and NGO operating in Africa for data coming from Afr_GeoData. It can also help its partners to evaluate other opensource data : Aster DTM (GDEM); Aster and Landsat satellite images; quick-looks from Spot, Ikonos, Quick-Bird, RapidEye, Worldview; Russian topographic data on Africa, geological maps and scanned soil maps accessible on Internet; ethnographic maps; disaster data (forest fires, earthquakes, floods); biomass and primary productivity, etc...

The use of opensource data is sometime criticized by African agencies, mainly by mapping agencies, the main criticisms being, first, the lack of completeness or exactness of some opensource data, second, the "unfair" competition with local geodata that the agencies have to sell to reach their financial goals. However, for the first point, one can say that it is always better to have opensource data than nothing. Although small scale data have not a high commercial value, the second point is a more fundamental issue dealing with public policies that the Africa GI community has to address.

Africa-Géodev is permanently updating his data inventory and collection. A dissemination policy has been defined as well. The N.G.O. is highly aware of the evolution of the concepts related to the transferability to the African countries of cooperative vector data such as VMAP1 and MGCP. Such data has been produced by the Western countries and are covering a large part of the African territory.

To address the issue of the great lack of geographical data in Africa, it become clear that opensource and cooperative data have a very positive role to play.

Content of the African Geospatial Databank

Bio-physical geodata

Gazetters (toponyms):

§ DCW Gazetteer (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 2005. Full Digital Chart of the world Gazetteer database. The DCW_GZTR shapefile data layer is comprised of more than 150.000 derivative point gazetteer and annotation features derived based on 1:1.000.000 data originally from DCW. The layer provides nominal analytical/mapping at 1:1.000.000.

§ GEOnet Gazetteer database (vector shp). Source : FAO/Geonetwork data catalogue. Edition : 5, 2006. Full value-added derivative of ASCII GEOnet 2006 gazetteer baseline, including non-diacritical names. The GNS_GZTR shapefile data layer is comprised of more than 1 million derivative point gazetteer features derived based on 1:250.000 data originally from GEOnet. The layer provides nominal analytical/mapping at 1:250.000. 6 majors topical classes.

Reference geodata :

§ African Virtual Base Map (raster, geotif). Source : FAO/Geonetwork data catalogue. Edition : 1, 2002. 1:750.000 scale seamless base map of continental Africa based on VMap0-Ed3, DCW, and Classified GTopo30.

§ VMap0 layers:

o Populated places (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Robust derivative of VMap0 - Ed5 Populated Place data layer. The PPL_PT shapefile data layer is comprised of

more than 39,000 derivative vector framework library features derived based on 1:1,000,000 data originally from VMap0. The layer provides nominal analytical/mapping at 1:1,000,000.

o Level 3 administrative limits (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 1, 2002. Ad3-Polygonal representation of 2nd-order subnational boundaries from country sources integrated with Ad1 boundaries from VMap0 and DCW. The AD3_PY shapefile data layer is comprised of more than 5,500 derivative polygon african national-subnational areas features derived based on 1:1,000,000 data originally from FAO. The layer provides nominal analytical/mapping at 1:1,000,000.

o Airports (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Robust derivative of VMap0 - Ed5 data layers with harmonized encoding. The AIRPT_PT shapefile data layer is comprised of more than 750 derivative vector framework library features derived based on 1:1,000,000 data originally from VMap0. The layer provides nominal analytical/mapping at 1:1,000,000.

o Roads (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Seamless and robust derivative of VMap0 - Ed5 Library Reference data features. The LR_RD_LN shapefile data layer is comprised of more than 10,000 derivative vector framework library features derived based on 1:1,000,000 data originally from VMap0. The layer provides nominal analytical/mapping at 1:1,000,000.

o Railways (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Seamless and topologically robust derivative of all linear Transport/Rail VMap0 - Ed5 data layers. The RR_LN shapefile data layer is comprised of more than 2,400 derivative vector framework library features derived based on 1:1,000,000 data originally from VMap0. The layer provides nominal analytical/mapping at 1:1,000,000.

o Rivers (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Seamless (more or less) and topologically robust derivative of source VMap0 - 5th Edition Rivers integrated with SWB (Surface Waterbody) linear outlines and limited number of dam, canal and other features where available from source library layers. The VMAP_RIV shapefile data layer is comprised of more than 173,000 derivative vector rivers and major surface water bodies features derived based on 1:1,000,000 data originally from VMap0/ DCW. The layer provides nominal analytical/mapping at 1:1,000,000. Seamlessly complete globally, with consolidation-harmonization @ ~70%.

o Water bodies (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2006. Seamless (more or less) and topologically robust derivative of source VMap0 SWB and related hydrological features, i.e. swamps, etc. data layers. The VMAP_PY shapefile data layer is comprised of more of 25,000 derivative vector framework library features derived based on 1:1,000,000 data originally from VMap0/DCW. The layer provides nominal analytical/mapping at 1:1,000,000. Seamlessly complete globally, with consolidation-harmonization @ ~70%.

o NB : for some areas, Vmap1 layers (more accurate) can be provided.

§ RWDB2 layers :

o Roads (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 2005. Linear roads layer consolidated from 3 separate source data layers. The RWDB_RD shapefile data layer is comprised of more than 72,000 derivative vector framework library features derived based on 1:3,000,000 data originally from RWDBII. The layer provides nominal analytical/mapping at 1:3,000,000.

o Rivers (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 2006. Enhanced Rivers linear derivative based on 4 separate RWDB2 Library layers. The RWDB_RIV shapefile data layer is comprised of more than 4,300 derivative line framework library features derived based on 1:3,000,000 data originally from . The layer provides nominal analytical/mapping at 1:3,000,000

o Water bodies (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 2005. This dataset derives from the RWDB_SWB-PY shapefile data layer which covers the entire globe and is comprised of more than 8,700 derivative vector framework library features derived based on 1:3,000,000 data originally from RWDBII. The original dataset is an enhanced SWB polygonal derivative based on 4 separate RWDB2 Library layers. The layer provides nominal analytical/mapping at 1:3,000,000.

Elevation :

§ SRTM-C band at 3 arc-second (90m) from CGIAR (raster, geotif). Source : CGIAR. Edition : 2, 2006 (edition 4 is available). The data distributed are in Arc GRID format, in decimal degrees and datum WGS84. They are derived from the USGS/NASA SRTM data. CIAT/CGIAR has processed this data to provide seamless continuous topography surfaces. Areas with regions of no data in the original SRTM data have been filled in using interpolation methods.

Watershed limits :

§ Alcom-WWF model (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 3, 2003. ALCOM/WWF watershed model of Africa, continental expansion of the ALCOM-WWF/SARPO SADC-

WRD watershed model edited to VMAP0/DCW Rivers. The ALCOMWWF shapefile data layer is comprised of more than 5,400 derivative vector watershed model features derived based on 5,000 cell data originally from WWF-ALCOM. The layer provides nominal analytical/mapping at 1:2,500,000. NB: except for small scale mapping, this layer can now be replaced by watershed limits coming from the processing of SRTM-C band radar data. No data for Madagascar and insular states.

§ HYDRO1K Lev6 model (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 2003. H1k_WS: 6-level watershed model based on the HYDRO1k, reprojected, verified, and downstream encoded version of the 6th level Pfafstetter encoded H1k watersheds. The H1K_LEV6 shapefile data layer is comprised of more than 7,100 derivative raster watershed and flow network features derived based on 4,000 cell data originally from HYDRO1k and based on the Gtopo30. The layer provides nominal analytical/mapping at 1:2,000,000. NB: except for small scale mapping, this layer can now be replaced by watershed limits coming from the processing of SRTM-C band radar data. No data for insular states.

Climate :

§ CRU annual mean precipitation (raster, img). Source : FAO/Climapag, from the Climatic Research Unit / University Est Anglia. Edition: 2009. Thematic content and unit: annual precipitations in mm/month, on 30'*30' cells. File name: Precip_CruP_All_fine_Cont_Afr.img.

§ GPCC annual mean precipitation (raster, tif). Source : FAO/Climapag, from the NOAA/ESRL/Global Precipitation Climatology Centre. Edition: 2009. Thematic content and unit: annual precipitations in mm/month, on 30'*30' cells. File name: Precip_Full_All_fine_Cont_Afr.tif

§ VASclimO annual mean precipitation (raster, tif). Source : FAO/Climapag, from the NOAA/ESRL/Global Precipitation Climatology Centre and German Met Service. Edition: 2009. Thematic content and unit: annual precipitations in mm/month, on 30'*30' cells. File name: Precip_Vasc_All_fine_Cont_Afr.tif

§ WORLDCLIM monthly mean precipitation, 12 months (raster, bil). Source: Worldclim. Edition: 2009. Thematic content and unit: monthly precipitations in mm/months in 1/120 square degree cells. File name: precM_00.bil

§ WORLDCLIM calculated annual mean precipitation (raster, tif). Source : Africa GeoDev calculated from Worldclim. Thematic content and unit: annual precipitations in mm/year in 1/120 square degree cells. File name: AfrAnnualPrec.tif

§ CRU annual mean temperature (raster, img). Source : FAO/Climapag, from the Climatic Research Unit / University Est Anglia. Edition: 2009. Thematic content and unit: annual temperature in [Celcius degree * 10], on 30'*30' cells. File name: Temp_CruT_All_fine_Cont_Afr.img.

§ WORLDCLIM monthly mean temperature, 12 months (raster, bil). Source: Worldclim. Edition: 2009. Thematic content and unit: monthly mean temperatures in °C in 1/120 square degree cells. File name: TmeanM_00.bil

§ WORLDCLIM calculated annual mean temperature (raster, tif). Source : Africa GeoDev calculated from Worldclim. Thematic content and unit: calculated annual mean temperature in °C in 1/120 square degree cells. File name: AfrAnnualTempMean.tif

§ Evapotranspiration, annual ETP, (raster, grid). Source : FAO/Geonetwork data catalogue. Edition : 1, 2004. Annual Total Evapotranspiration. The ET_YR grid data layer is comprised of more than 2,330,000 derivative raster evapotranspiration features derived based on 0.167 degrees resolution data originally from CRU. The layer provides nominal analytical/mapping at 1:10,000,000.

§ CRU Koeppen-Geiger climate classification (raster, img). Source : FAO/Geonetwork data catalogue. Edition : 2, 2006. The globally gridded Koeppen climatologies are based on climatological observations (temperature and precipitations) rasterized to grids of 0.5 x 0.5 degrees. They cover 4 different periods and are based on 3 different precipitation datasets. This leads to a total number of 12 rasterized Koeppen climatologies. Source: Mean annual cycles of temperature are always taken from the Climatic Research Unit. Precipitation is taken from GPCC VASclimO data, based on 9,343 stations that provide at least 90% coverage within 1951-2000.

Geology, soils and land degradation :

§ WRB soil resources map (vector, shp). Source : FAO/Geonetwork data catalogue. Edition : 2, 1990. Reduced and Simplified version of the FAO-UNESCO Soil Map of the World (FAO, 1971-1981) using the Revised Legend (FAO 1988) with amendments based on additional soil information. To be used at 1:5,000,000 scale. NB: except for small scale mapping, this layer can now be replaced by the following.

§ HWSO harmonized world soil DB (raster, img). Source : FAO/Geonetwork data catalogue. Edition : version 1.1, 2009. HWSO is a 30 arc-second raster database with over 16,000 different soil mapping units

that combines existing regional and national updates of soil information worldwide with the information contained within the 1:5,000,000 scale FAO-UNESCO Soil Map of the World.

Land cover :

§ Global Land Cover (raster, img). Source : JRC/GVM at Ispra and FAO/Geonetwork data catalogue. Edition 1, 2004. The Global Land Cover is a product of the GVM Unit that is coordinating and implementing the GLC 2000 Project in collaboration with a network of partners around the world, under the coordination of the European Commission's Joint Research Centre. The legend of the map is based on FAO Land Cover Classification System (LCCS). NB: except for small scale mapping, this layer can now be replaced by the following.

§ Globcover (raster, tif). Source: ESA/Medias France for the entire Africa and FAO/Geonetwork data catalogue for Globcover per country. Edition : 1, 2009. This land cover data set is derived from the original raster based Globcover regional (Africa) archive. It has been post-processed to generate a vector version at national extent with the LCCS regional legend (46 classes).

NDVI :

§ VGT for Africa S10, 2004-2008 and further (raster, tif). Source Medias France and VITO. Thematic content : dekadal synthesis of vegetation index (NDVI) coming from the SPOT4/5 Vegetation sensor. File name (example) : VGTextract010908.tif

§ NB: other bio-physical satellite products (NDWI, VPI, LAI, fCOVER...) : on request.

Socio-economical geodata

Population:

§ African Population Database 2000 and 1960 (raster, tif). Source : UNEP/CIESIN. Edition 1, 2005. Thematic content: Gridded population for 1960 and 2000 in nb of inhabitant. File name (example) : afpop60_WGS84.tif

§ African Population Density Database 2000 and 1960 (raster, tif). Source : UNEP/CIESIN. Edition 1, 2005. Thematic content: Gridded density of population for 1960 and 2000 in nb of inhabitant/km². File name (example): afpopd00.tif

§ Calculated population annual growth 1960-2000 (raster, tif). Source : Africa GeoDev from UNEP/CIESIN. Edition 1, 2009. Thematic content: calculated and gridded population annual growth 1960 – 2000 in %. File name : PopAnGrowth1960-2000_WGS84.tif

Agricultural Statistics :

§ FAO agro-maps, GSDALUS, (database format + shp). Source : FAO Agro-Maps. There are many data available in the Global Spatial Database of Agricultural Land Use Statistics (FAO Agro-Maps) server. We can extract agricultural statistics together with the administrative limits used for the statistics and bring them into a GIS database.

Land use systems

§ FAO/LADA land use systems (raster, img). Source: FAO/Geonetwork data catalogue. Edition 1, 2009. This is the version 1 of a thematic grid of Land Use Systems (LUS) and its attributes with a spatial resolution of 5 arc minutes or 0.083333 decimal degrees. This dataset is developed in the framework of the LADA project (Land degradation Assessment in Drylands) by the Land Tenure and Management Unit of the Food and Agriculture Organization of the United Nations and is copyright of FAO/UNEP GEF. The LUS map implementation is based on a innovative methodology combining more than 10 global datasets.

Opensource geodata : a big issue for development

The use of the opensource geospatial data as well as collaboratives geospatial data is growing very fast in Africa and had now a great number of users, who do not belong any more only to the topography and mapping sectors, as it was the case a few years ago.

Initiatives such as OpenStreetMap (OSM), now very well known, or Tracks4Africa (T4A) in Southern Africa, federate users more and more. OSM provides a very precise collaborative cartography of the majority of the main African cities, which is updated and supplemented by the users themselves.

In addition a certain number of free and downloadable geospatial data is available on certain zones of Africa, in particular:

§ VMap1 vector topographic data at 1: 250,000 scale, manufactured by the cartographic services of the Western armies. Some areas are downloadable freely, the others are available with the agreement of the producing country.

§ Russian topographic raster data at 1: 200,000 scale, elaborated in 1980-1990, are also downloadable freely, but the “free” version is not georeferenced.

We must also mention Western military topographic data, called MGCP (Multilateral Geospatial Co-production Program), at 1: 50,000 scale, which covers a large part of Africa. Discussions have started to find an agreement to make possible the transfer of this vector data to the African national mapping agencies, which need urgently this data for development purposes such as town and land planning, urbanisation monitoring, deforestation assessment, agricultural and environmental management, transportation and infrastructures master plans.... most of them having only topographic maps at 1:200.000 scale from 1950-1960.

Some worlds about the N.G.O. Africa GéoDev and its data policy

Africa GéoDev aim's is to promote fair development by facilitating the distribution within the African countries of the best geospatial data and the dissemination of the most recent and efficient techniques and methods of geographical engineering.

Africa Géodev is a NGO that brings the expertise of its members to the disposal of international organizations, African governments and the civil society, on a fair base. This assistance is willing to fight against the rural poverty and precariousness in using the best the geo-environmental technologies to promote a better management of lands and natural resources as well as a better assessment of the factors which increase the vulnerability of the populations, such as climate change.

Africa Géodev is a non-governmental organisation under the French law.

Africa GéoDev is acting with its members and friends both in Africa and Europe. We are able to recruit any expert or trainer required to realize studies, projects, training sessions, in our expertise domains, by mobilizing African or international skills (juniors and seniors). We can also provide African and international organisations for geodata coming from our African Geospatial Databank (see above). We are also able to assist these organisations in testing other sources of free-of-charge geodata (such as Aster GDEM, Landsat and Aster satellites images, quick-looks of Spot and Ikonos images,) as well as commercial geodata.

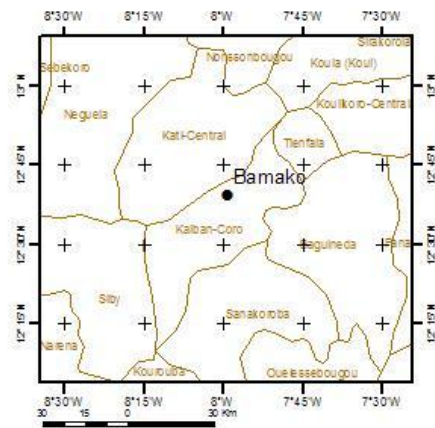
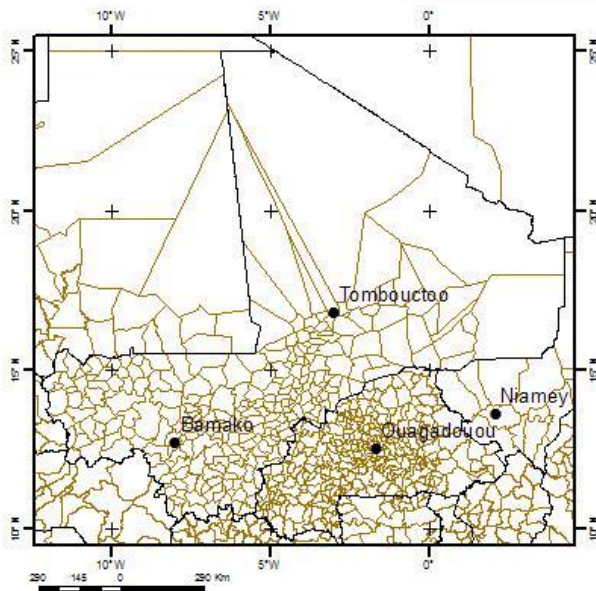
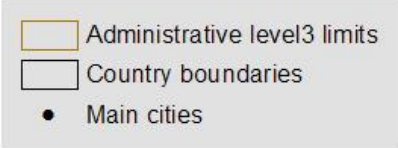
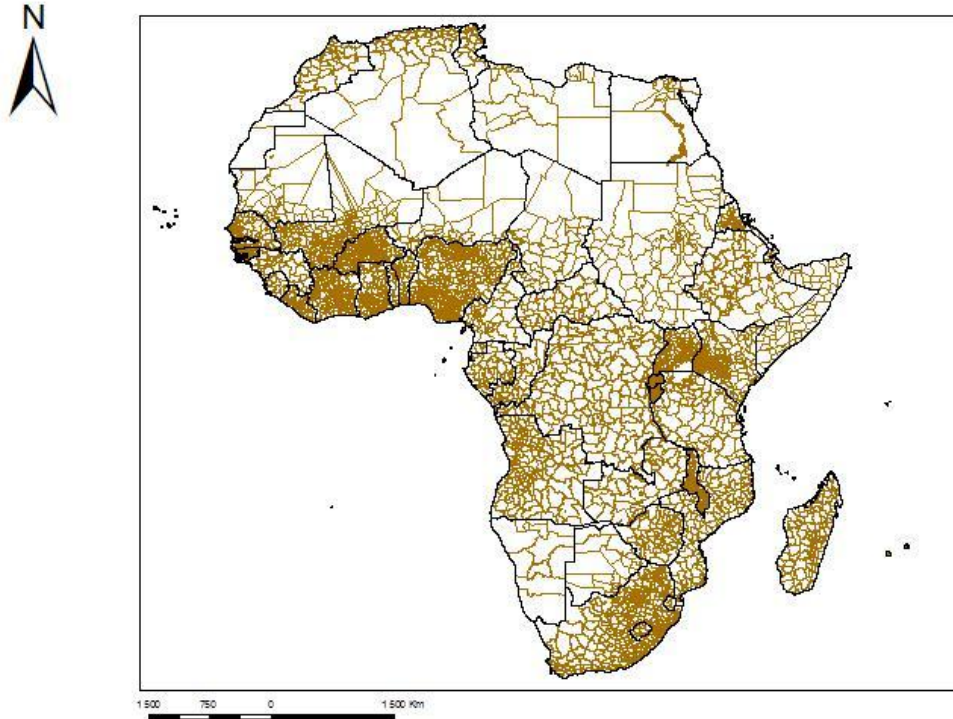
To know more about Africa GéoDev:

§ Web site: <http://africa-geodev.org>

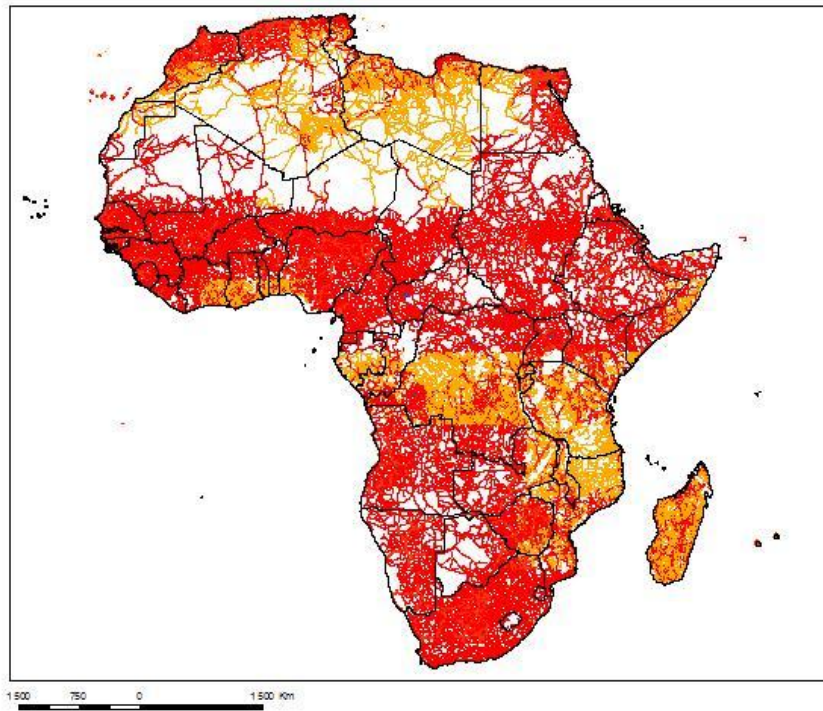
§ email: Africa_geodev@yahoo.com

Some illustrations of the African Geospatial Databank:

Vmap0 Administrative Level 3 limits

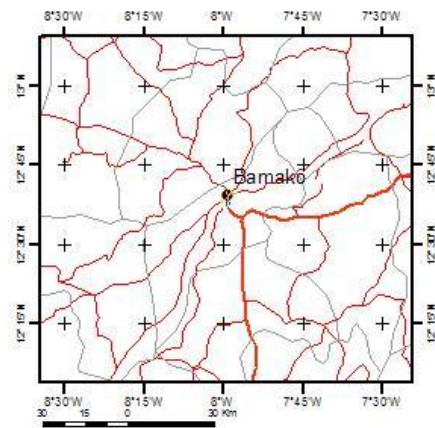
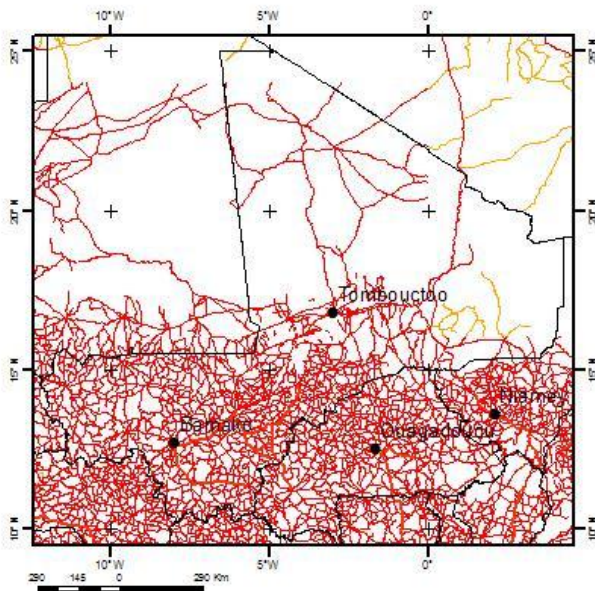


Vmap0 Roads



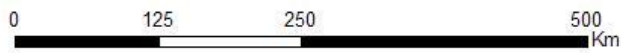
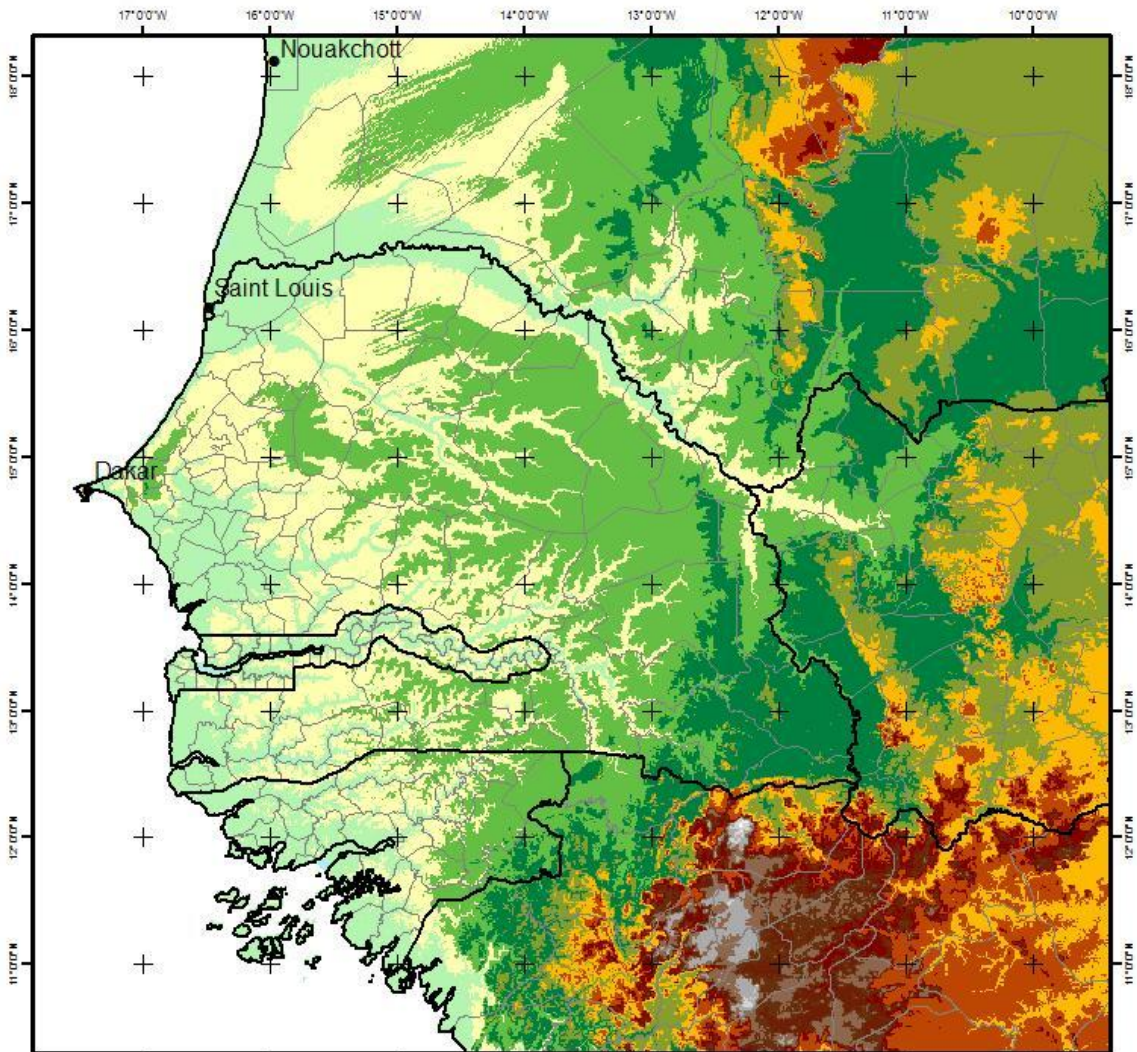
Roads network

- Primary Route
- Secondary Route
- - - Other (bridge, ferry line...)
- Unknown
- Country boundaries
- Administrative level3 limits
- Main cities

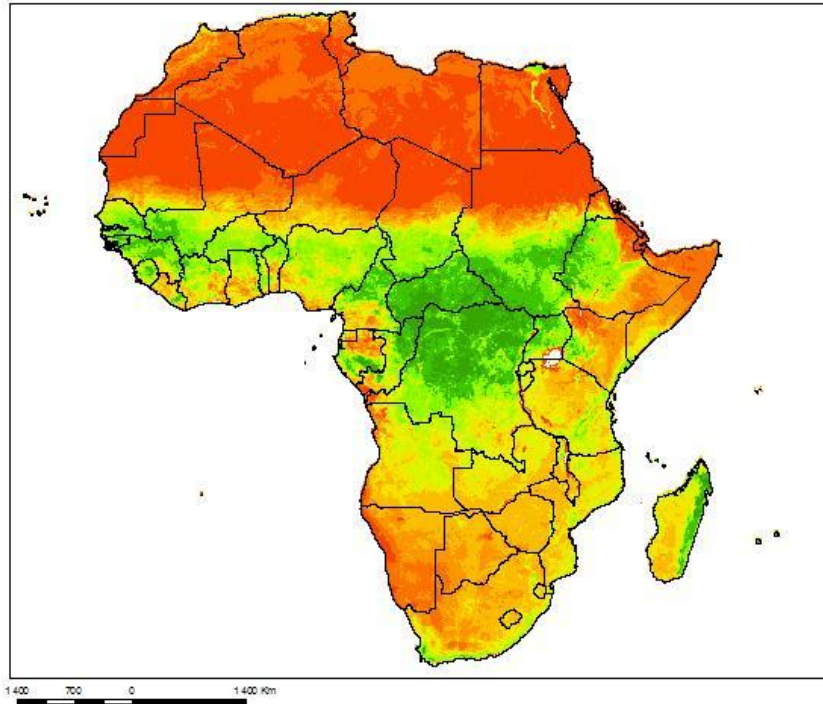


ELEVATION (from SRTM/CGIAR)

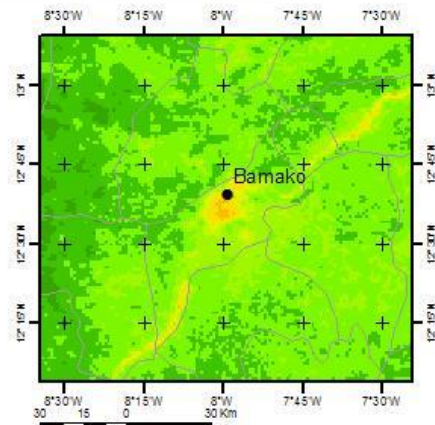
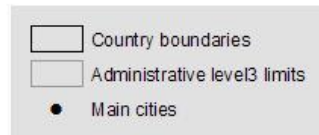
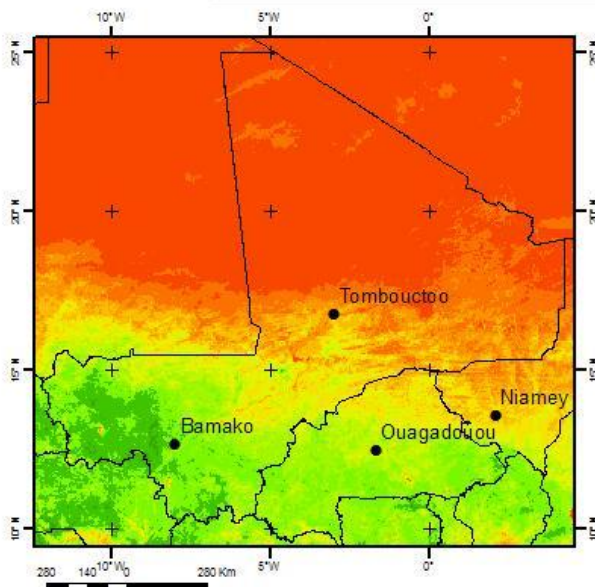
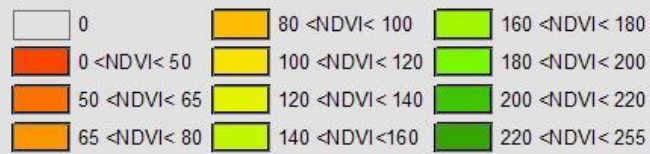
Western Africa



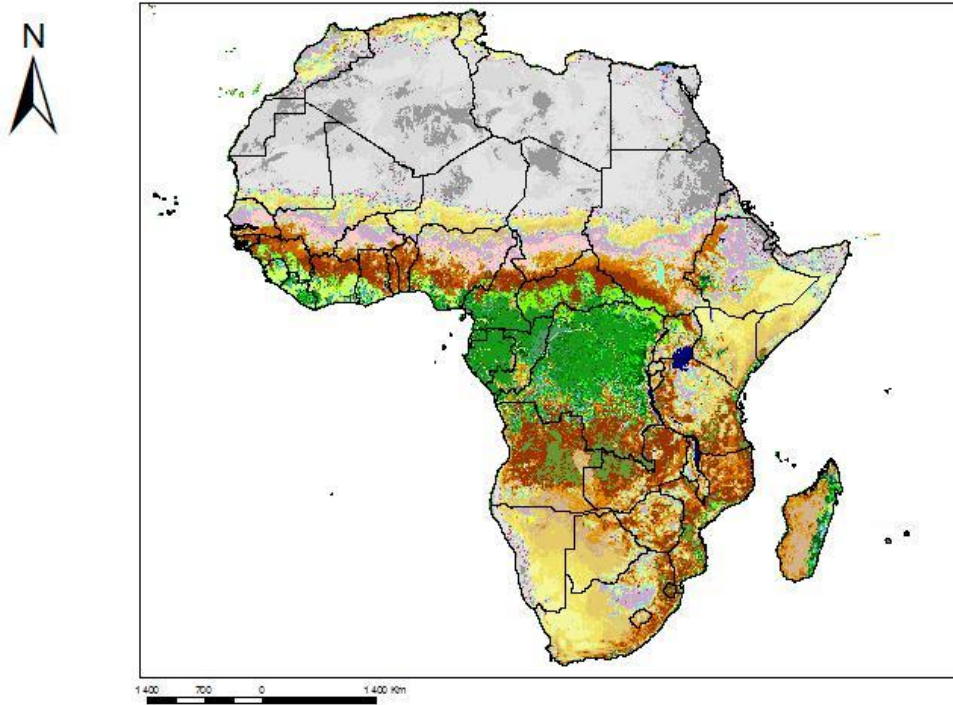
Example of SPOT/VGT S10 NDVI



NDVI values for the first decade of September 2008

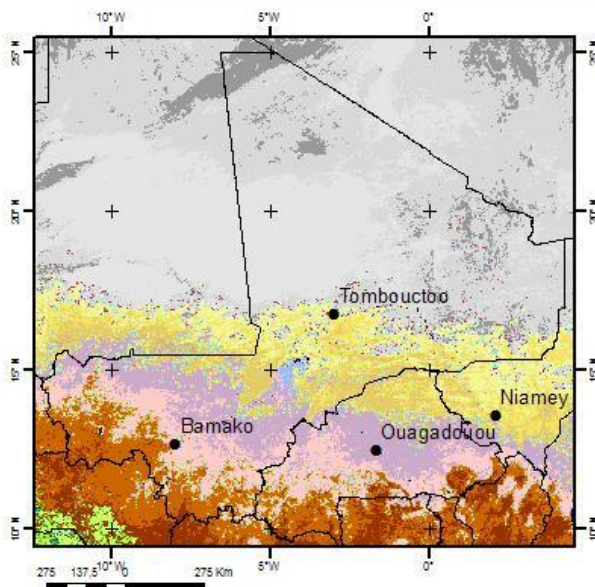


GLC2000 Land Cover Map



Land cover classes

Agriculture (>50 %)	Deciduous dense forest	Mix Agriculture / Humid forest	Trees and deciduous savanna
Irrigated Agriculture	Degradated dense forest	Mix Agriculture / Dry vegetation	Dense herbaceous deciduous savanna
Background	Humid dense forest	Mix Forest / Savanna	Flooded herbaceous savanna with trees
Salted grounds	Swampy forest	Pseudo-steppe	Open herbaceous savanna
Rocky desert	Mountain forest (> 1500 m)	Rocks without vegetation	Open herbaceous savanna with some trees
Dunes and sandy desert	Submountain forest (900-1500 m)	Deciduous savanna with trees	Orchards
Water	Mangrove	Deciduous savanna	Urban



Country boundaries
Administrative level3 limits
Main cities

