GIS DataBase for the Environment Protection and Sustainable Management of the Okavango River Basin Project EPSMO
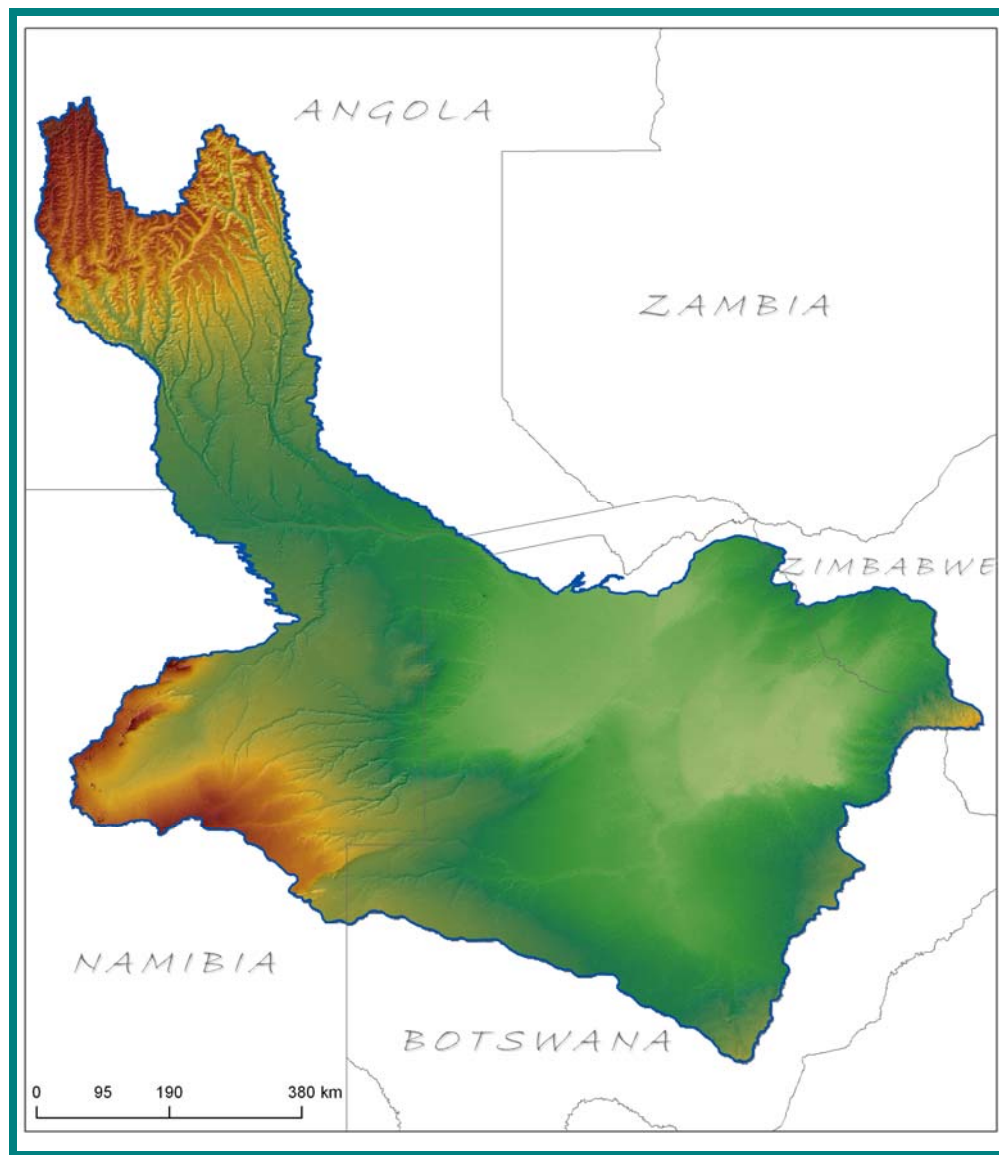

Luis Veríssimo
Consultante
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CONTENTS

1. INTRODUCTION

This document presents the development of the Geographic Information System (GIS) database within the EPSMO Project. The objective of the development of the GIS database was to create an array of thematic layers (biophysical and socio-economic), covering the geographic area of the Okavango River Basin, with the intent to support: the assessment and strategic decision-making by partners in the EPSMO project; the existing management structures within the riparian countries of Angola, Botswana and Namibia; and, to a certain extent, the awareness of general public.

More specifically, the GIS database is indented to aid with:

- Meeting many of the information needs of the Project, especially in regard to the technical Environmental Flows Assessment reporting;
- Facilitating policy-making in the riparian countries, concerning water management and environmental needs;
- Characterization of the river basin to support the transboundary Diagnostic Analysis;
- Water quality issues, based on surface water quality monitoring data when available;
- Cooperation on transboundary conservation areas and wildlife information integration;
- Consider potential future hydro morphological alterations: dams, hydropower plants, agriculture infrastructures, etc.

The GIS database, is in part comprised of the "top-down" ready GIS layers that are available from various sources and/or in the public domain and chosen on the basis of information prioritized by the Project partners. Nevertheless, in view of different stages on availability/existence of geographic information data in the basin countries (Angola, Namibia, Botswana and Zimbabwe), a considerable range of the so called "bottom-up" layers, had to be produced and incorporated in the database to harmonize and provide better detailed GIS data for the project tasks and goals and as well to the related partner institutions.

The content and quality of this multi-thematic GIS database is oriented towards a strategic-level, transboundary assessment, decision-making and awareness concerned with hydrologic variables and environmental and socio-economic parameters of the Okavango River Basin, organized in a set of different thematic groups that define the extent and relevance of the database.

2. METHODOLOGY

2.1 INTRODUCTION

The development of the GIS database for the EPSMO project is outlined below. The extent of contents and data production of the database must take in consideration the fact that the Project was conducted in a short-period of time (8 months), with restricted possibilities to develop the database extensively.

2.2 MAIN STEPS

2.2.1. Needs and Requirements

The EPSMO GIS database, ultimately presents a toll to serve several purposes for different target groups and goals, such as government agencies responsible for the management of water resources, local/regional state administrations dealing with water issues, river basin commissions and other stakeholders, such as other national and local institutions, researchers and the public in general.

Nevertheless, in a first stage, the choices for the content of the database, are based fundamentally on the project data priorities, which were communicated principally at the meeting of the EPSMO in Maun in October 2008. Based on the needs and requirements presented, the following "top-down" assembly of data layers were prioritised for the database concerning the all of the Okavango Basin:

- International borders and administrative units;
- Hydrological data;
- Climatologic data;
- Geological, geomorphologic and soil data;
- Land use / land cover;
- Population distribution;
- Digital elevation model.

"Bottom-up" layers that were also prioritized to be included, when available, in the GIS database:

- Hydrographic network and units;
- Hydrologic monitoring stations;
- Water quality monitoring data;
- Wildlife distribution;
- Protected areas;
- Infrastructures network.

2.2.2. Inventory of Data Sources and Acquisition of Data Sets

In order to fulfill the priorities established, it was necessary to start an inventory of potential data sources. For that, factors that are relevant for the search and acquisition of pre-existing GIS data, include aspects such as the data quality, availability, cost and users rights. In this initial step, the inventory of data should be considered at the 4 national levels involved independently, and guided by the proposed structure presented in part

GIS Database for the EPSMO Project   4

4. Following the acquisition of the data sets identified by the inventory, this information was processed and analyzed.

2.2.3 Data Harmonization

Data harmonization can relate to different types (see table 1), and is here referenced as the process by which data sets with dissimilar characteristics (geodetic, temporal, thematic) are modified in order to contain the same reference parameters so that can be properly analyzed and used. This process can be rather time consuming, depending on the type of harmonization required. Concerning the geodetic reference system for the GIS database, the procedure was carried out using the ArcGIS 9 software (ArcTools/ArcCatalog), in order to project or reproject acquired data to the database projection coordinate system. Another factor, is if a specific data source covers a larger area then the EPSMO target area (the Okavango River Basin). For this mater, it is necessary to clip according to the defined database boundaries. Raster files were resampled during the projection process using the "nearest neighbor" resample method for land cover data, or a "bilinear" resample method for elevation data and remote sense data.

Table 1 – Types of Data Harmonization

Harmonization Type	Description
Intralayer harmonization	Harmonization of data within a single data layer
Interlayer harmonization	Harmonization of data between data layers
Geodetic harmonization	Intra or interlayer harmonization with respect to the geodetic reference system. The adopted reference system and projection should be applied to the data
Temporal harmonization	Intra or interlayer harmonization with respect to the temporal dimension of the data. Optimally, to be fully comparable, all data layers should originate from the same point in time
Thematic harmonization	Intra or interlayer harmonization with respect to the thematic content. Optimally all data layer of a specific thematic variable should have the same attributes, be measured in the same way with the same measurement interval and with the same constrains.

In the case of the GIS database of the EPSMO project, the target area comprises a Transboundary reality, which implies data originating from 4 different countries, with varying thematic, geodetic, temporal and geographic contents. It is to be understood that same of the existing thematic layers available do not cover with the same level of spatial detail or attributes included, for the areas of the Basin shared by the 4 countries, presenting a challenge when the generalization is not the option, and in many cases addressing fundamental information gaps. Temporal harmonization can be partly achieved, in what concerns themes like landcover, infrastructures, population, etc, if the available sources options are limited to the most recent ones, centering around the time frame between 2002 and the present. A more complex task can be the thematic harmonization of layers, especially when "bottom-up" data layers are later added to the database. This might imply the need to access the specific national and international coding systems and parameters involved in the production of the original data, invariably reflecting different approaches and instruments used.

2.2.4 Database Structure

The GIS information assembled, is presented under an organized thematic data structure as depicted below. The subdivision indicated does not reflect the availability of layer sets for all the different sub aggregations. In stead, serves has a proposed hierarchical guidance for the future expansion and inclusion of information sets in a update and shared dynamic multi-thematic database process.

Administrative and Political Boundaries
- Country
- Regional
- Local

Agriculture and Livestock
- Land
- Livestock

Atmospheric and Climate Data
- Precipitation
- Temperature

Base Maps, Remote Sense and Toponomy
- Digital Georeferenced Topo Maps
- Digital Orthoimagery
- Satellite Imagery
- Toponomy

Biologic and Ecologic Information
- Fauna
- Flora
- Habitat

Social and Demographic Information
- Cultural
- Demographical

Earth Surface Characteristics and Land Cover
- Land Use
- Land Cover

Elevation
- Contours
- DEMs
- Slope

Environmental Monitoring and Modelling
- Managed Areas

Fresh Water Resources
- Hydrography
- Wetlands

Geologic and Geophysical Information
- Geology
- Geomorphology
- Hydrogeology
- Soils

Transportation Networks
- Air
- Rail
- Road

Utility Distribution Networks
- Water Distribution
- Transmission

2.2.5 Database Information

The EPSMO GIS database has a easily accessible metadata for the identification and further use of the data for various applications areas. Each layer is associated to a metadata file with a description created using the standards established by the Federal Geographic Data Committee of the US (FGDC-ESRI), included in the ArcCatalog metadata tools.

3 DATABASE DESCRIPTION: GENERAL CONSIDERATIONS

3.1. OVERALL CHARACTERISTICS

The multi-thematic GIS database covering the transboundary Okavango River Basin, is composed to a large extent by a collection of harmonized data layers acquired from a wide variety of sources. For this reason, it is a database with a pronounced variable interlayer characteristics and qualities, and, at the same time, developed to assist the project priorities and goals.

3.2. COORDINATE SYSTEM, PROJECTION AND GEODETIC INFORMATION

The geographic and cartographic data produced in the region until recently is based fundamentally in regional coordinate systems, not allowing immediate integration and comparison of this cartographic sets. The 4 national coordinate systems are the following:

- Angola – Transverse Mercator (Projection), Camacupa (Datum);
- Botswana – Transverse Mercator (Projection), South African (Datum);
- Namibia – Transverse Mercator (Projection), Schwarzeck (Datum).
- Zimbabwe – Transverse Mercator (Projection), Clark 1880 (Spheroid).

The EPSMO GIS database is referenced in the World Geodetic System 1984 (WGS 1984) geographic coordinate system (GCS). The parameters and geodetic model are:

Geographic Coordinate System
GCS Name: WGS (1984)
Latitude of Reference: 0.0º
Longitude of Reference: 0.0º
Geographic Coordinate Units: Decimal degrees

Geodetic Model
Datum: WGS 84
Ellipsoide: WGS 84
Semi-major Axis: 6378137
*Inverse Flattening*: 298.257

3.3. SCALE

The importance of spatial scale in geographic related assessments, and the effect scale has on the interpretation and representation of spatial phenomena being observed or modeled is a key factor in the overall consistency of the geographic information systems outputs and validity. Multiple scales may be necessary for interpreting and characterize a complete system over time and space. Nevertheless, in a GIS database layers can be zoomed in or out, so it is extremely important to maintain data of similar scale grouped apart from data or lesser or greater scale, in order to prevent erroneous overlay and analysis of data of non-common scale.

Taking in consideration the size and heterogeneity of the are considered as the Okavango River Mega Basin (Fig. 1), it was necessary to subdivide the GIS data information in different scale groups, prioritizing the more detailed data sets to the Okavango Active Catchment Area and Delta Sector (Fig. 2)
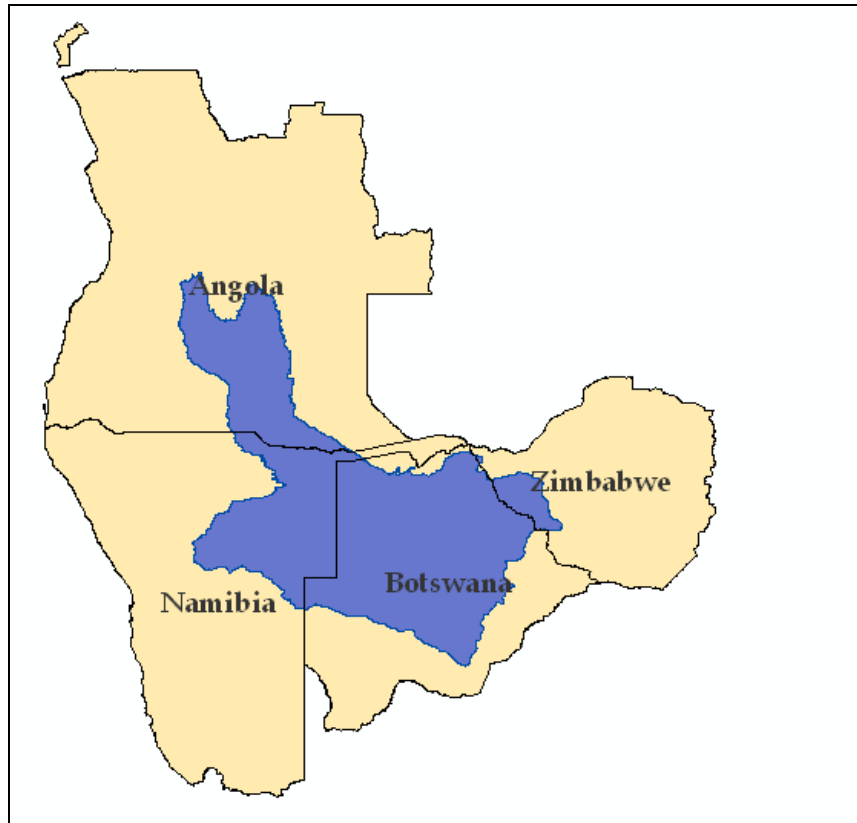
Figure 1 – Okavango River (Macro) Basin.

Figure 2 – Okavango Active Catchment Area (in blue).

The EPSMO GIS database aggregates data in two separate spatial scale groups (see Part I and II of the report), with the scale range for each category as follow:

Okavango Macro Basin – >1:500 000 – <1: 10 000 000
Okavango Active Catchment Area – >1:200 000 – <1:500 000

3.4 GEOGRAPHIC COVERAGE

The bounding coordinates (in decimal degrees) for the EPSMO GIS database are as follows:

North Bounding Coordinate: -12.00
West Bounding Coordinate: 16.00
South Bounding Coordinate: -22.00
East Bounding Coordinate: 24.00

The set of bounding coordinates serves only as an overall reference to determine the geographic layout enclosing the Okavango Mega River Basin, the focal area of the project.

Administrative bounding of the Okavango River (Macro) Basin

Angola: part of the Huambo, Bie, Moxico, Huila and Kuando Kubango provinces;
Namibia: part of the Kavango, Ohangwena, Otjozondjupa and Omaheke regions;
Botswana: part of Ngamiland, Chobe, Central, Francistown, Western and Gaborone districts.
Zimbabwe: part of Matabeleland North and Matabeleland South provinces.

4 DATABASE DESCRIPTION: SOURCES

4.1. DATA SOURCES

As referred earlier, there is a heterogenic reality concerning GIS data for the Okavango River Mega Basin, since the production of this resources has been undertaken in different conditions and approaches in the four riparian countries independently: Angola, Botswana, Namibia and Zimbabwe. Under this consideration, it is presented in the next sections sources in each country that allocate viable GIS data.

4.1.1. Angola

Instituto de Geodesia e Cartografia de Angola (IGCA), Luanda

This institution is the national repository and producer of cartographic data, namely topographic maps. Presently IGCA provides topo maps in analogue (paper) format for the all country in the scales: 1/1 000 000; 1/500 000; 1/250 000 and 1/100 000. Incomplete collections cover selected parts of the country at 1/50 000 and 1/25 000. There is an ongoing process of digitizing the map and aerial photo collections in to digital formats. All of the above map scale sets have already bean scanned, and some vectorization has been conducted.

FAO, Luanda

This organization has been engaged in the compilation of GIS data for Angola for a large variety of projects, namely the production of the "*Angola Municipality Atlas*", were general data related to agriculture, livestock, household food security and more is provided. In this product, FAO provides also a complete collection of 1/100 000 georeferenced topographic maps for the all country.

Instituto para o Desenvolvimento Florestal (IDF), Luanda

IDF contracted Angola Alliance, a South Africa company consortium, to conduct a land cover analysis (including change over time) for the country, which will form the basis of IDF's forest inventory. This data is so far not available for the general public.

Sinfic, Luanda

This private company has been assembling GIS data for Angola, and has the potential of providing thematic layers for the EPSMO project, namely vector layers extracted from the 1/100 000 topographic maps. Administrative boundaries of Angola have been assemble for the project.

4.1.2. Botswana

Department of Survey and Lands, Gaborone/Maun

This institution is the national repository and producer of cartographic data, namely topographic maps. The country has incomplete coverage of topographic maps in the scale 1/50 000 and complete, although outdated, in the scales 1/250 000 and 1/500 000. The cartographic quality of the topographic series that cover the North of the country is generally poor.

Harry Oppenheimer Okavango Research Centre (HOORC), Maun

HOORC is a research center of the University of Botswana, that has been engaged in promoting and extending the use of GIS components in the institution scientific activities, and has so far assembled a comprehensive data bank of GIS data for most of the North of Botswana. It is a key partner of the EPSMO project.

4.1.3. Namibia

The Surveyor General, Windhoek

This institution is the national repository and producer of cartographic data, namely topographic maps. The country is covered at the scales: 1/50 000; 1/250 000; 1/500 000, in analogue and digital formats. There is a complete collection for the country of aerial photos for the years 1996 and 2006, available in digital format. The institution has a GIS department that has all the thematic layers that are used in the production of the most recent topographic maps series (NE of the Country), in vector format.

Ministry of Environment and Turism (MET), Windhoek

The institution with the responsibility of promoting and protect the natural resources of Namibia, namely the protected areas network, has a considerable databank on wildlife census data formatted in GIS language.

Lux-Development, Rundo

This institution has been conducting development cooperation programmes in NE Namibia as the implementing agency for the Government of Luxembourg. In the Kavango and Caprivi regions, it's been the key player in developing a GIS database and cartographic production for this part of the country, with a vast assembly of geographic referenced data, under the aim of produce an updated version of the 1/50 000 topographic maps of Kavango and Caprivi, and to create and develop awareness of using GIS data (cartographic data in digital format) for regional development.

Research and Information Services of Namibia (RAISON), Windhoek

This private company, has been engaged in the fields of environmental information, education and health for the Okavango River Basin, and has compiled a GIS database for this purposes.

4.1.4. Zimbabwe

The Surveyor General, Harare

This institution is the national repository and producer of cartographic data, namely topographic maps. A collection of 1/250 000 maps has been included in the database.

4.1.5. Other Sources

Russian Topographic Map Series

The quality and extent of the former Soviet Union cartographic efforts, have until recently been unknowned of the general public. Most of Southern Africa has been mapped at detailed scales of 1/100 000 and 1/200 000 during the mid 80´s to the late 90´s by Russian cartographers. This information is now available, in most part, with limited acquisition constrains, which make this data ready to use if necessary, by the absence of more qualified topographic information for some of the areas of the sub continent.

The Soil Maps of Africa

A large raster, non georeferenced, data bank of thematic maps mainly related with pedology, for the African continent. This information is provided by the Joint Researched Center of the European Commission, and is freely available from http://eusoils.jrc.it/ESDB_Archive/EuDASM/Africa/.

Soil/Terrain (SOTER) Database for Southern Africa

A soil GIS database is available, by the agreement between FAO and ISRIC for the compilation and harmonization of SOTER databases, for seven countries (Angola, Botswana, Namibia, Mozambique, South Africa, Swaziland, Tanzania and Zimbabwe) at an equivalent scale of 1/2 000 000.

Landsat GeoCover 2000/ETM+

The Landsat satellite series represents one of the longest continuous records in remote sense observation of the Earth, at a nominal scale ranging from 1/250 000 to 1/100 000. Only recently, mid 2003, the latest sensor in the series (Landsat 7 ETM+) developed a malfunction that has prevented since then the proper acquisition of information from this sensor. The data is distributed for selected dates freely from the Global Land Cover Facility. Sets of the complete collection for this satellites data can be purchased from the US Geological Survey.

Shuttle Radar Topography Mission (SRTM) 90m Digital Elevation Data

In February 2000, with the aid of a 60-m (200-ft) boom added to the SIR-C, the Shuttle Radar Topography Mission (SRTM) circled Earth for 10 days mapping 80 percent of the world's land area. The resulting high-resolution topographic map is the most accurate available and provides a worldwide topographic data set between 60° N and S latitudes with a consistent datum. This provides the fundamental base information in the characterization of the topography elevation, slopes, aspect, etc., and underlines the essential level for building analytic models. At the time this data is provided freely, by the CGIAR Consortium for Spatial Information, at a resolution of 3 arc seconds (aprox. 90m), for the region concerned.

Part I – Okavango Mega Basin

GIS Data Base / Map Sets

SECTION: ADMINISTRATION AND POLITICAL BOUNDARIES

THEME CLASS: COUNTRY BOUNDARIES
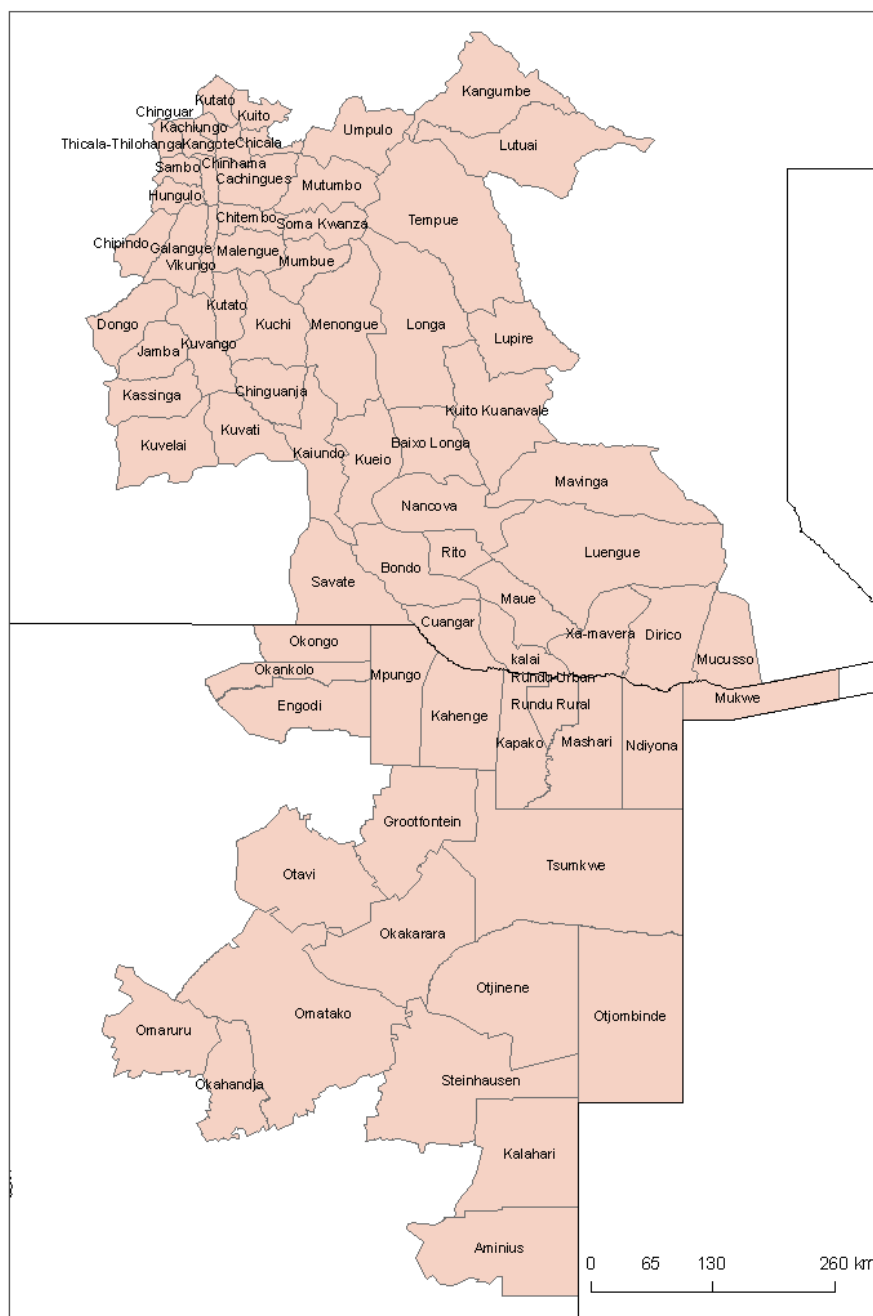**COVERAGE NAME:** *OB_APB_COUNTRY_BOUNDARIE*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the political boundaries of the 4 riparian countries.
SOURCE: Digital Chart of the World (DCW) with further editing corrections for a more accurate spatial definition.
STATUS: Completed

SECTION: ADMINISTRATION AND POLITICAL BOUNDARIES

THEME CLASS: REGIONAL BOUNDARIES
COVERAGE NAME: *OB_APB_REGIONAL_BOUNDARIE*
FEATURE CLASS TYPE: *Polygon*
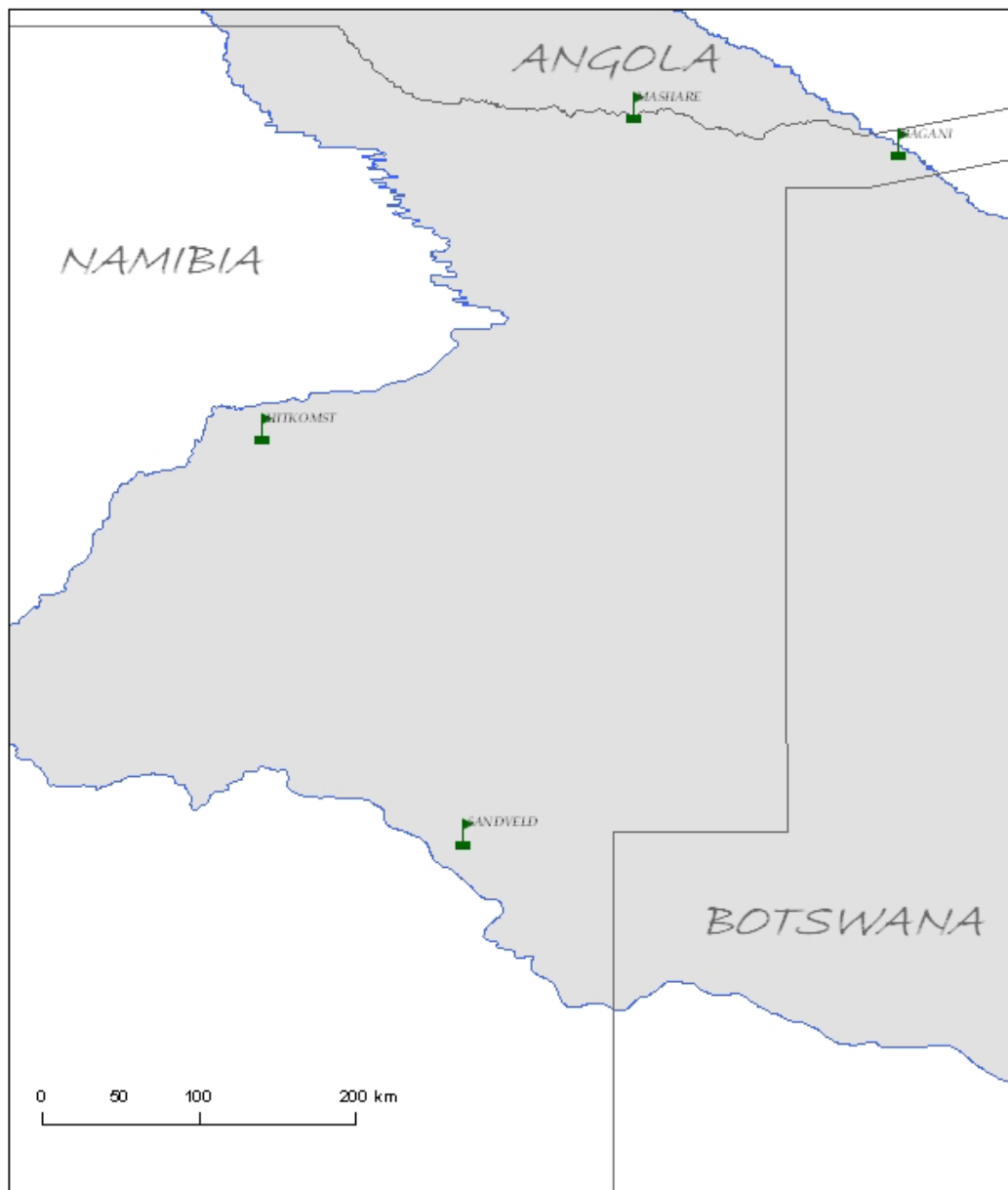**SCALE:** *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the political regional boundaries (level of Province, Region and District) in the 4 riparian countries, that share geographical overlapping with the Okavango Basin.
SOURCE: DCW with further editing corrections for a more accurate spatial definition.
STATUS: Completed

SECTION: ADMINISTRATION AND POLITICAL BOUNDARIES

THEME CLASS: LOCAL BOUNDARIES
COVERAGE NAME: *OB_APB_LOCAL_ADMIN1_BOUNDARIE*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the political administration level 1 boundaries (level of Municipality, (Region) and subdistrict) in the 4 riparian countries, that share geographical overlapping with the Okavango Basin.
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: ADMINISTRATION AND POLITICAL BOUNDARIES

THEME CLASS: LOCAL BOUNDARIES
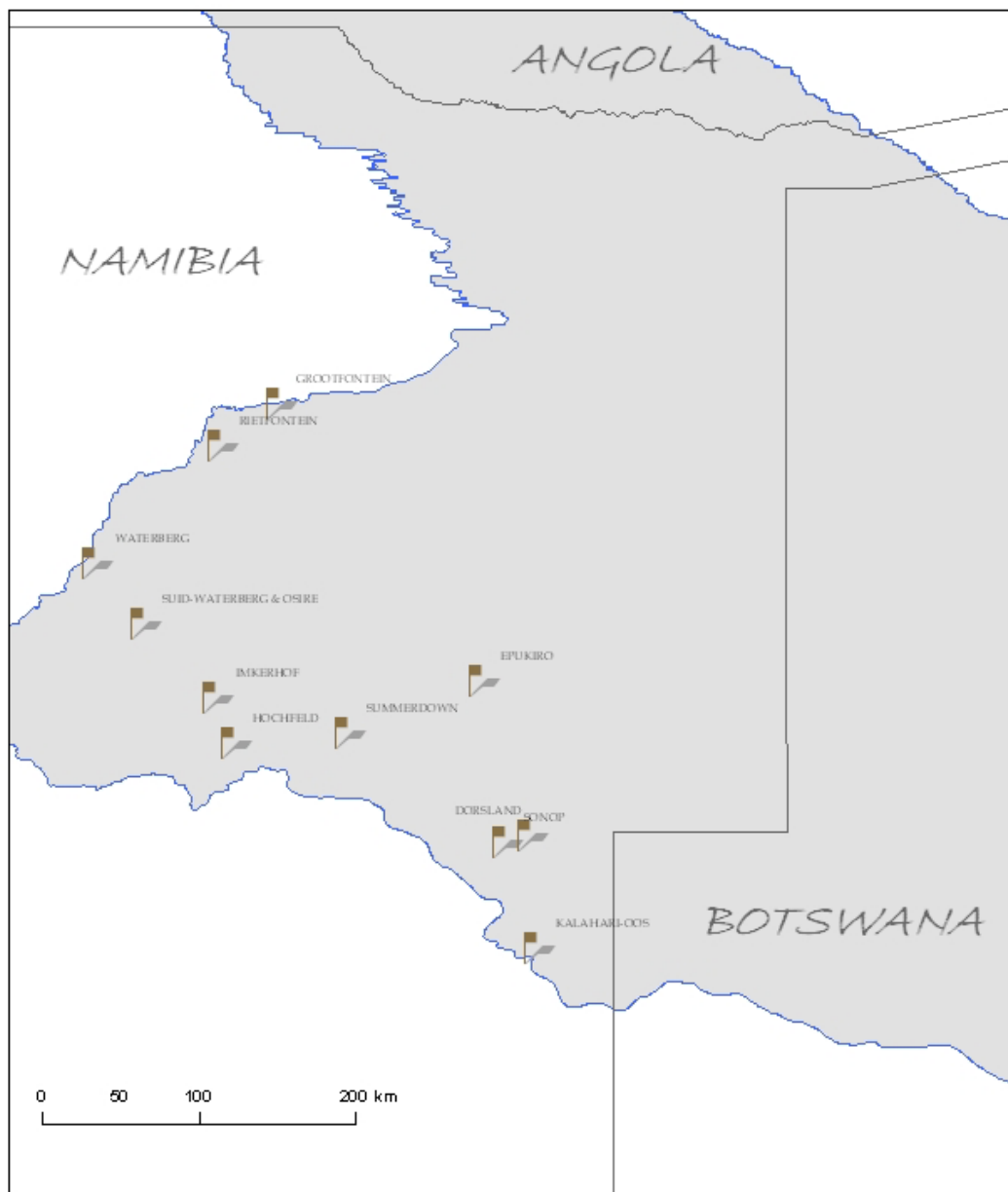**COVERAGE NAME:** *OB_APB_LOCAL_ADMIN2_BOUNDARIE*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the political administration level 2 boundaries (level of Communa, and Constituancie) in Angola and Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LAND
COVERAGE NAME: *OB_AL_LAND_GOVERMENTFARMS_NAMIBIA*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Government Farms, as of 2005, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
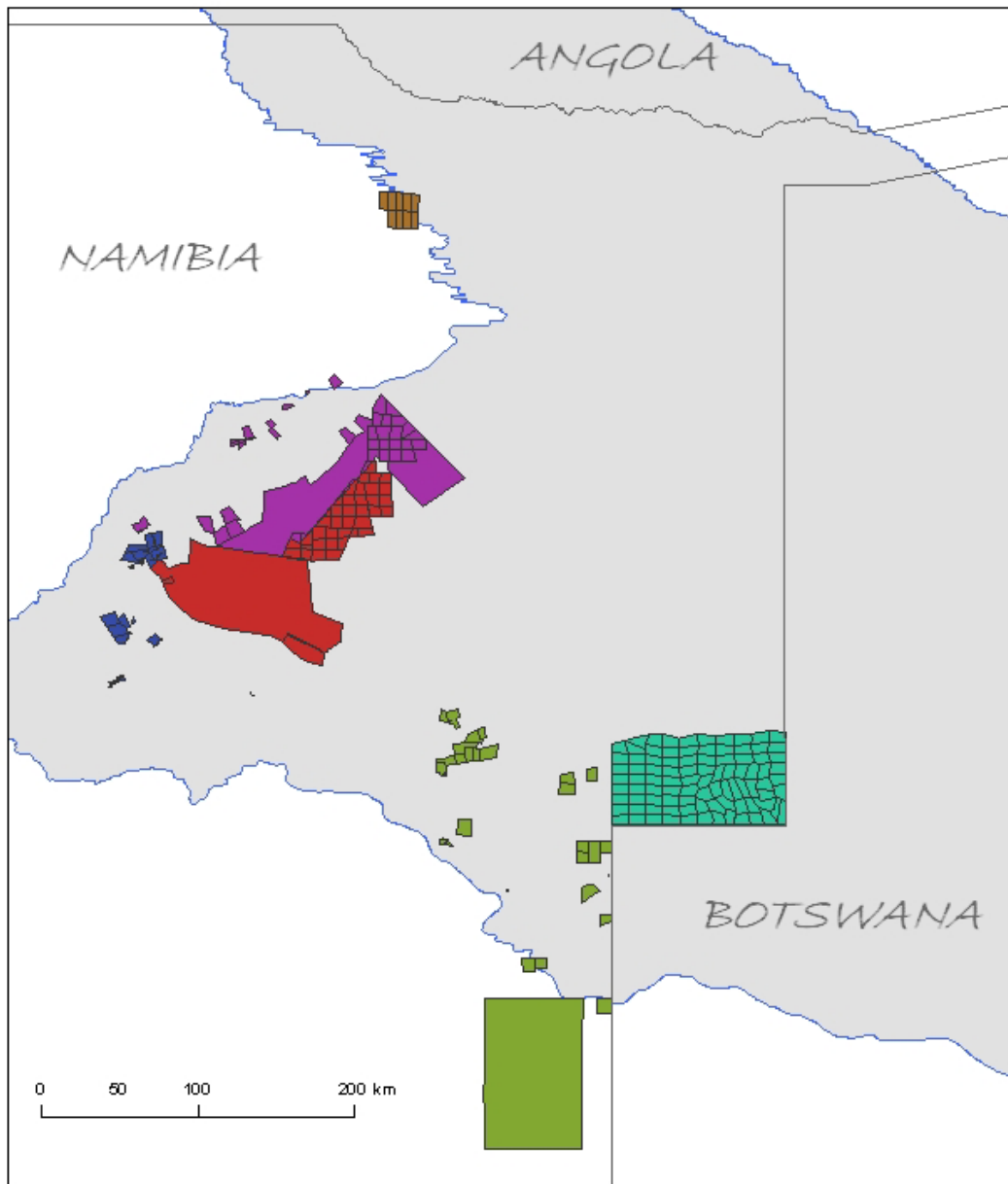
SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LAND
**COVERAGE NAME:** *OB_AL_LAND_RESETTLEMENTFARMS_NAMIBIA*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of resettlement Farms, as of 2005, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
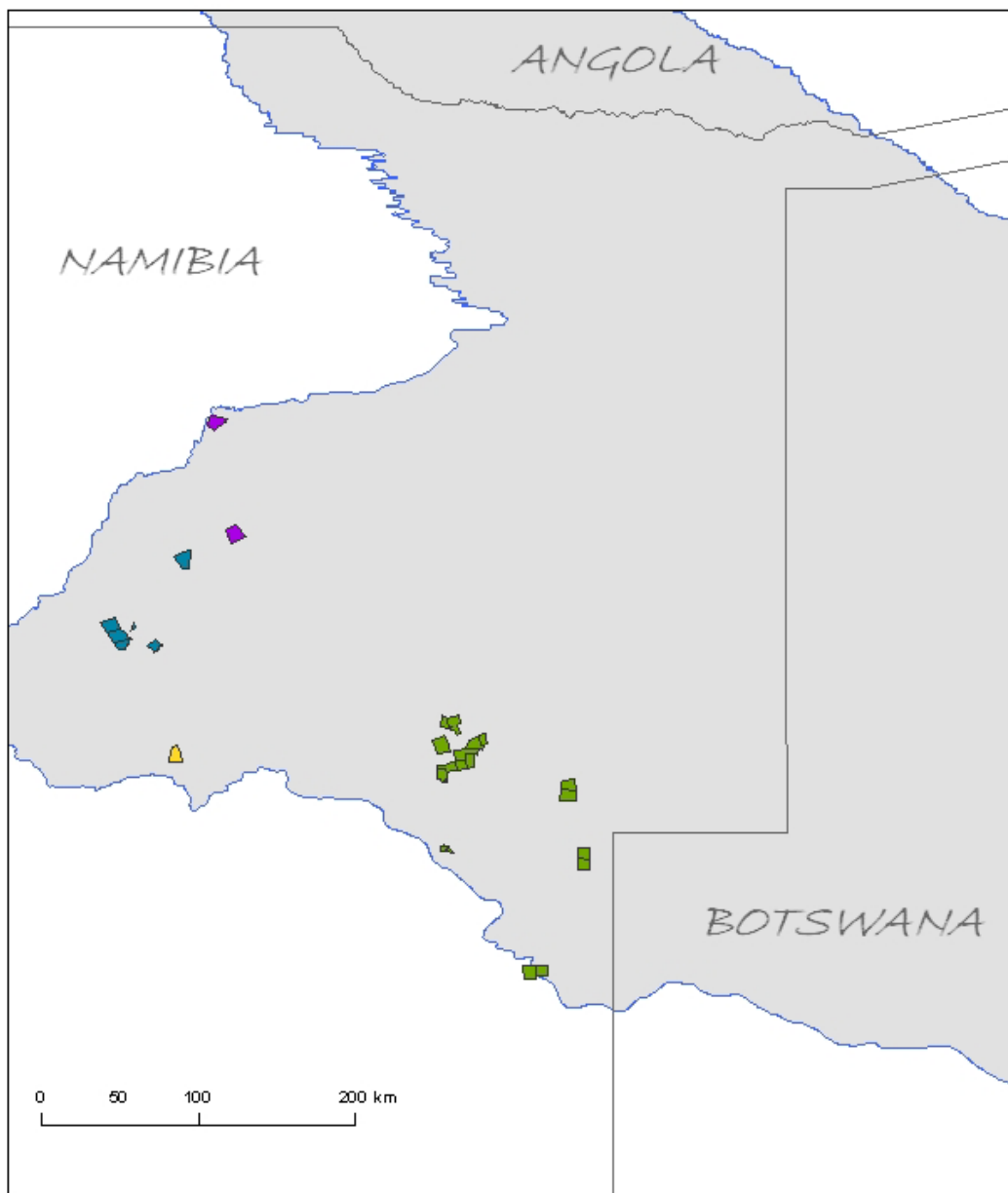
SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LAND
COVERAGE NAME: *OB_AL_Land_Agriresearchstations03_Namibia*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Agriculture Research Stations, as of 2003, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LAND
COVERAGE NAME: *OB_AL_LAND_FARMERSASSOCIATIONS05_NAMIBIA*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Farmers Associations, as of 2005, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LIVESTOCK
COVERAGE NAME: *OB_AL_LIVESTOCK_VETERINARIANOFFICES_NAMIBIA*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Veterinarian Offices, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: AGRICULTURE AND LIVESTOCK

THEME CLASS: LIVESTOCK
COVERAGE NAME: *OB_AL_LIVESTOCK_VETERINARIANGAMEFENCES*
FEATURE CLASS TYPE: *Line*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Veterinary and Game Fences, that share geographical overlapping with the Okavango Basin.
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: ATMOSPHERIC AND CLIMATE DATA

THEME CLASS: PRECIPITATION
COVERAGE NAME: *OB_ACD_PRECIPITATION_RAINSTATIONS_NAMIBIA*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: This layer represents the spatial distribution of Rain Mesuring Stations, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
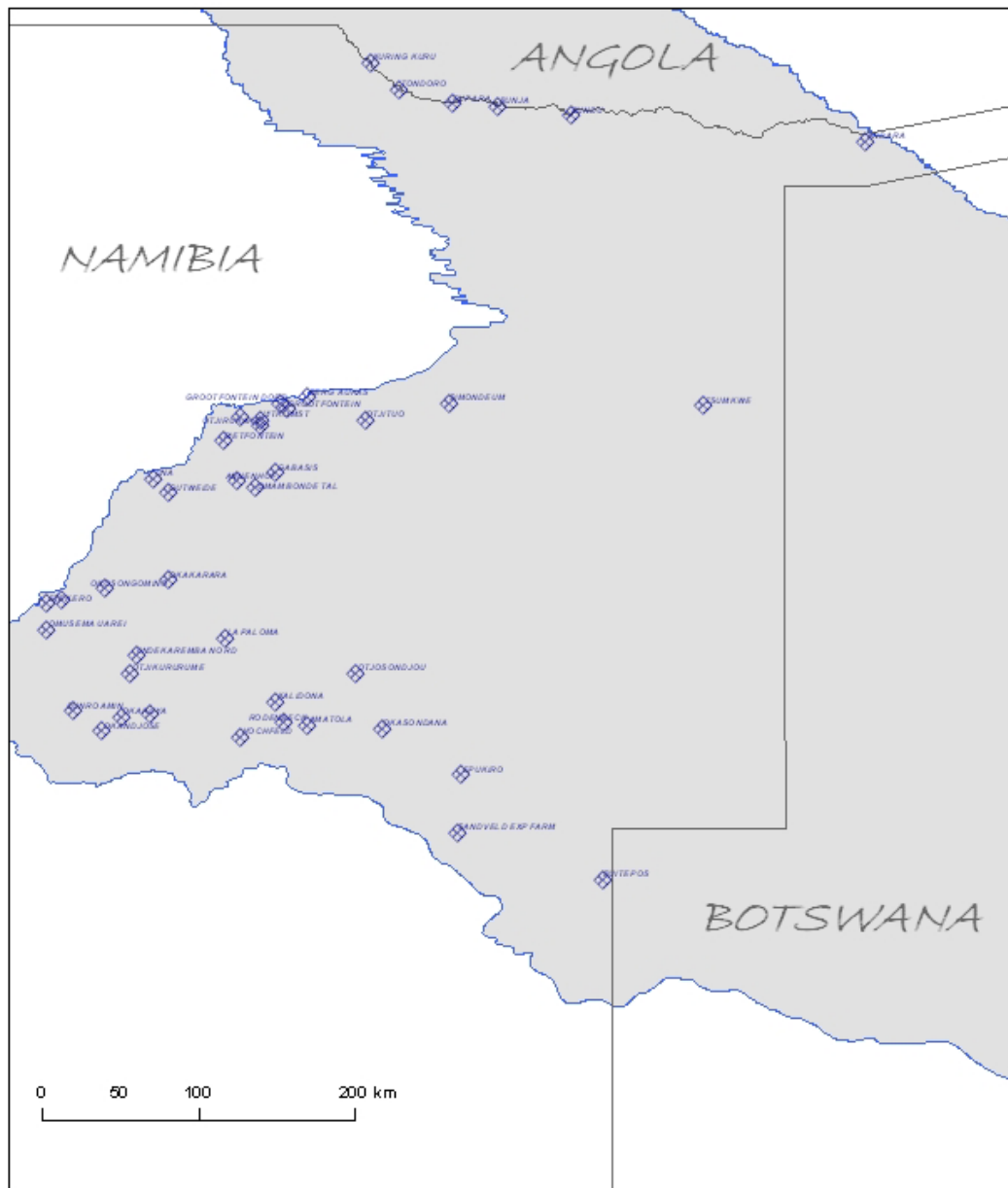
SECTION: ATMOSPHERIC AND CLIMATE DATA

THEME CLASS: TEMPERATURE
COVERAGE NAME: *OB_TP_JAN, ..., OB_TP_DEC, OB_TP_AVR, OB_TP_ANN, OB_TP_MN*
FORMAT: *Raster*
SCALE: *1:5 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: A set of 15 raster layers representing the monthly, annual, mean and average temperature for the Okavango Rive Basin.
SOURCE: Africa Water Resources Database (FAO).
STATUS: Completed
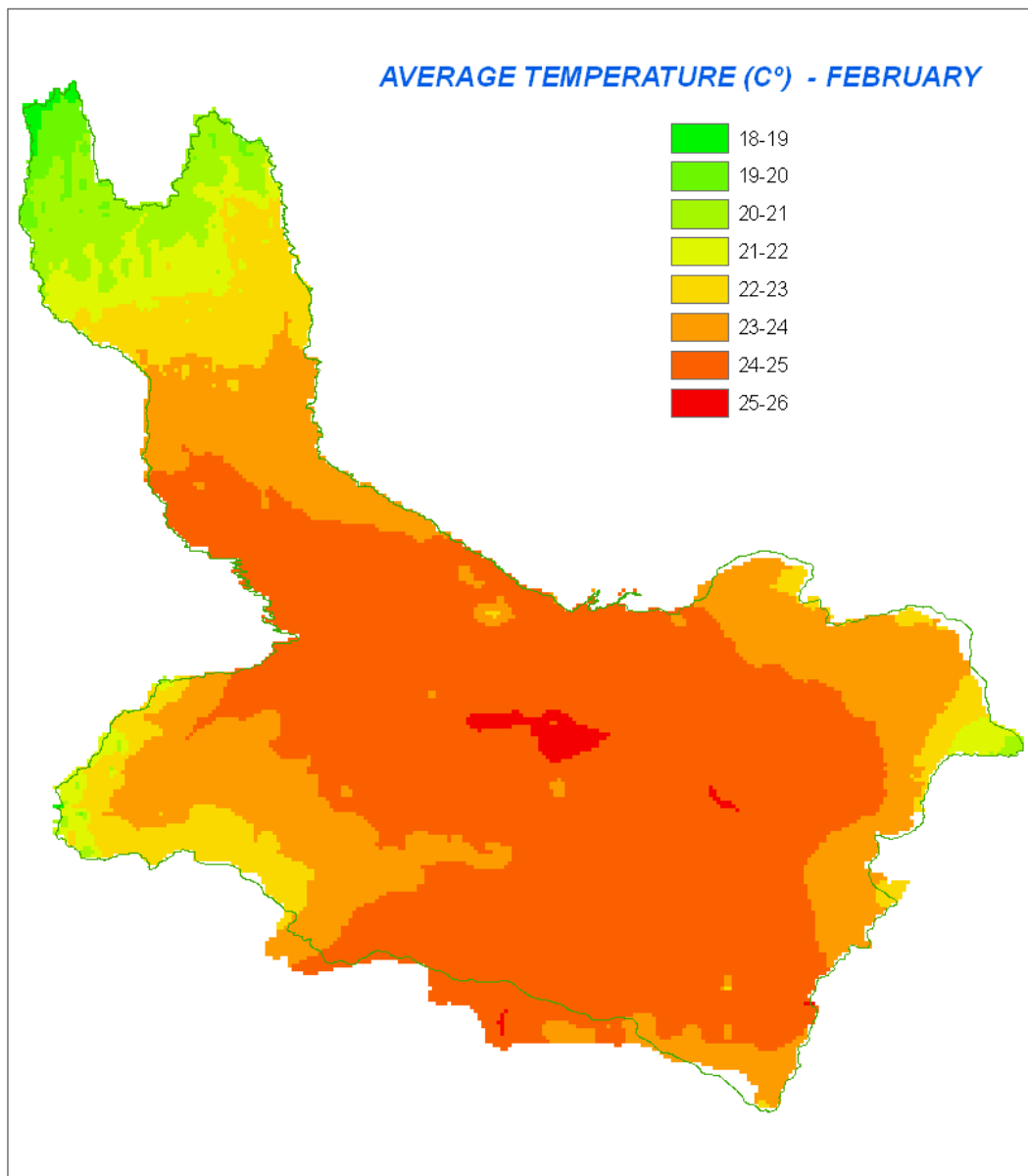
SECTION: ATMOSPHERIC AND CLIMATE DATA

THEME CLASS: PRECIPITATION
COVERAGE NAME: *OB_PP_JAN, ..., OB_PP_DEC, OB_PP_ANN,*
FORMAT: *Raster*
SCALE: *1:10 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: A set of 13 raster layers representing the monthly and annual, average precipitation for the Okavango Rive Basin.
SOURCE: Africa Water Resources Database (FAO).
STATUS: Completed
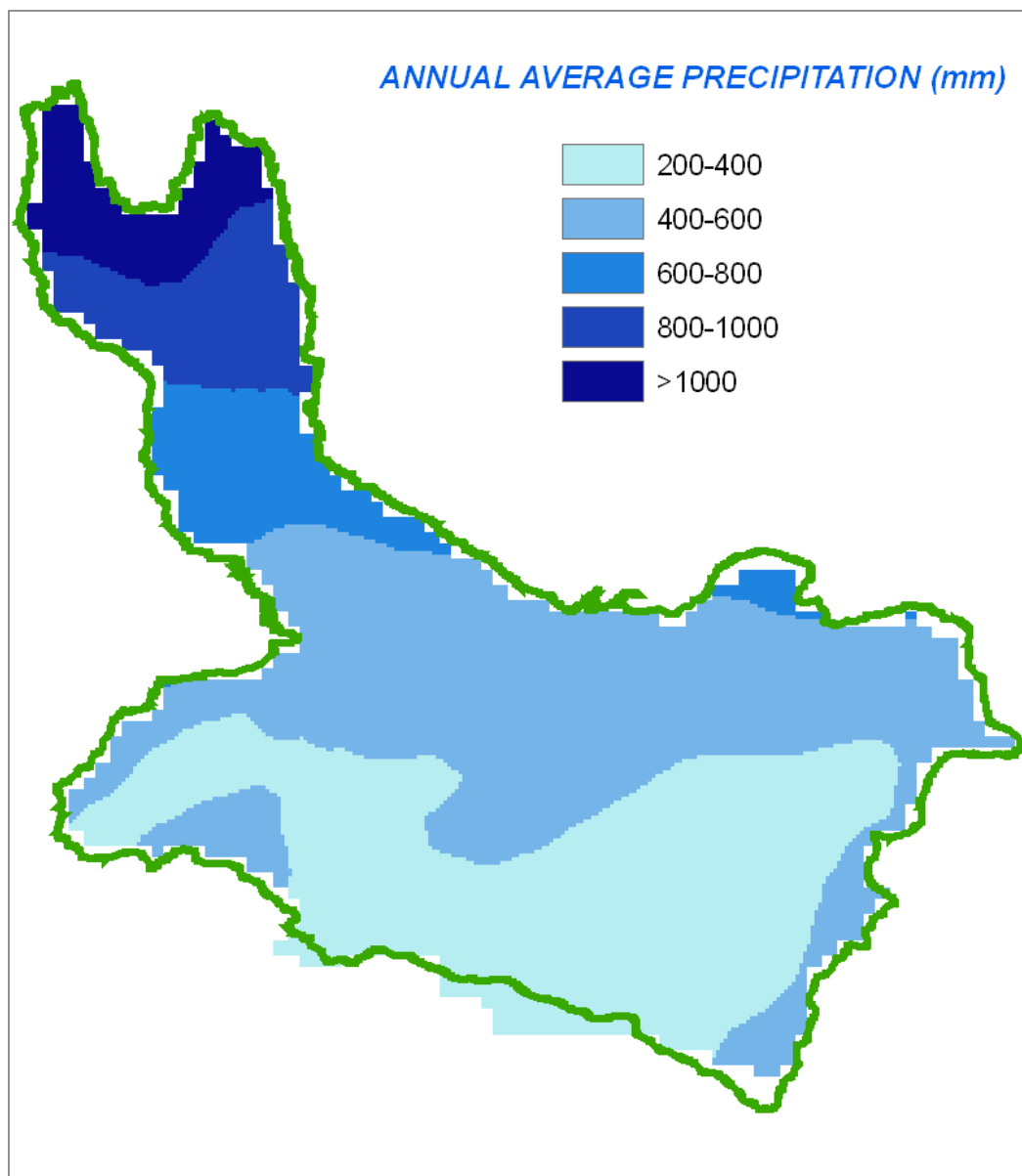
SECTION: BIOLOGIC AND ECOLOGIC INFORMATION

THEME CLASS: FAUNA, FISH
COVERAGE NAME: *OB_BEI_FISH_CG, OB_BEI_FISH_PP*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: A set of 2 features depicting the distribution of two important fish species (*Clarias gariepinus* and *Pseudocrenilabrtus philander*).
SOURCE: Africa Water Resources Database (FAO).
STATUS: Completed
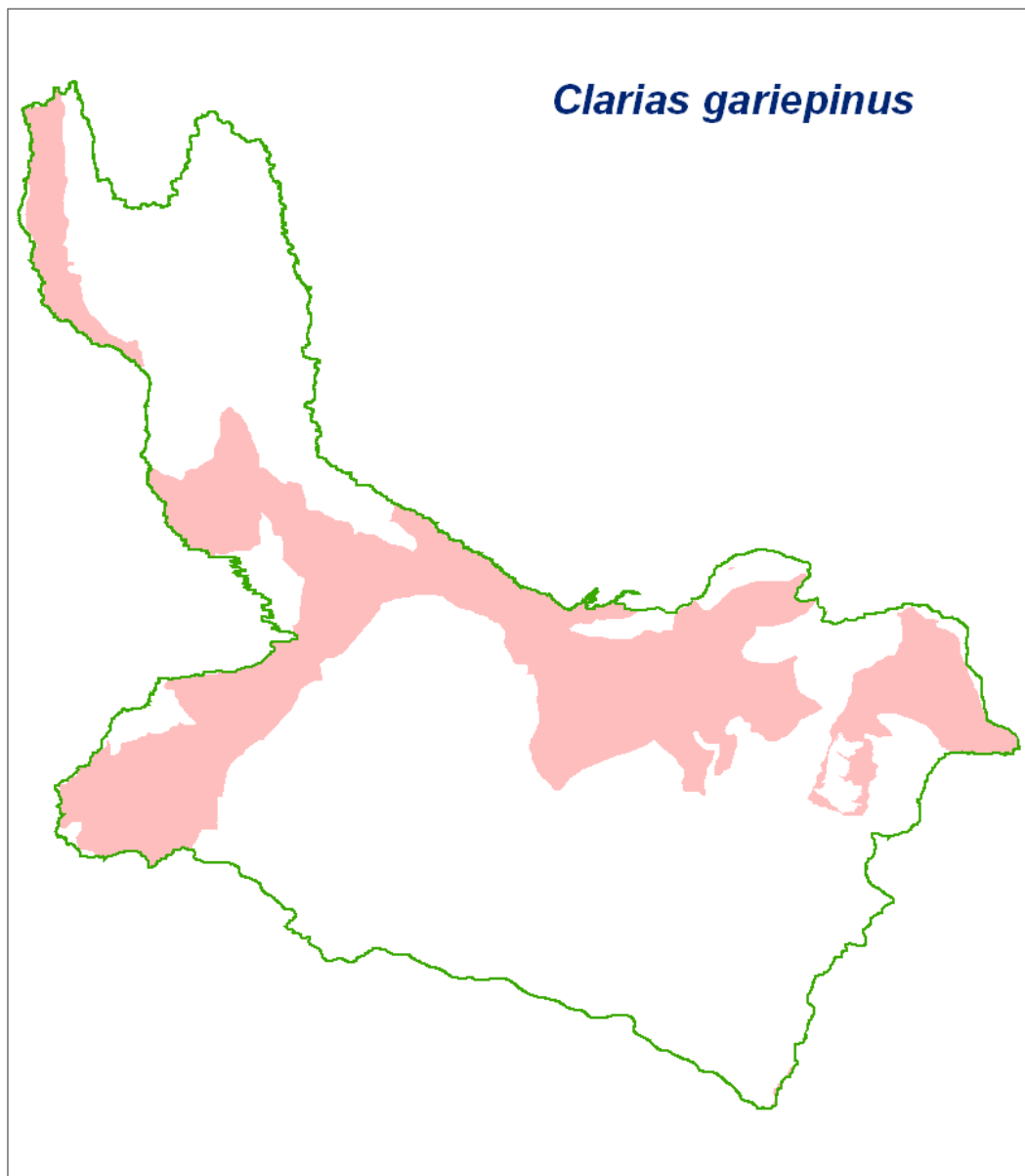
SECTION: BIOLOGIC AND ECOLOGIC INFORMATION

THEME CLASS: FAUNA, FISH
COVERAGE NAME: *OB_BEI_FISH_SPECIES*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Comprises de location of fish species records within the Okavango Basin.
SOURCE: Africa Water Resources Database (FAO).
STATUS: Completed

Fish Species Records
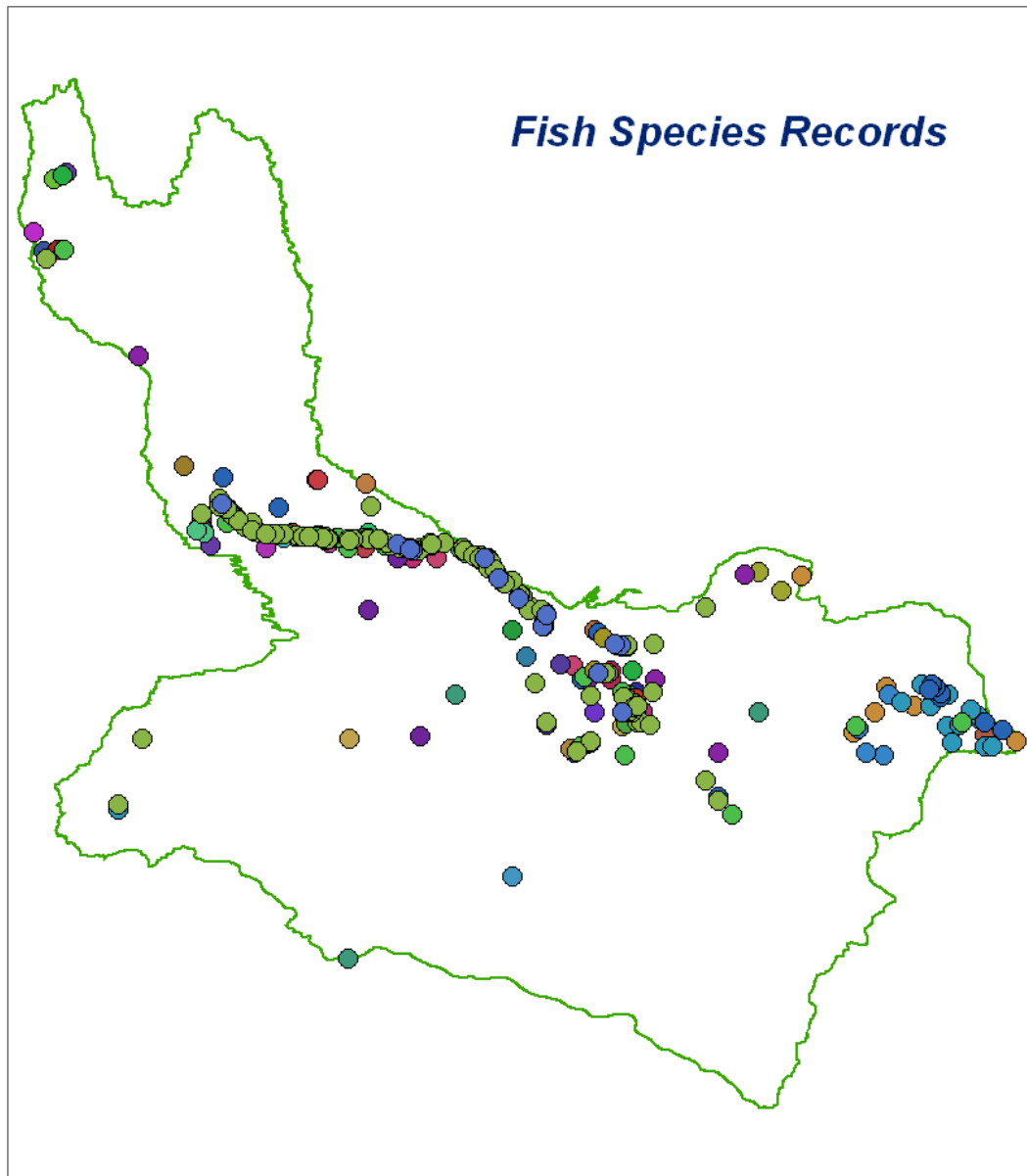
SECTION: BIOLOGIC AND ECOLOGIC INFORMATION

THEME CLASS: FLORA
COVERAGE NAME: *OB_BEI_FLORA_PHYTOGEOGRAPHICUNITS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineates phytogeographic units within the Okavango Basin.
SOURCE: Several (FAO, WCMC, Phytogeographic Chart of Angola). Irreconcilable adjustments between Namibia and Botswana.
STATUS: Completed
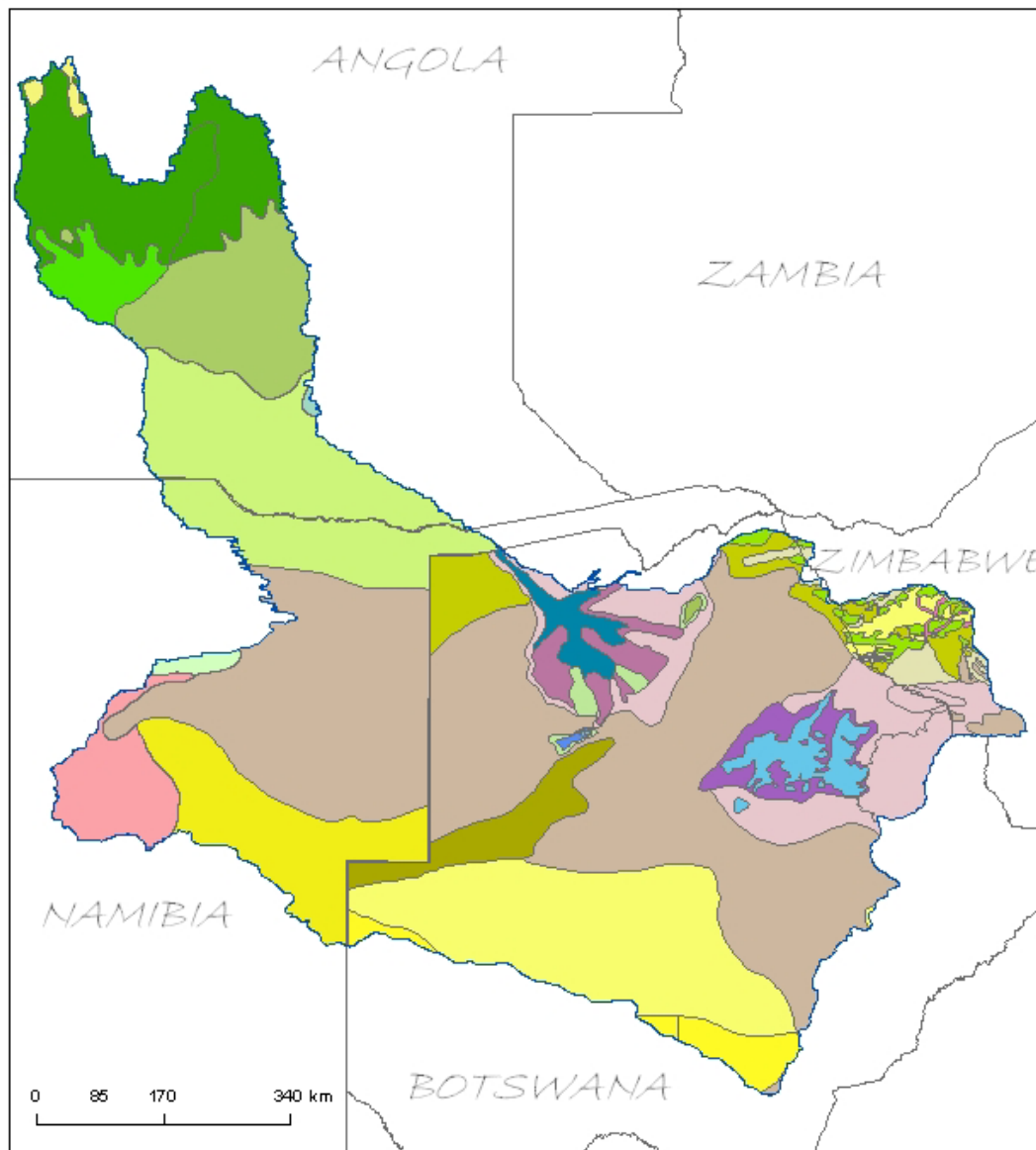
SECTION: BIOLOGIC AND ECOLOGIC INFORMATION

THEME CLASS: FLORA
COVERAGE NAME: *OB_BEI_FLORA_VEGETATIONUNITS_WHITE1983*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineates vegetation units within the Okavango Basin.
SOURCE: Vegetation Map of Africa, White 1983, UNESCO/AETFAT/UNSO.
STATUS: Completed
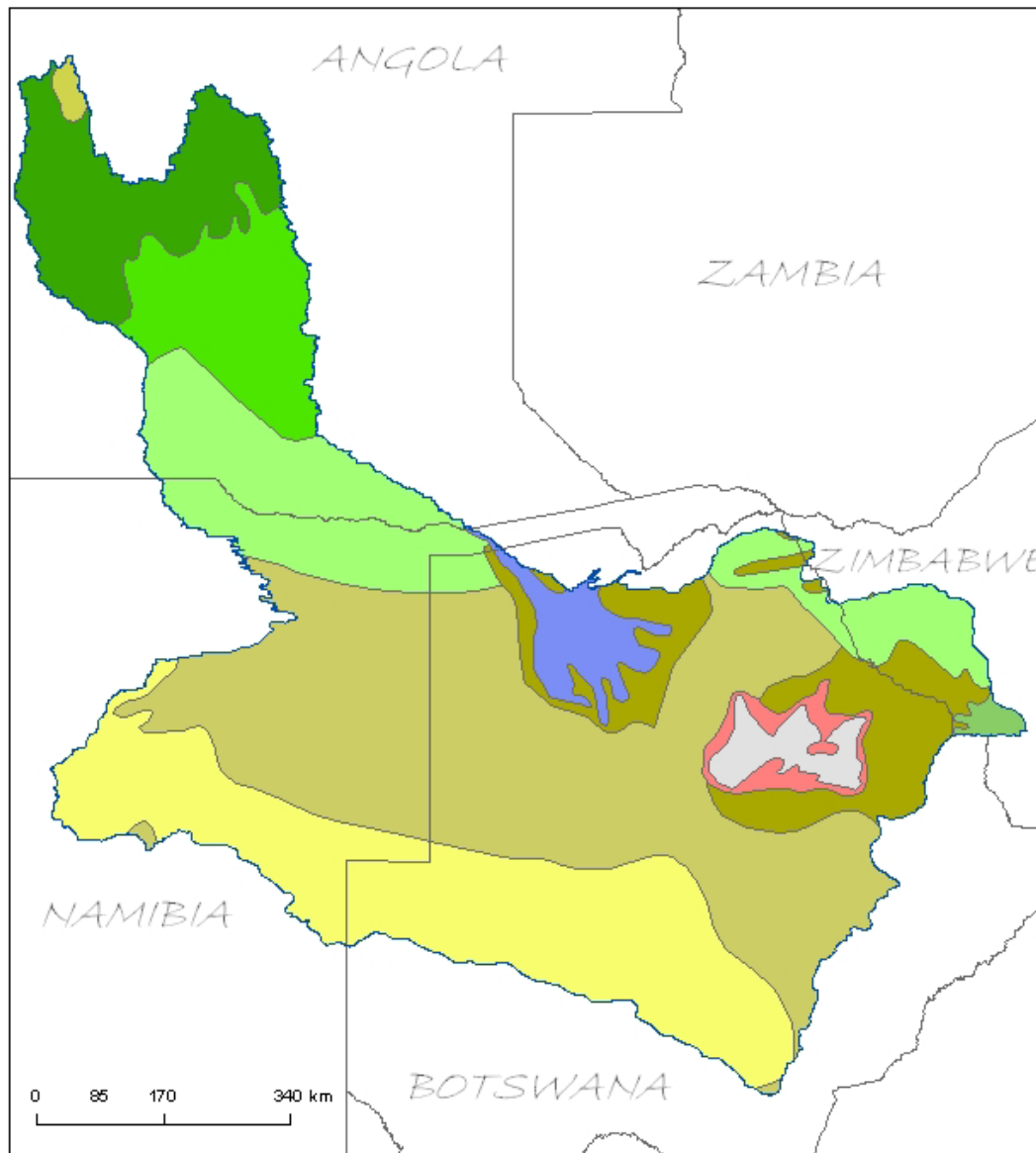
SECTION: BIOLOGIC AND ECOLOGIC INFORMATION

THEME CLASS: HABITAT
COVERAGE NAME: *OB_BEI_HABITAT_ECORREGIONS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineates Ecorregions within the Okavango Basin.
SOURCE: World Wild Life Fund (WWF).
STATUS: Completed
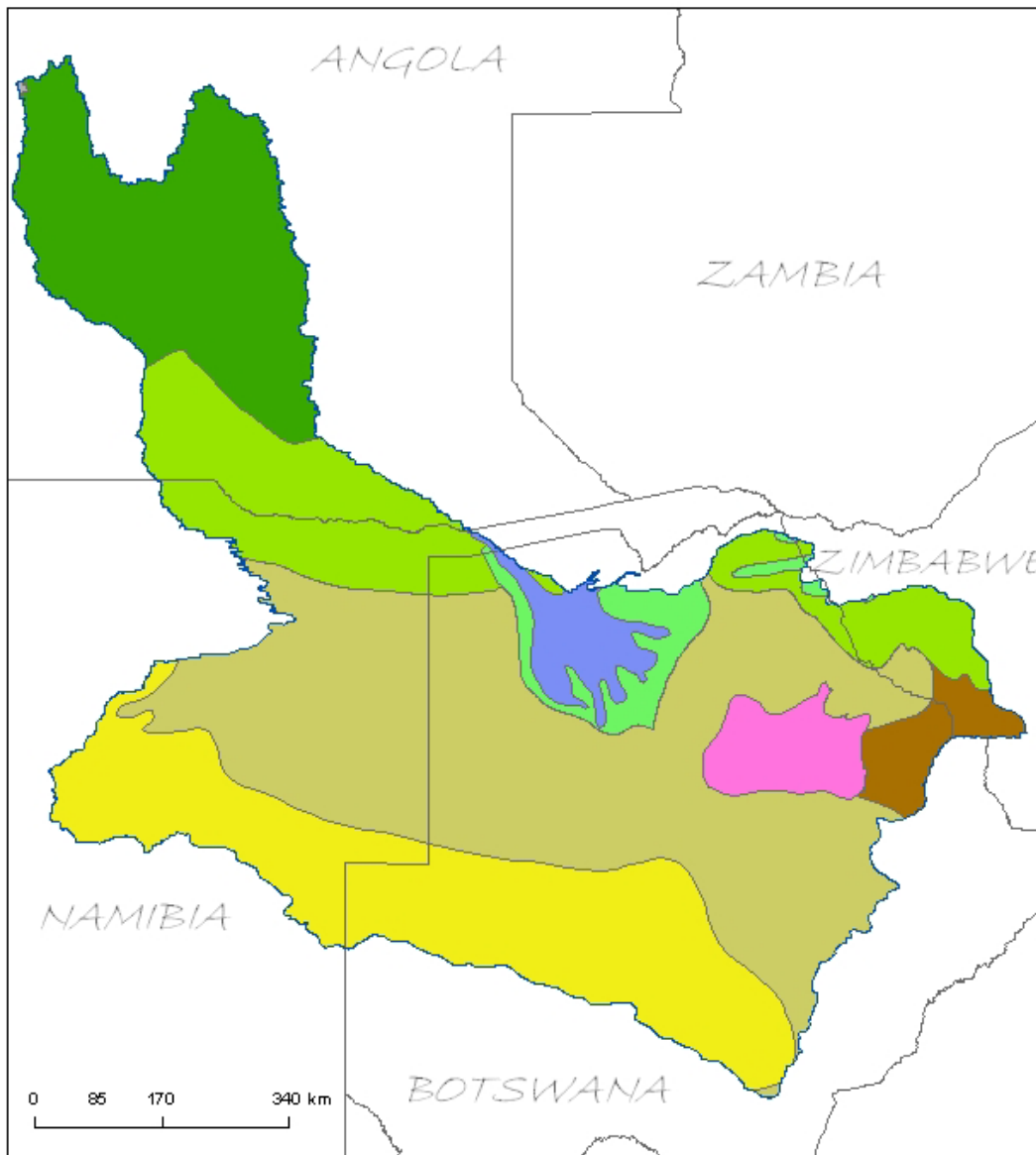
SECTION: EARTH SURFACE CHARACTERISTICS / LAND COVER

THEME CLASS: LANDCOVER
COVERAGE NAME: *OB_LANDCOVER*
FORMAT: *Raster*
SCALE: *1: 1 000 000 (250m)*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Land Cover Model.
SOURCE: Generated under the GIS EPSMO program (Classification based on MODIS Vegetation Continues Fields data from 2000-2005).
STATUS: Completed
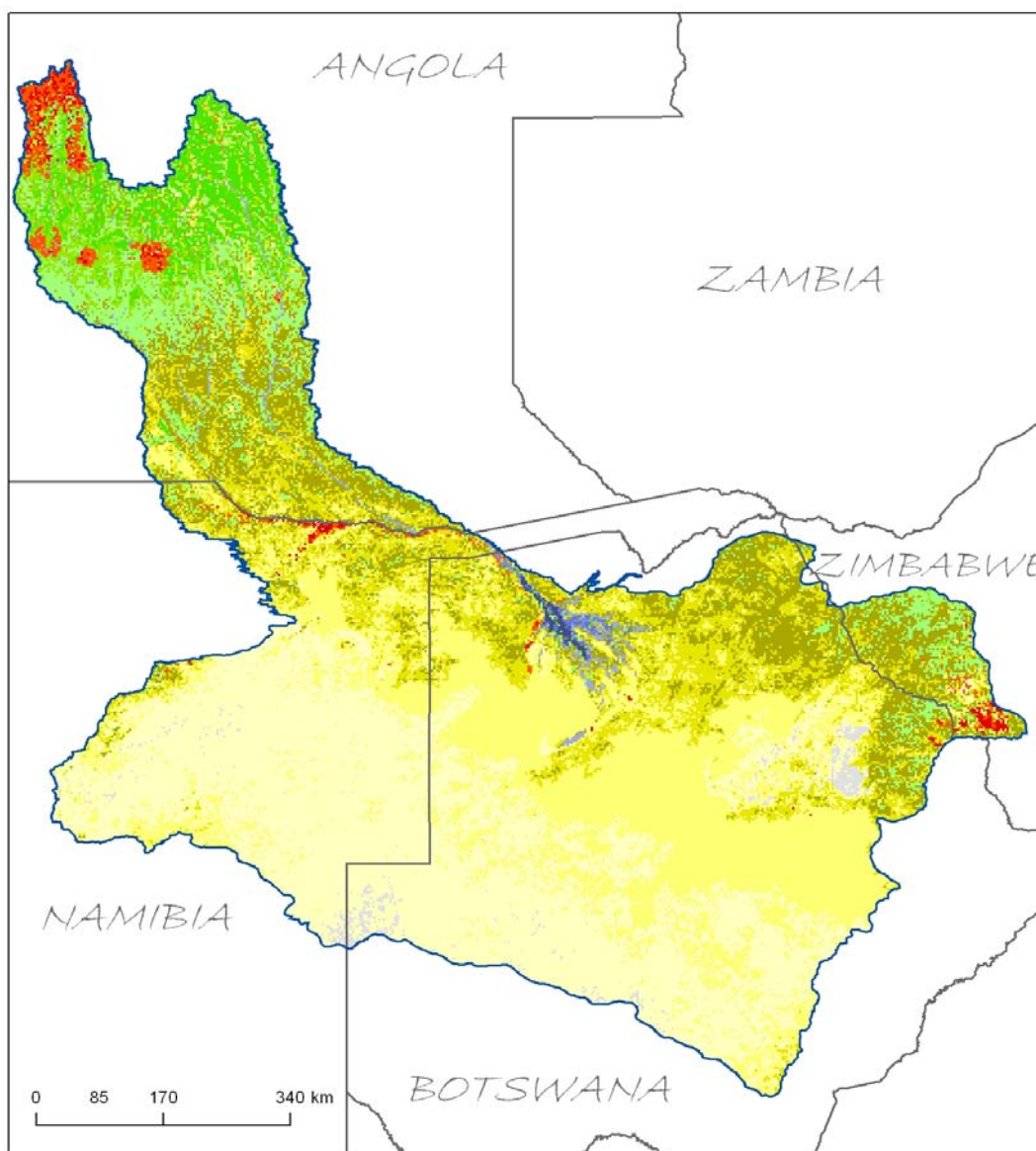
SECTION: EARTH SURFACE CHARACTERISTICS / LAND COVER

THEME CLASS: LAND USE
COVERAGE NAME: *OB_ESCLC_LANDUSE_COMMUNAL_CONSERVANCIES_NAMIBIA*
FORMAT: *Polygon*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Communal Conservancies in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
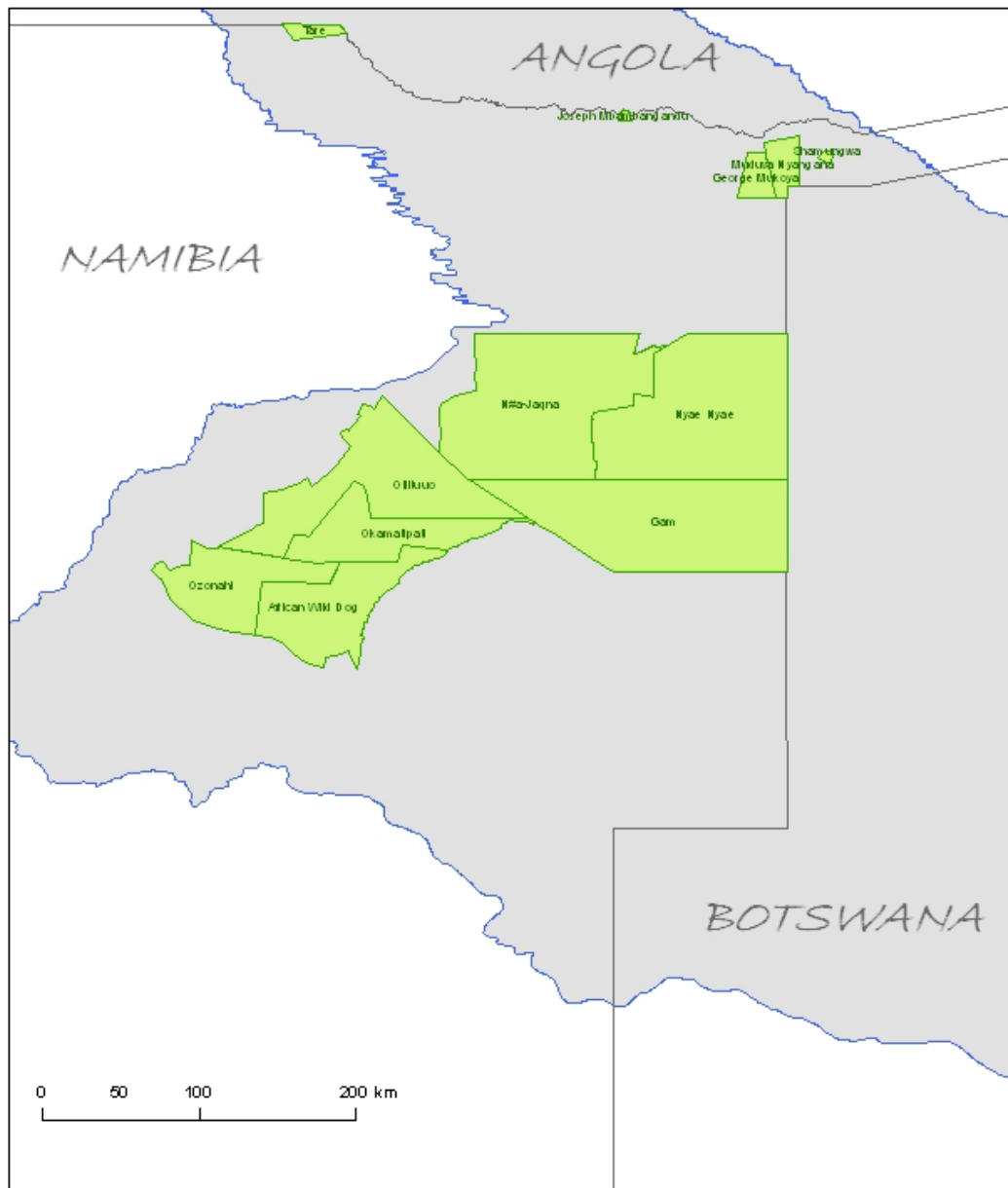
SECTION: EARTH SURFACE CHARACTERISTICS / LAND COVER

THEME CLASS: LAND USE
COVERAGE NAME: *OB_ESCLC_LANDUSE_FARMS2005_NAMIBIA*
FORMAT: *Polygon*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Farms, as of 2005, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
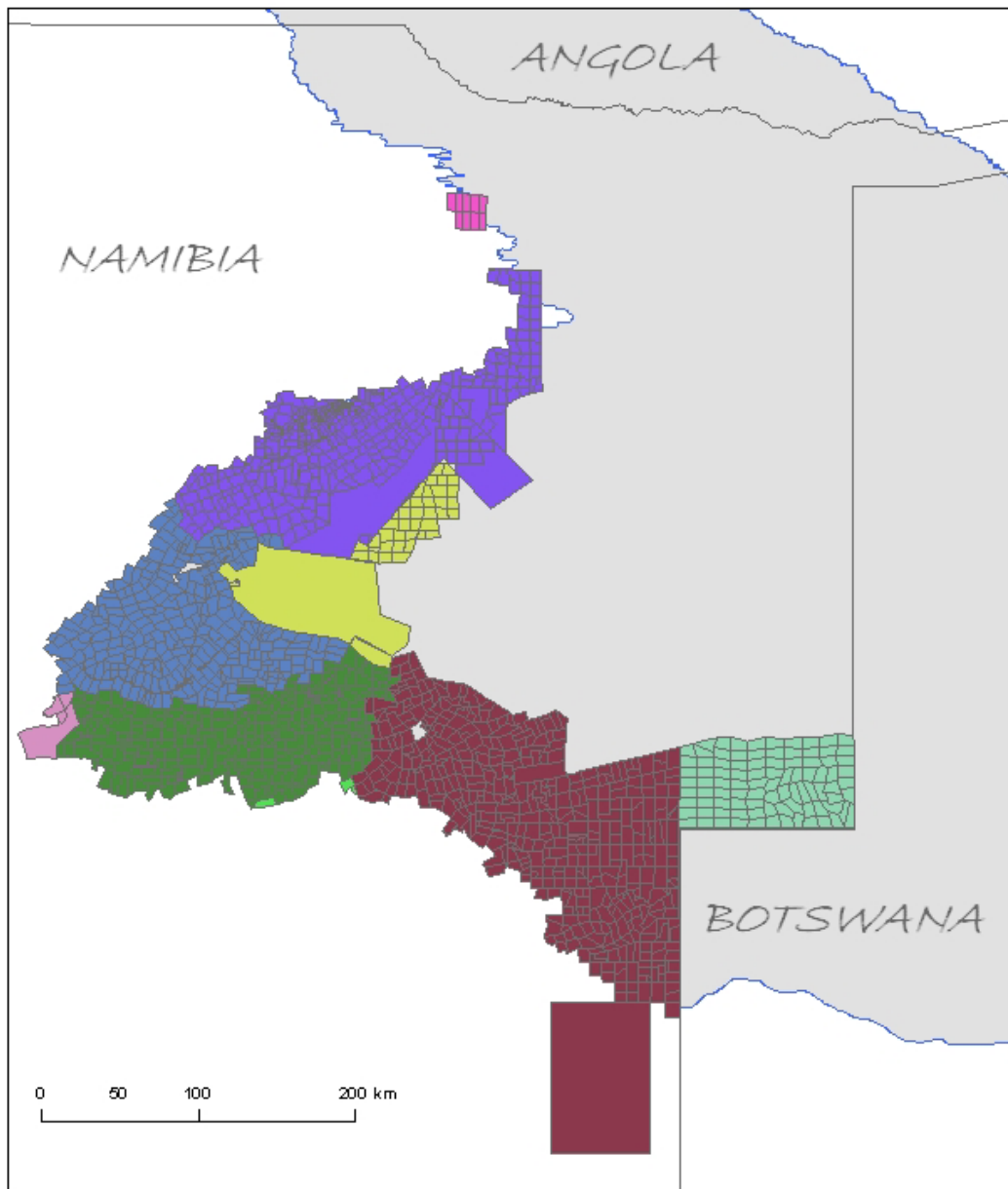
SECTION: EARTH SURFACE CHARACTERISTICS / LAND COVER

THEME CLASS: LAND USE
COVERAGE NAME: *OB_ESCLC_LANDUSE_TOWNLANDS_NAMIBIA*
FORMAT: *Polygon*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Townlands, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: EARTH SURFACE CHARACTERISTICS / LAND COVER

THEME CLASS: LAND USE
COVERAGE NAME: *OB_ESCLC_LANDUSE_LANDUSES_BOTSWANA*
FORMAT: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Land Use Units in Botswana, that share geographical overlapping with the Okavango Basin.
SOURCE: The Botswana National Atlas (The Department of Survey and Mapping).
STATUS: Completed
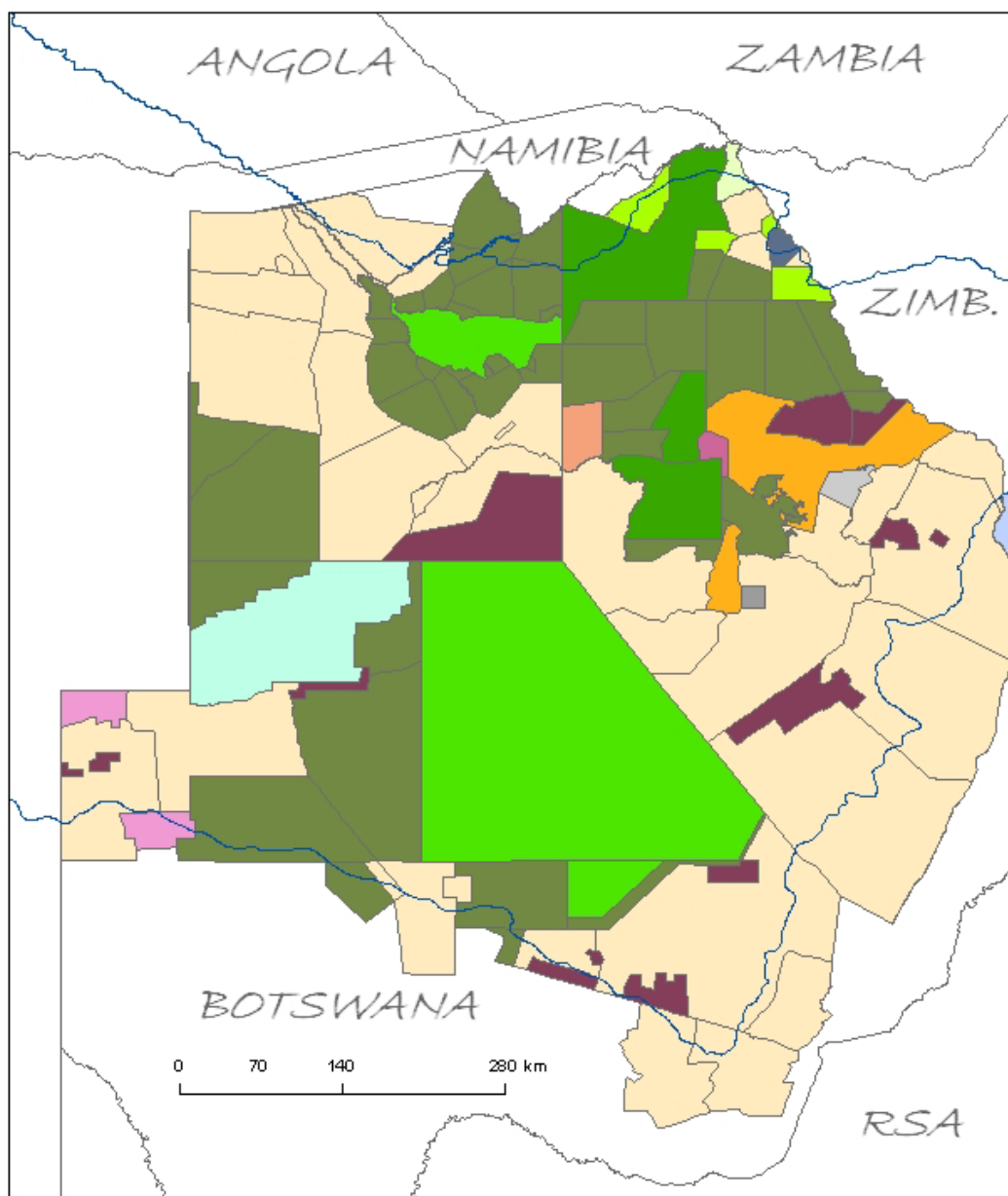
SECTION: ELEVATION

THEME CLASS: CONTOURS
COVERAGE NAME: *OB_E_CONTOURS_CONTOURS100M*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Elevation contours at every 100m.
SOURCE: Generated under the GIS EPSMO program, by interpolation of the DTM model, and further operations of smoothing tolerance.
STATUS: Completed

SECTION: ELEVATION

THEME CLASS: CONTOURS
COVERAGE NAME: *OB_E_CONTOURS_CONTOURS200M*
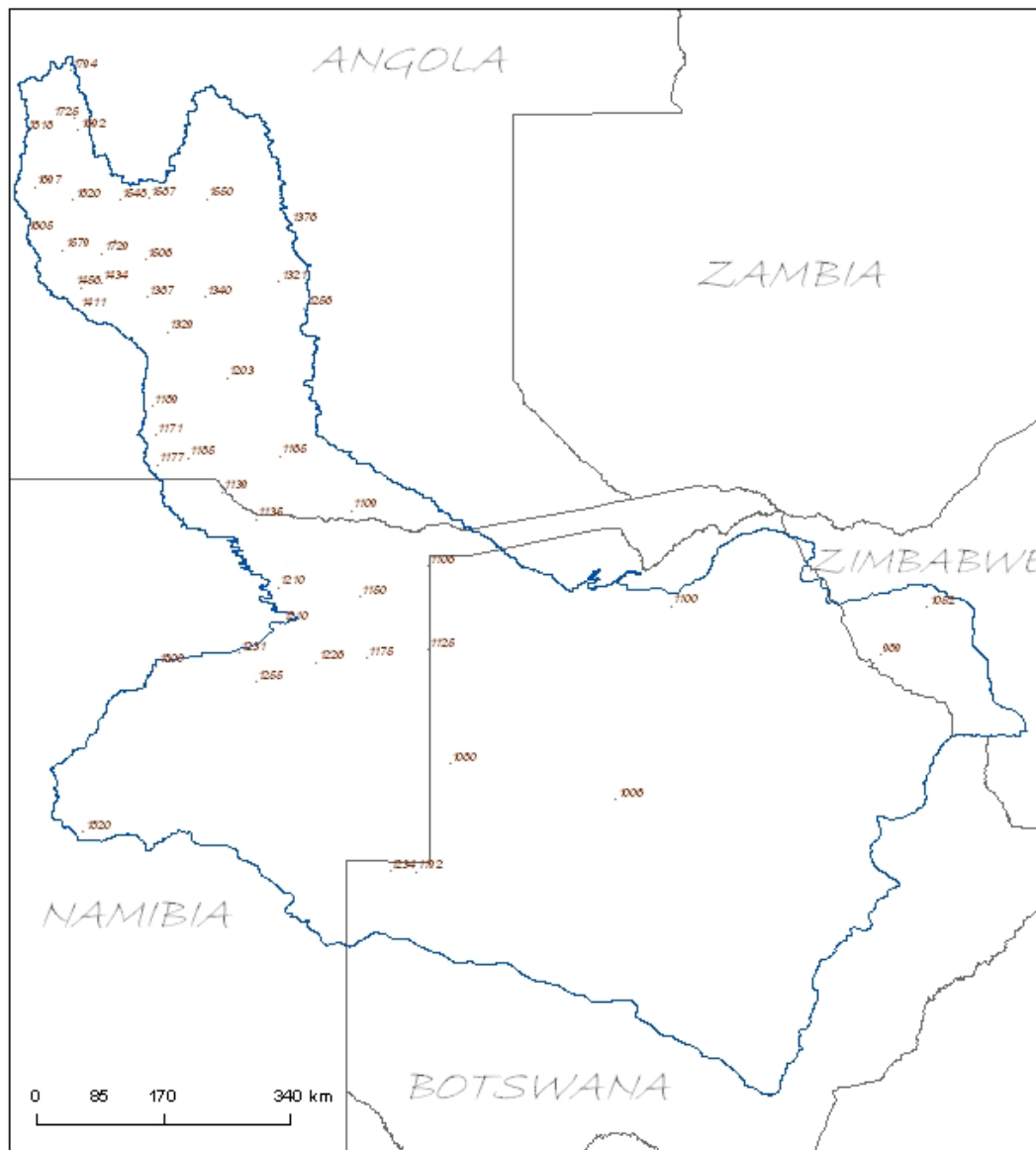**FEATURE CLASS TYPE:** *Line*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Elevation contours at every 200m.
SOURCE: Generated under the GIS EPSMO program, by vectorization of existing topographic maps at 1/1 000 000.
STATUS: Completed

SECTION: ELEVATION

THEME CLASS: DEMs
COVERAGE NAME: *OMB_DTM*
FORMAT: *Raster*
SCALE: *1: 500 000 (90m)*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Digital Elevation Model.
SOURCE: Generated under the GIS EPSMO program (base:SRTM data).
STATUS: Completed
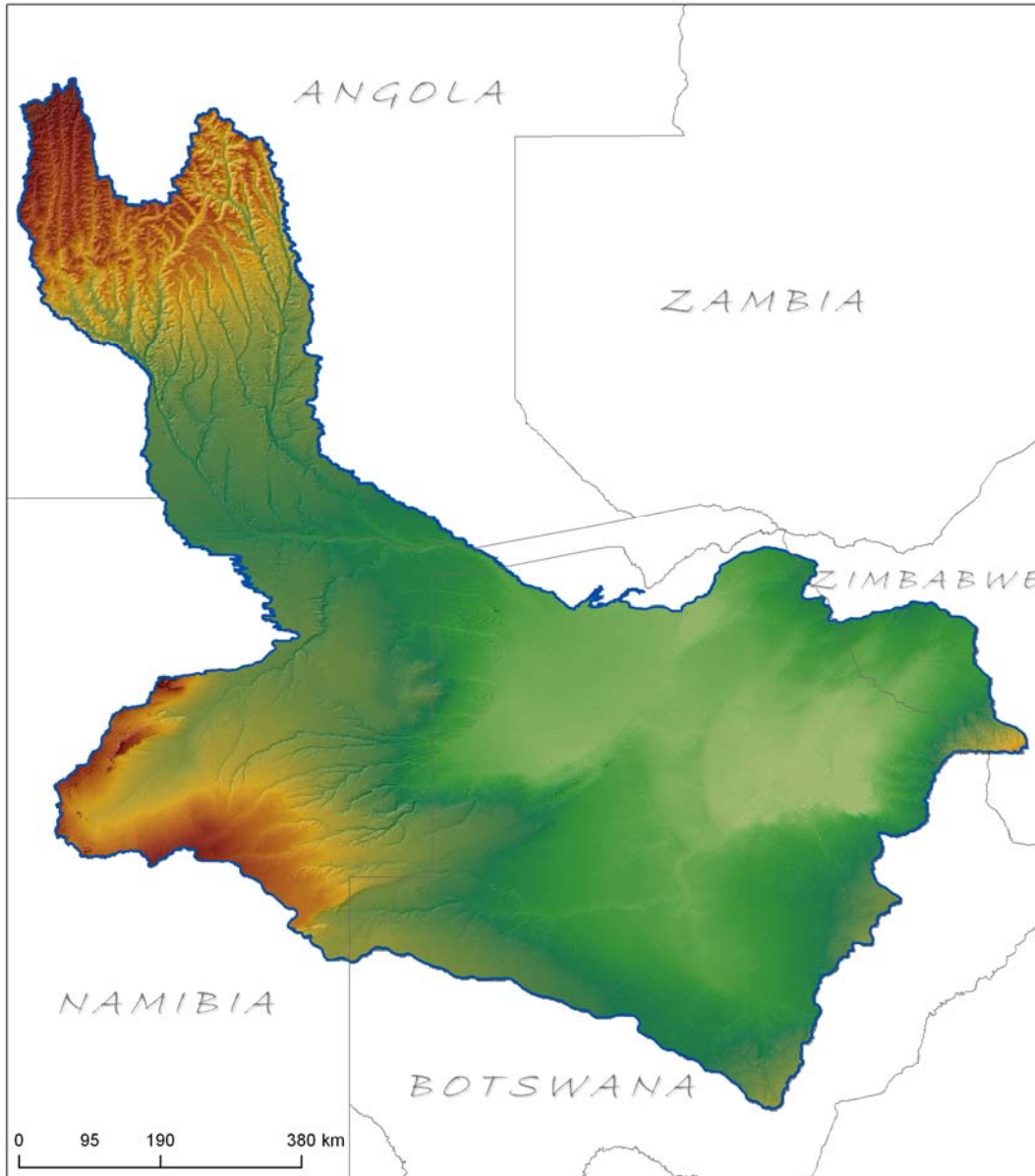
SECTION: ELEVATION

THEME CLASS: DEMs
COVERAGE NAME: *OMB_HSHD*
FORMAT: *Raster*
SCALE: *1: 500 000 (90m)*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Hill Shade Model.
SOURCE: Generated under the GIS EPSMO program (base:OB_DTM).
STATUS: Completed

SECTION: ELEVATION

THEME CLASS: SLOPE
COVERAGE NAME: *OMB_SLP*
FORMAT: *Raster*
SCALE: *1: 500 000 (90m)*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Slope Model.
SOURCE: Generated under the GIS EPSMO program (base:OB_DTM).
STATUS: Completed
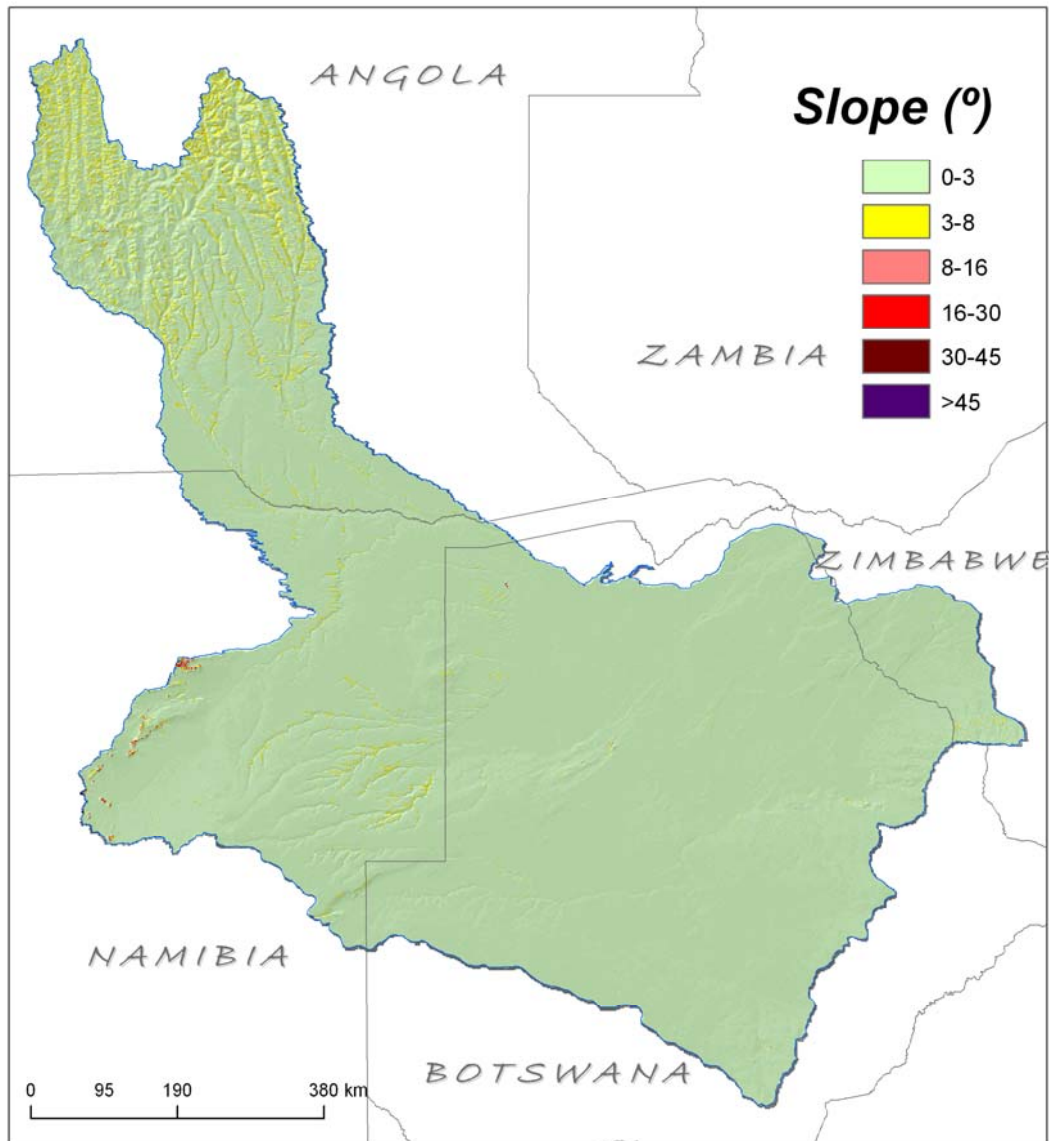
SECTION: ELEVATION

THEME CLASS: HEIGHT POINTS
COVERAGE NAME: *OB_E_SpotHight*
FEATURE CLASS TYPE: *Point*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Elevation points in meters.
SOURCE: Generated under the GIS EPSMO program, by vectorization of existing topographic maps at 1/1 000 000.
STATUS: Completed

SECTION: ENVIRONMENTAL MONITORING AND MODELLING

THEME CLASS: MANAGED AREAS
COVERAGE NAME: *OB_EMM_MANAGEDAREAS_CONSERVATIONMANAGEDUNITS*
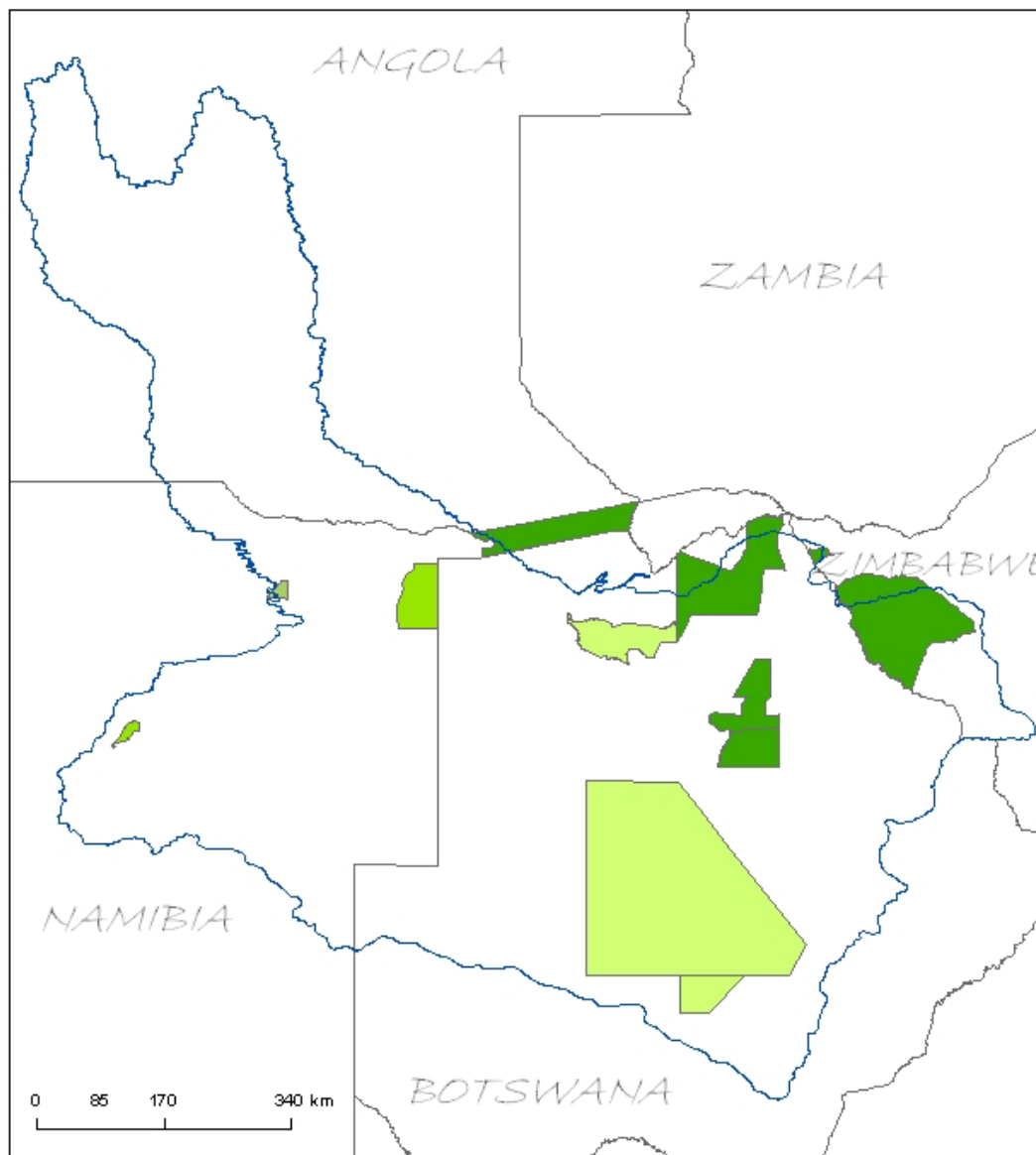**FEATURE CLASS TYPE:** *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Conservation Managed Units.
SOURCE: The World Database on Protected Areas WDPA/IUCN (2009).
STATUS: Completed
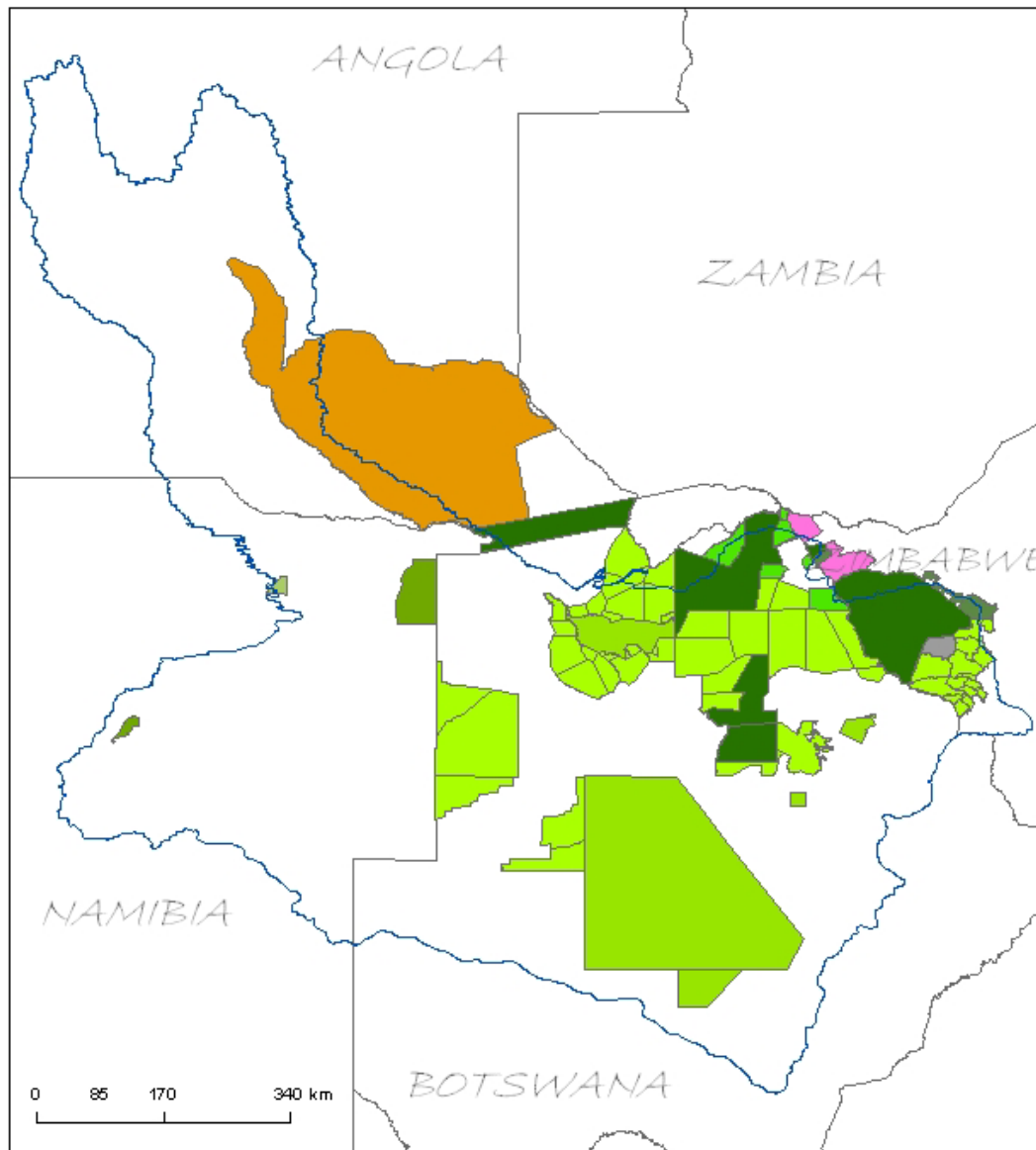
SECTION: ENVIRONMENTAL MONITORING AND MODELLING

THEME CLASS: MANAGED AREAS
COVERAGE NAME: *OB_EMM_MANAGEDAREAS_HUNTINGMANAGEMENTAREAS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Hunting Management Areas.
SOURCE: WDPA/IUCN (2009).
STATUS: Completed

SECTION: ENVIRONMENTAL MONITORING AND MODELLING

THEME CLASS: MANAGED AREAS
COVERAGE NAME: *OB_EMM_MANAGEDAREAS_HUNTINGMANAGEMENTUNITS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Hunting Management Areas.
SOURCE: WDPA/IUCN (2009).
STATUS: Completed
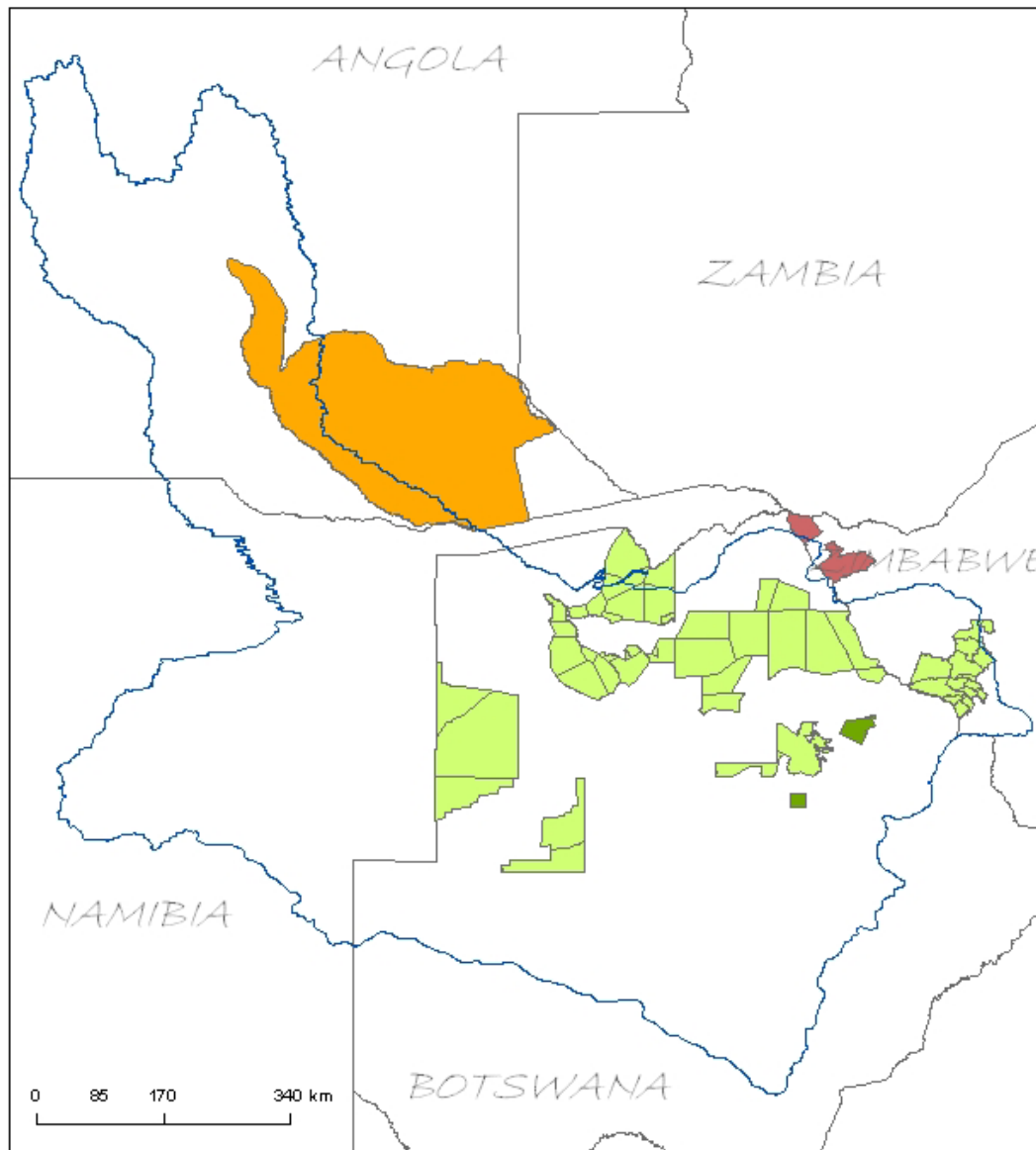
SECTION: ENVIRONMENTAL MONITORING AND MODELLING

THEME CLASS: MANAGED AREAS
COVERAGE NAME: *OB_EMM_MANAGEDAREAS_PROTECTEDAREAS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Protecte Areas.
SOURCE: WDPA/IUCN (2009).
STATUS: Completed

SECTION: ENVIRONMENTAL MONITORING AND MODELLING

THEME CLASS: MANAGED AREAS
COVERAGE NAME: *OB_EMM_MANAGEDAREAS_RAMSAR*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1:1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of the Okavango Delta System Ramsar site.
SOURCE: The RAMSAR Convention on Wetlands.
STATUS: Completed

SECTION: FRESH WATER RESOURCES

THEME CLASS: HYDROGRAPHY
COVERAGE NAME: *OB_FWR_HYDROGRAPHY_OKAVANGO_BASIN*
FEATURE CLASS TYPE: *Polygon*
**SCALE:** *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Okavango River (Macro) Basin.
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: FRESH WATER RESOURCES

THEME CLASS: HYDROGRAPHY
COVERAGE NAME: *OB_FWR_HYDROGRAPHY_OKAVANGO_DRAINAGE*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Okavango River (Macro) Basin drainage network, including permanent, seasonal, ephemeral and dry water courses.
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: FRESH WATER RESOURCES

THEME CLASS: HYDROGRAPHY
COVERAGE NAME: *OB_FWR_HYDROGRAPHY_OKAVANGO_SUBBASINS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Okavango River (Macro) Basin main subbasins
SOURCE: Generated under the GIS EPSMO program.
STATUS: Completed

SECTION: FRESH WATER RESOURCES

THEME CLASS: HYDROGRAPHY
COVERAGE NAME: *OB_FWR_HYDROGRAPHY_SURFACE_WATER_FEATURES*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Location of fall, reservoirs, springs and other features.
SOURCE: DCW.
STATUS: Completed

SECTION: FRESH WATER RESOURCES

THEME CLASS: HYDROGRAPHY
COVERAGE NAME: *OB_FWR_HYDROGRAPHY_GAZETEER*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Hydrographical related Toponomy.
SOURCE: Africa Water Resources Database (FAO).
STATUS: Completed
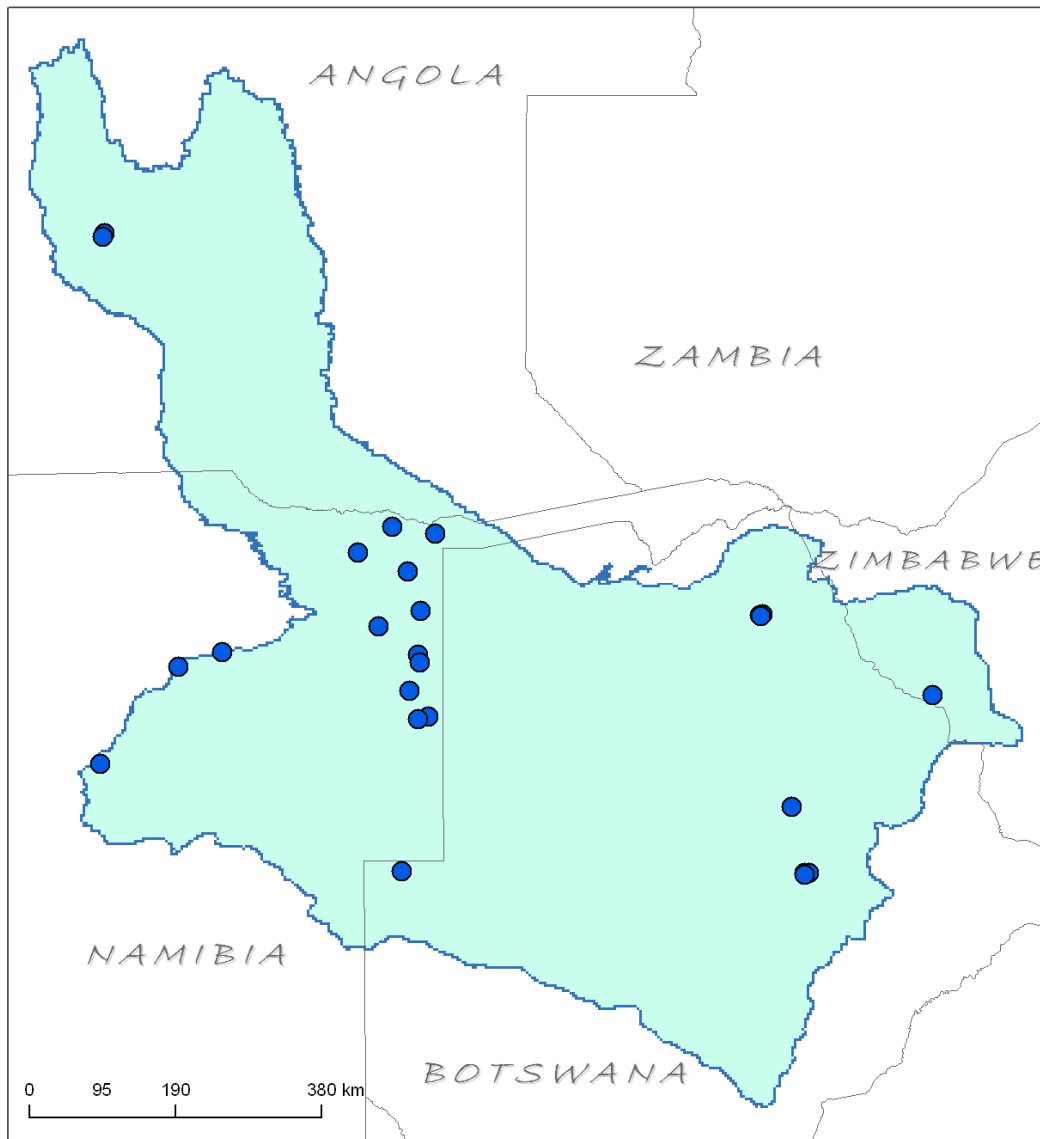
SECTION: FRESH WATER RESOURCES

THEME CLASS: WETLANDS
COVERAGE NAME: *OB_FWR_WETLANDS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Wetland types, including non active salt pans and interdune flats.
SOURCE: DCW and WCMC
STATUS: Completed

SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: GEOLOGY
COVERAGE NAME: *OB_GGI_GEOLOGY_GEOLOGICPROVINCES*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Geologic Provinces.
SOURCE: USGS
STATUS: Completed
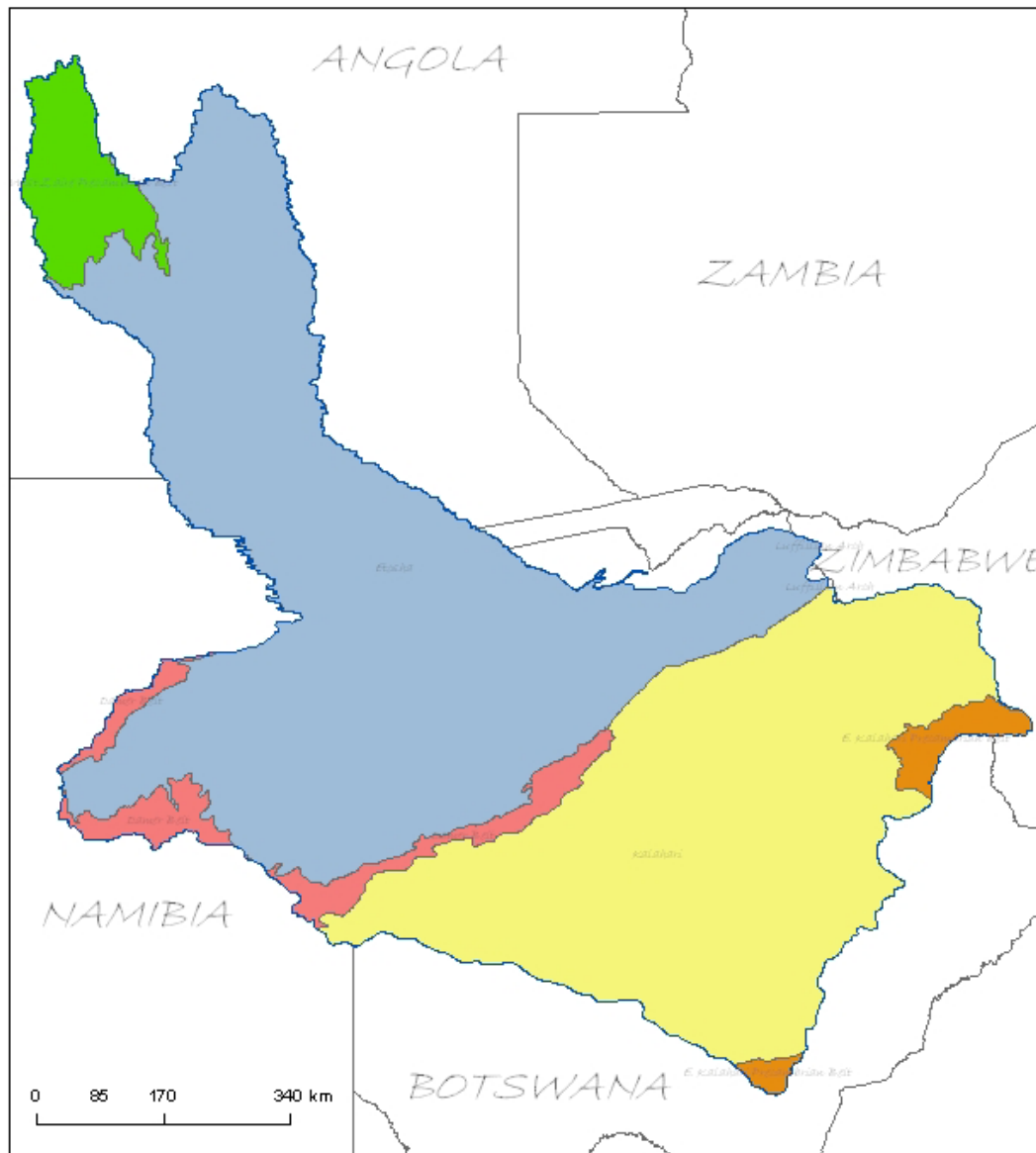
SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: GEOLOGY
**COVERAGE NAME:** *OB_GGI_GEOLOGY_GEOLOGY*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of Geologic Units.
SOURCE: USGS
STATUS: Completed

SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: GEOMORPHOLOGY
COVERAGE NAME: *OB_GGI_GEOMORPHOLOGY_SAND_DUNES*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Sand Dune fields.
SOURCE: DCW
STATUS: Completed

SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: GEOMORPHOLOGY
COVERAGE NAME: *OB_GGI_GEOMORPHOLOGY_SALT_PANS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Major Pans.
SOURCE: DCW
STATUS: Completed

SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: HYDROGEOLOGY
COVERAGE NAME: *OB_GGI_HYDROGEOLOGY_AQUIFER_NAMIBIA*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of aquifer systems in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry
STATUS: Completed
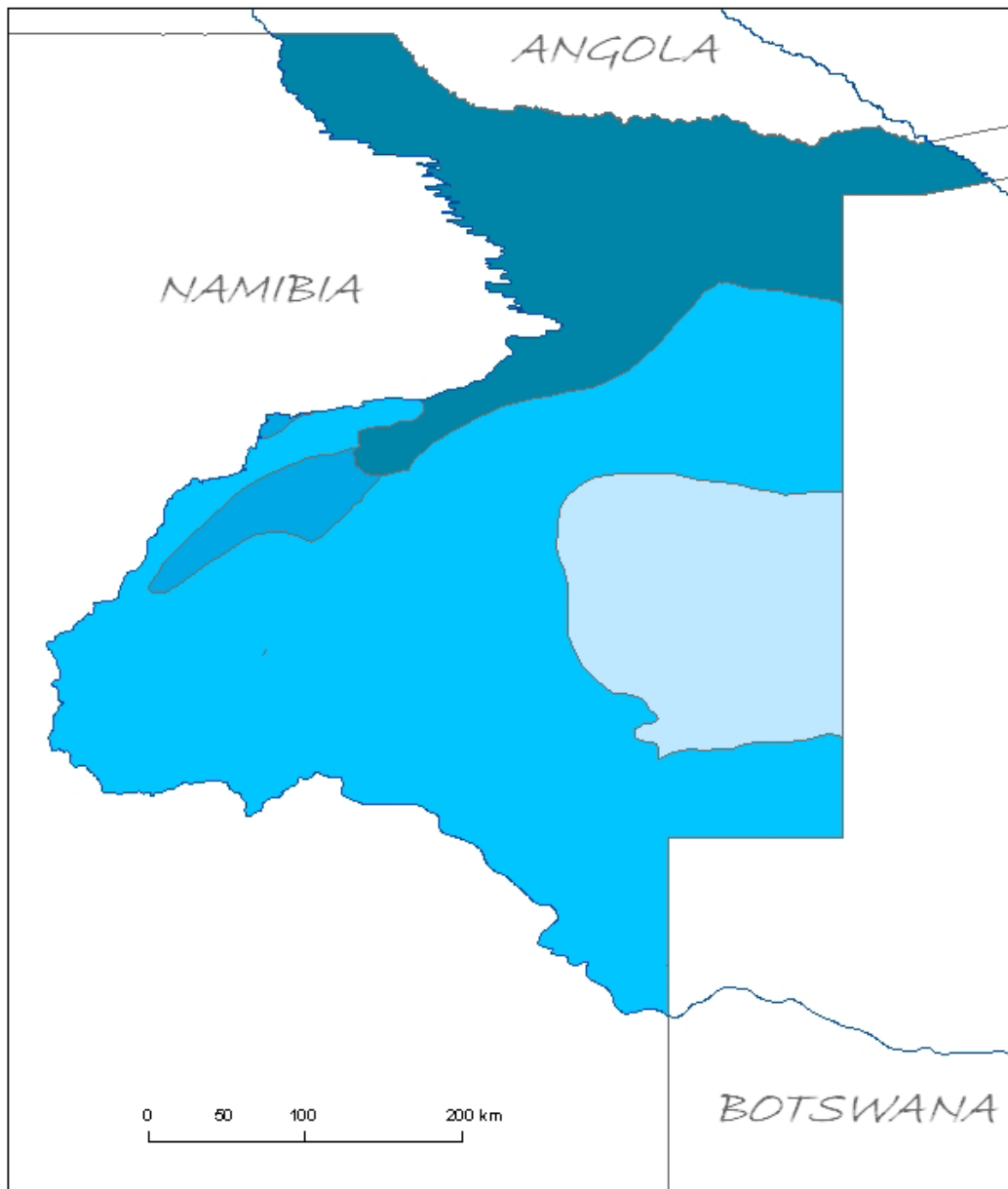
SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: HYDROGEOLOGY
COVERAGE NAME: *OB_GGI_HYDROGEOLOGY_AQUIFER_ANGOLA*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of aquifer systems in Angola, that share geographical overlapping with the Okavango Basin.
SOURCE: Generated for the EPSMO project based on hidrogeologic map of Angola provided by Direccao de Geologia e Minas at 1I1000000
STATUS: Completed
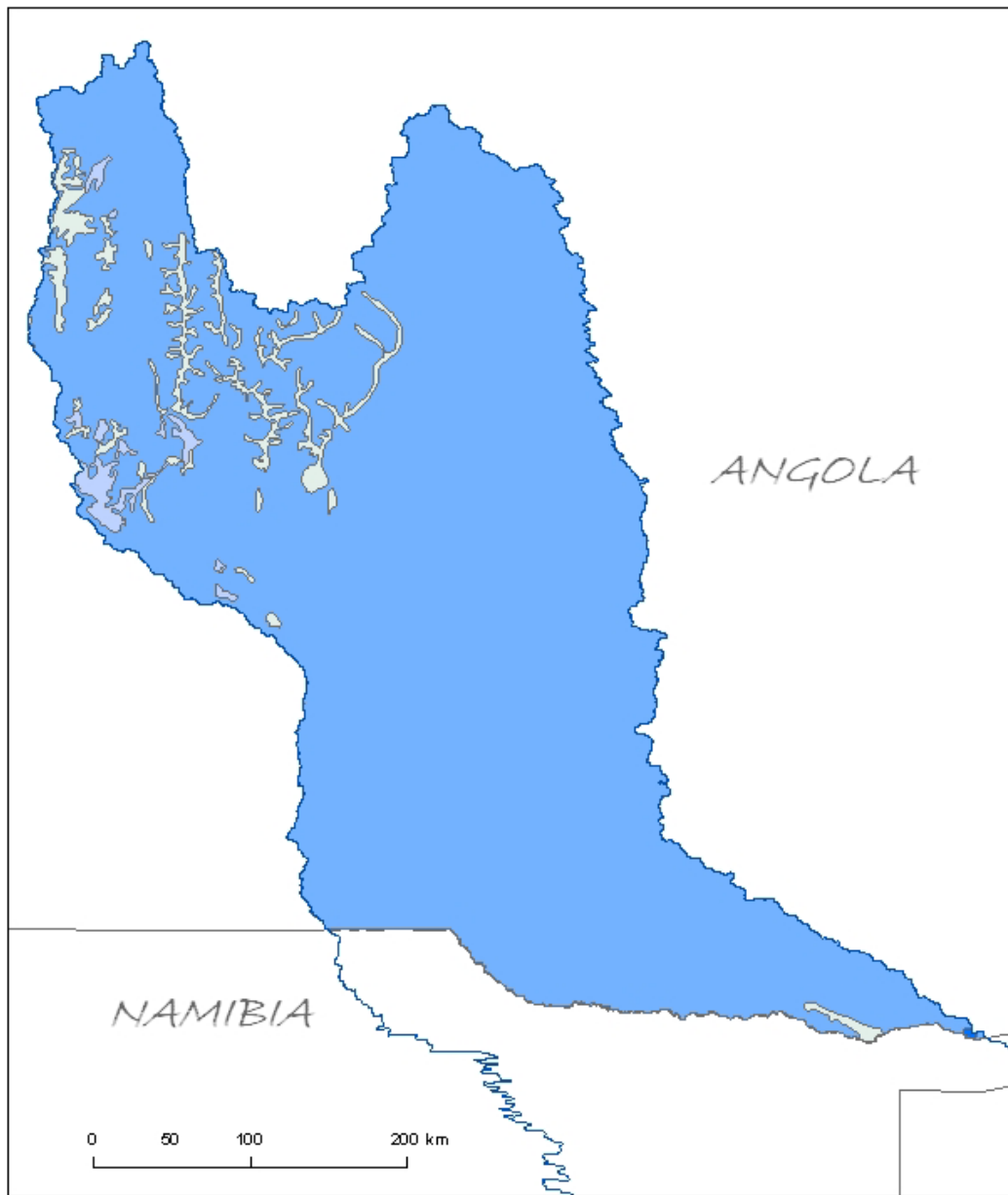
SECTION: GEOLOGICAL AND GEOPHYSICAL INFORMATION

THEME CLASS: SOILS
COVERAGE NAME: *OB_GGI_SOILS*
FEATURE CLASS TYPE: *Polygon*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Dominant soil types.
SOURCE: SOTER/FAO.
STATUS: Completed
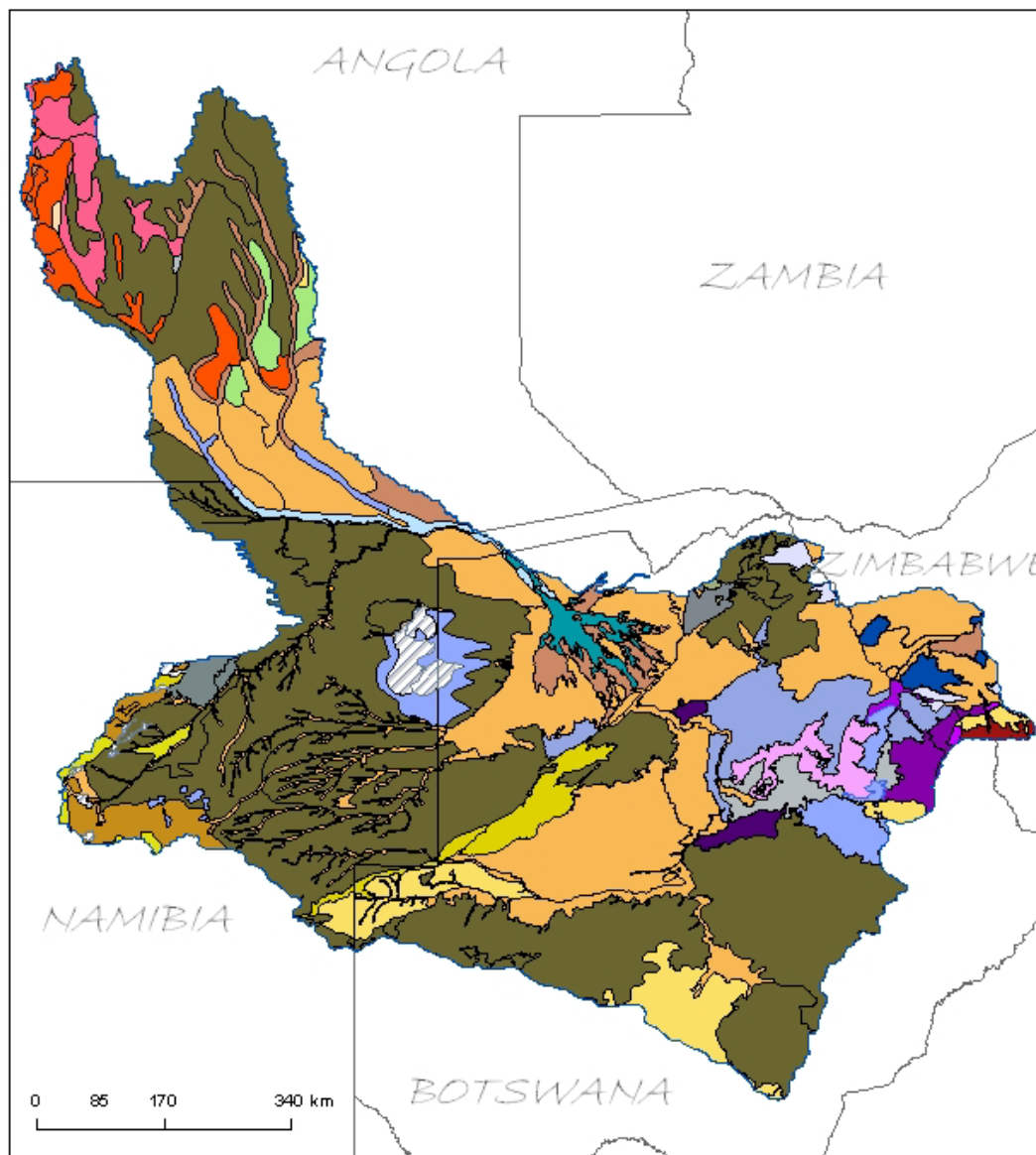
SECTION: SOCIAL AND DEMOGRAPHIC INFORMATION

THEME CLASS: CULTURAL
COVERAGE NAME: *OB_SDI_CULTURAL_SETTLEMENTS*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Locations of populated places.
SOURCE: DCW.
STATUS: Completed

SECTION: SOCIAL AND DEMOGRAPHIC INFORMATION

THEME CLASS: DEMOGRAPHICAL
COVERAGE NAME: *OB_LANDSCAN98, OB_LANDSCAN2K, OB_LANDSCAN07*
FORMAT: *Raster*
SCALE: *1: 2 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Population database compiled on a 30x30" lat/long grid, for the years: 1998, 2000 and 2007.
SOURCE: Oak Ridge National Laboratory (ORNL).
STATUS: Completed
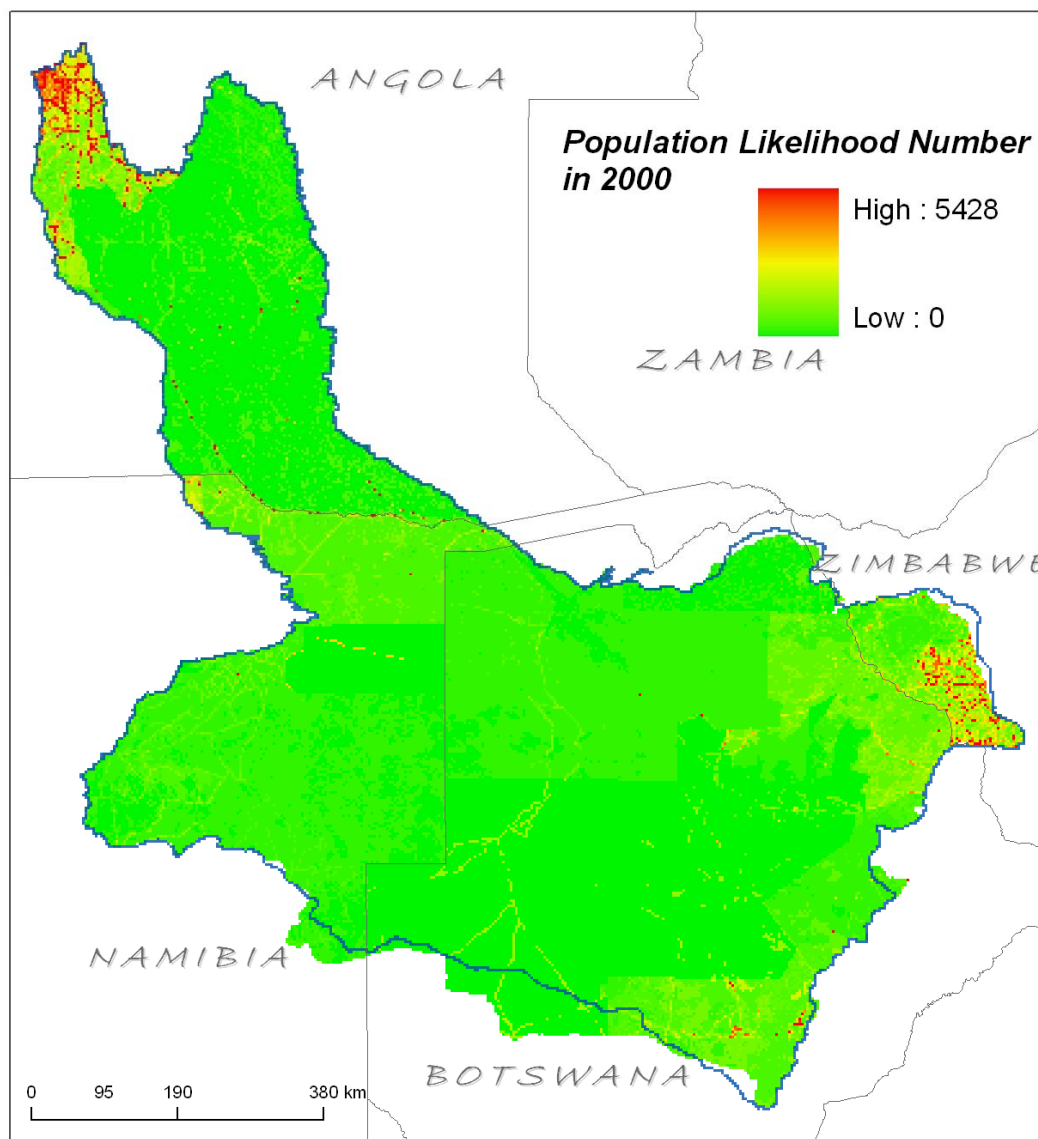
SECTION: TRANSPORTATION NETWORKS

THEME CLASS: AIR
COVERAGE NAME: *OB_TN_AIR_AIRFIELDS*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Location or Airfields.
SOURCE: DCW, and update vectorization from ONC charts
STATUS: Completed
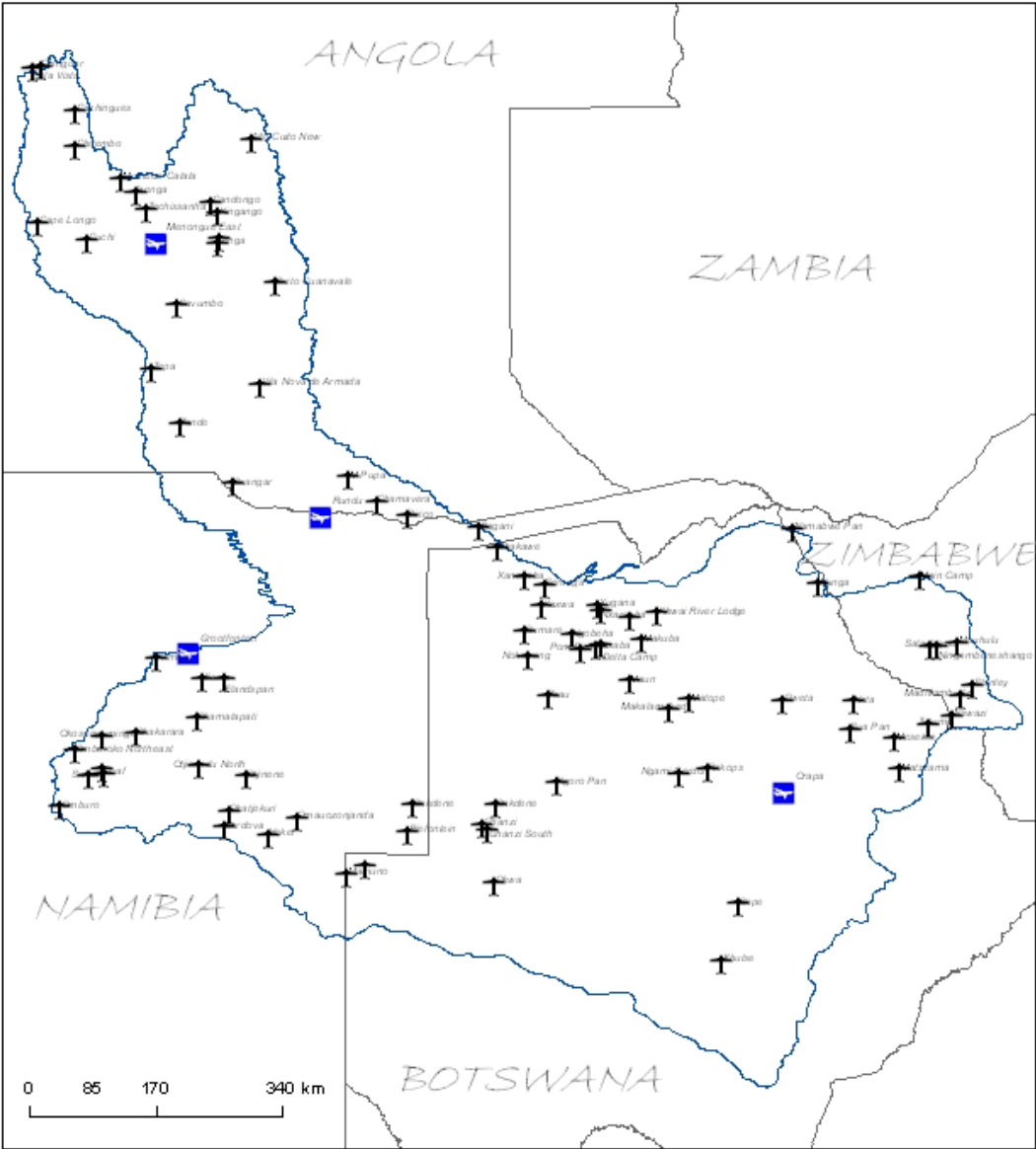
SECTION: TRANSPORTATION NETWORKS

THEME CLASS: RAIL
COVERAGE NAME: *OB_TN_RAIL_RAILROAD*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Rail road lines
SOURCE: DCW
STATUS: Completed
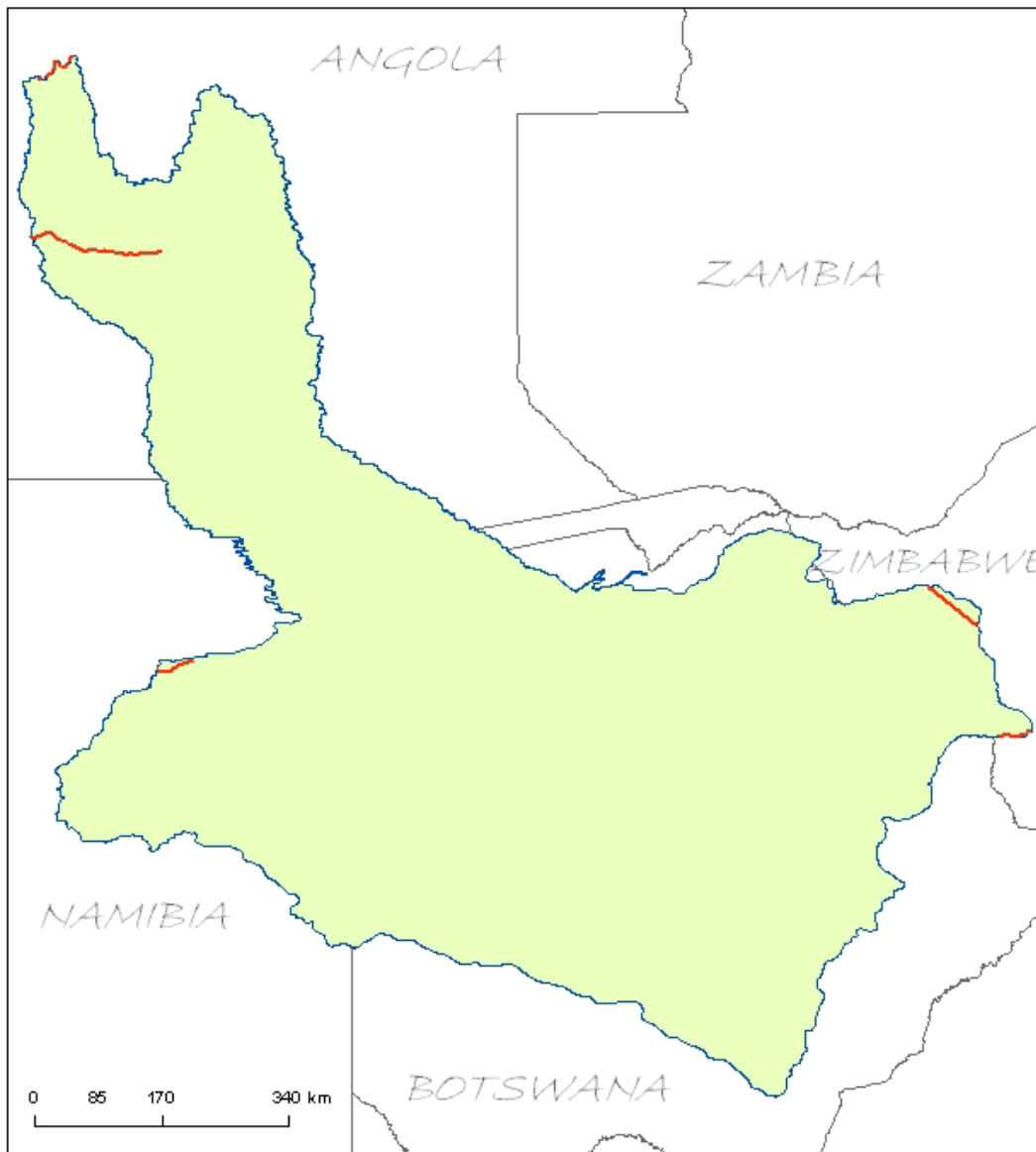
SECTION: TRANSPORTATION NETWORKS

THEME CLASS: ROAD
COVERAGE NAME: *OB_TN_ROAD_ROADS*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Roads and tracks
SOURCE: DCW, with partial update editing from remote sense data.
STATUS: Completed

SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: TRANSMISSION
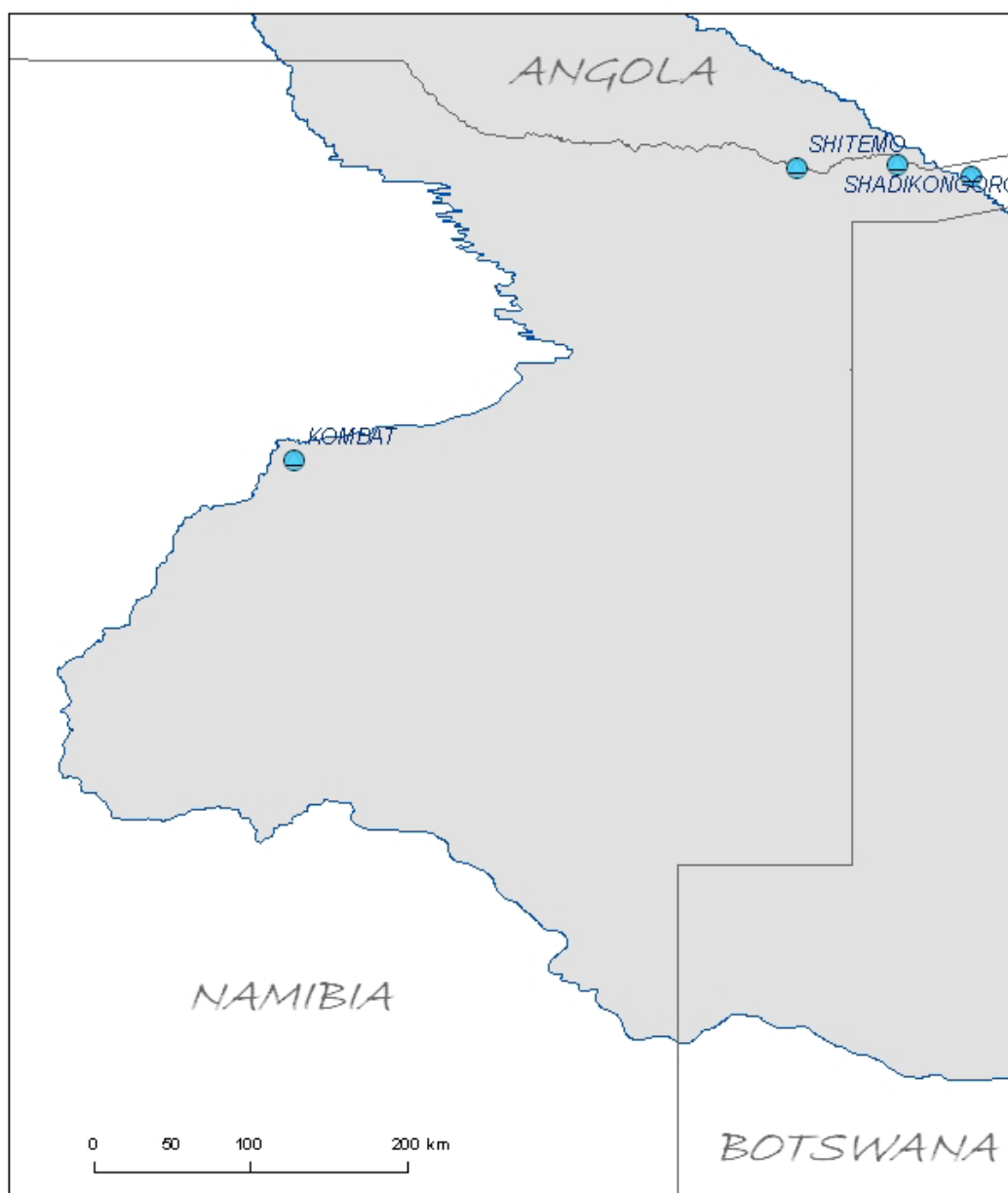**COVERAGE NAME:** *OB_UDN_TRANSMISSION_POWERGRID_NAMIBIA*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of power lines, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
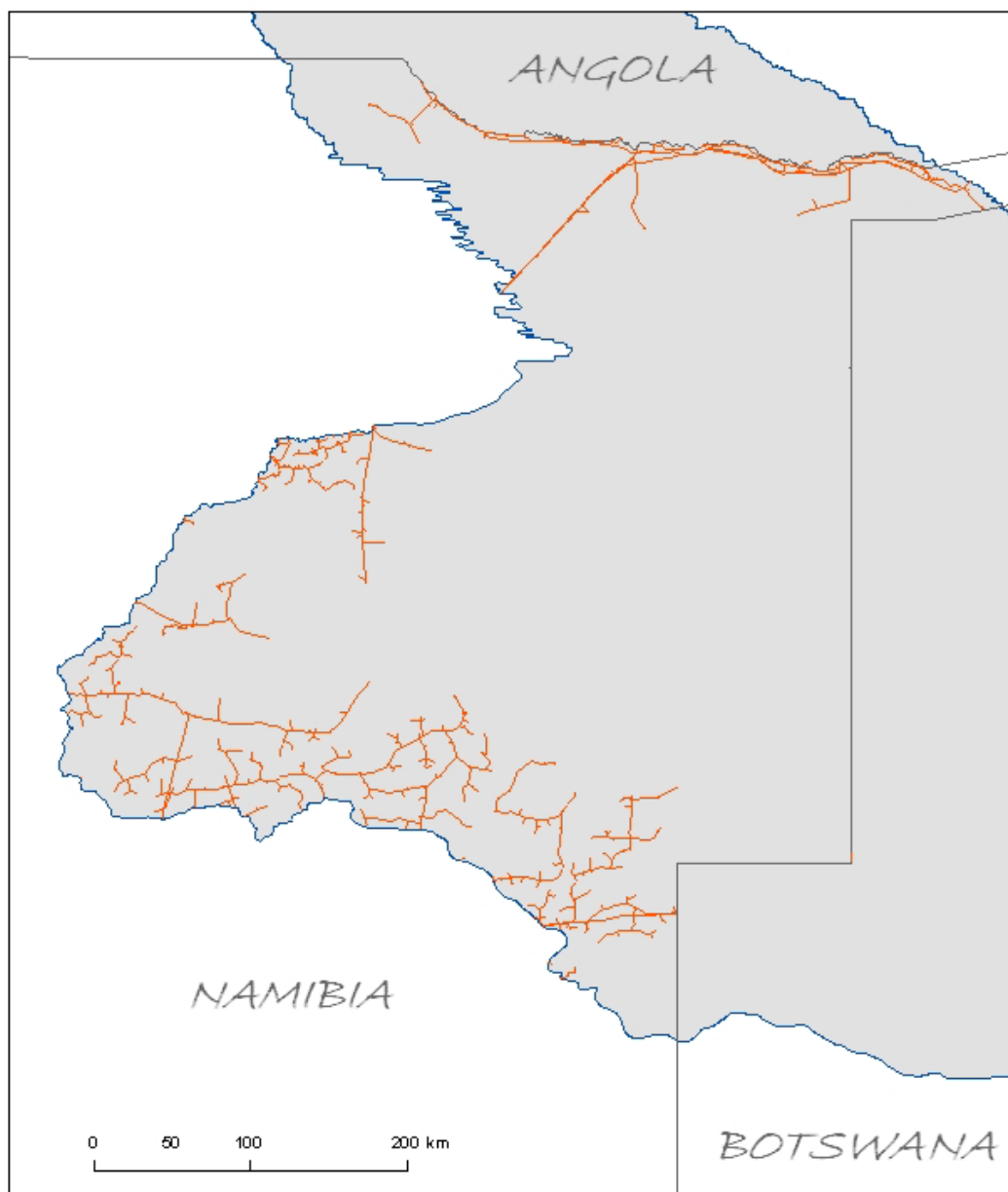
SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: WATER DISTRIBUTION
COVERAGE NAME: *OB_UDN_WATERDISTR_BOREHOLS_NAMIBIA*
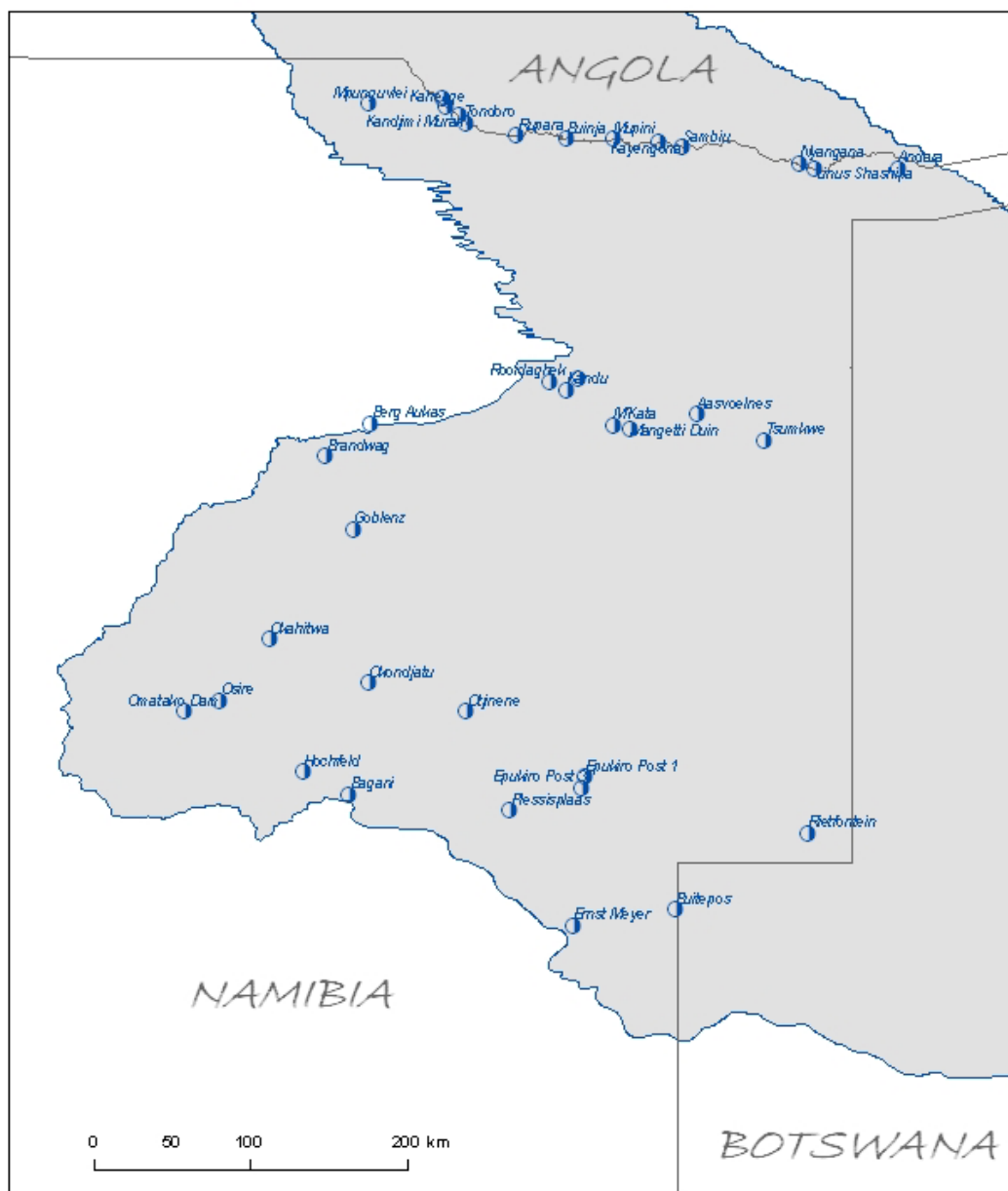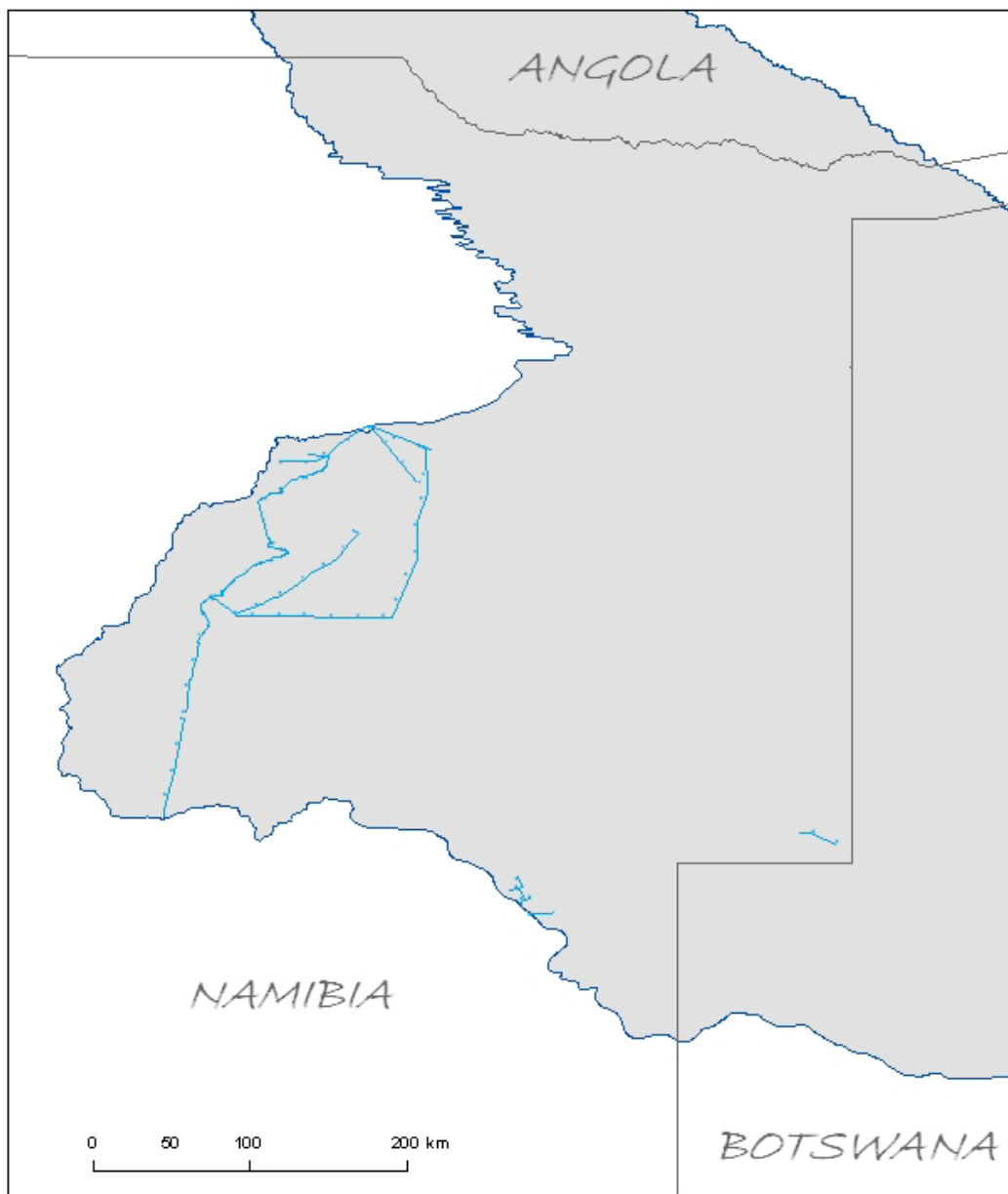**FEATURE CLASS TYPE:** *Point*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Location of boreholes, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed
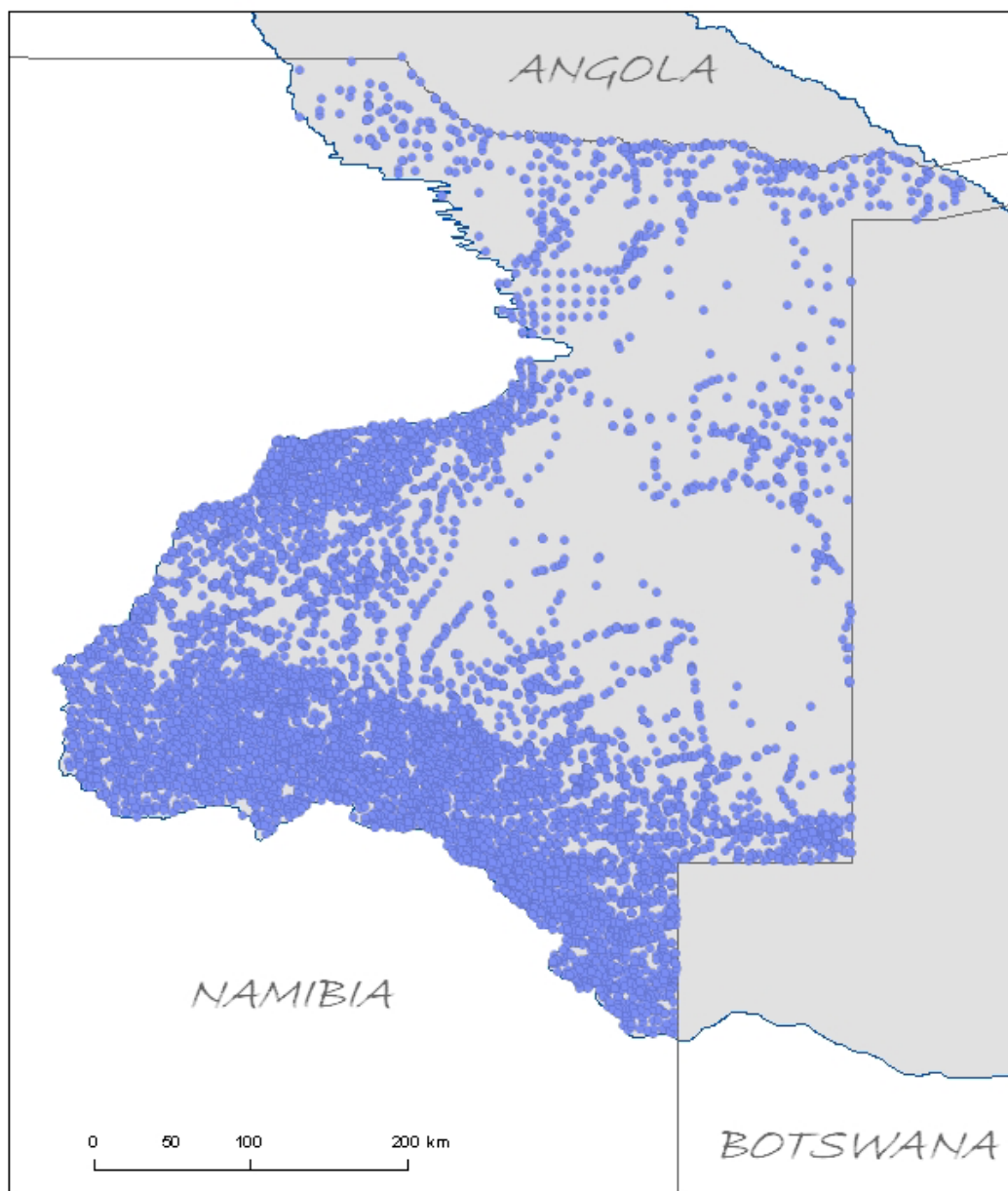
SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: WATER DISTRIBUTION
COVERAGE NAME: *OB_UDN_WATERDISTR_LARGEIRRIGATIONSCHEMES_NAMIBIA*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Location of large irrigation schemes, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: WATER DISTRIBUTION
COVERAGE NAME: *OB_UDN_WATERDISTR_STATEWATERSCHEMES_NAMIBIA*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Location of state water schemes, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: WATER DISTRIBUTION
COVERAGE NAME: *OB_UDN_WATERDISTR_WATERPIPELINES_NAMIBIA*
FEATURE CLASS TYPE: *Line*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Delineation of water pipelines, in Namibia, that share geographical overlapping with the Okavango Basin.
SOURCE: Ministry of Agriculture, Water and Forestry of Namibia.
STATUS: Completed

SECTION: UTILITY DISTRIBUTION NETWORKS

THEME CLASS: WATER DISTRIBUTION
COVERAGE NAME: *OB_UDN_WATERDISTR_WATERDISTRIBUTIONRESERVOIRES*
FEATURE CLASS TYPE: *Point*
SCALE: *1: 1 000 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Locations of Water Distribution Reservoirs.
SOURCE: DCW
STATUS: Completed

SECTION: BASE MAPS, REMOTE SENSE AND TOPONOMY

THEME CLASS: DIGITAL GEOREFERENCED TOPO MAPS
COVERAGE NAME: *INTERNATIONAL 1/500 000 RUSSIAN SERIES*
FORMAT: *Geotiff*
SCALE: *1: 500 000*
COORDINATE SYSTEM: *Pulkovo 1942*
OBSERVATIONS: Complete set of 21 medium scale topographic maps.
SOURCE: Georeferenced under the GIS EPSMO program.
STATUS: Completed
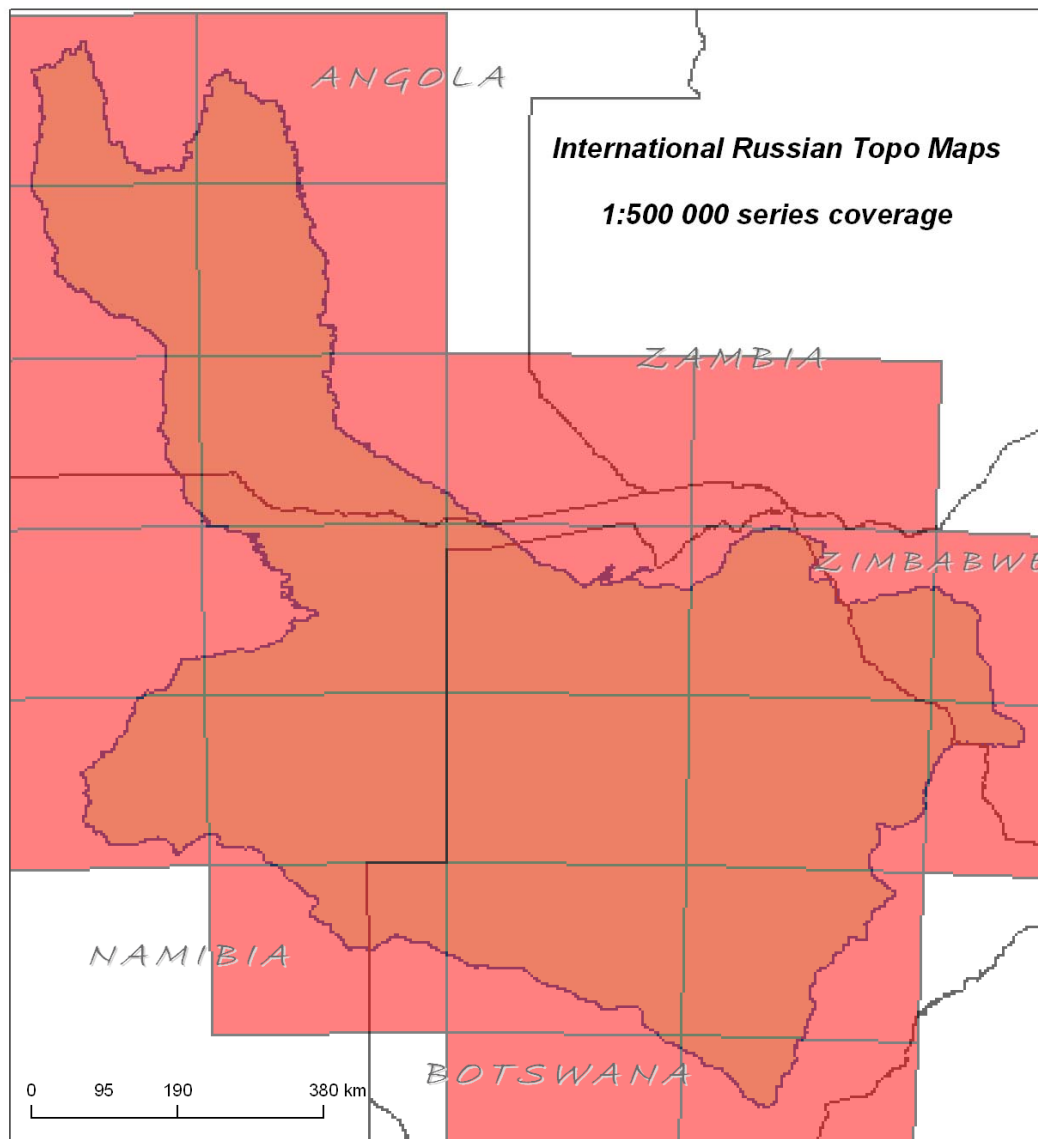
SECTION: BASE MAPS, REMOTE SENSE AND TOPONOMY

THEME CLASS: DIGITAL GEOREFERENCED TOPO MAPS
**COVERAGE NAME:** *ANGOLA 1:250 000 TOPO MAPS*
FORMAT: *Geotiff*
SCALE: *1: 250 000*
COORDINATE SYSTEM: *Transverse Mercator, Datum Camacupa*
OBSERVATIONS: Complete set of 23 medium scale topographic maps.
SOURCE: Georeferenced under the GIS EPSMO program.
STATUS: Completed

Angola National Map Series
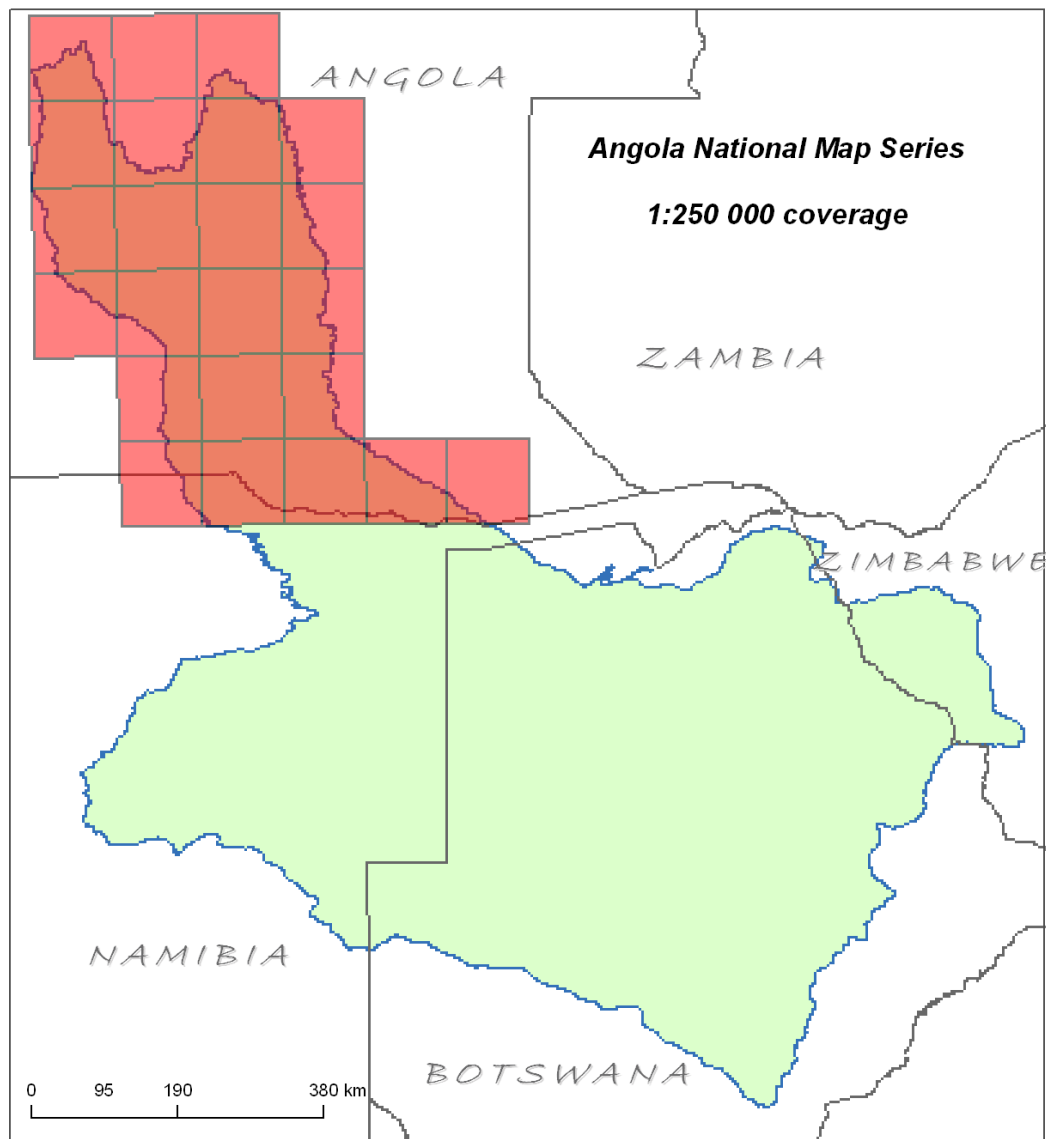
1:250 000 coverage

SECTION: BASE MAPS, REMOTE SENSE AND TOPONOMY

THEME CLASS: DIGITAL GEOREFERENCED TOPO MAPS
COVERAGE NAME: *NAMIBIA 1:250 000 TOPO MAPS*
FORMAT: *Geotiff*
SCALE: *1: 250 000*
COORDINATE SYSTEM: *Transverse Mercator, Datum* Schwarzeck
OBSERVATIONS: Complete set of 16 medium scale topographic maps.
SOURCE: Georeferenced under the GIS EPSMO program.
STATUS: Completed

Namibia National Map Series
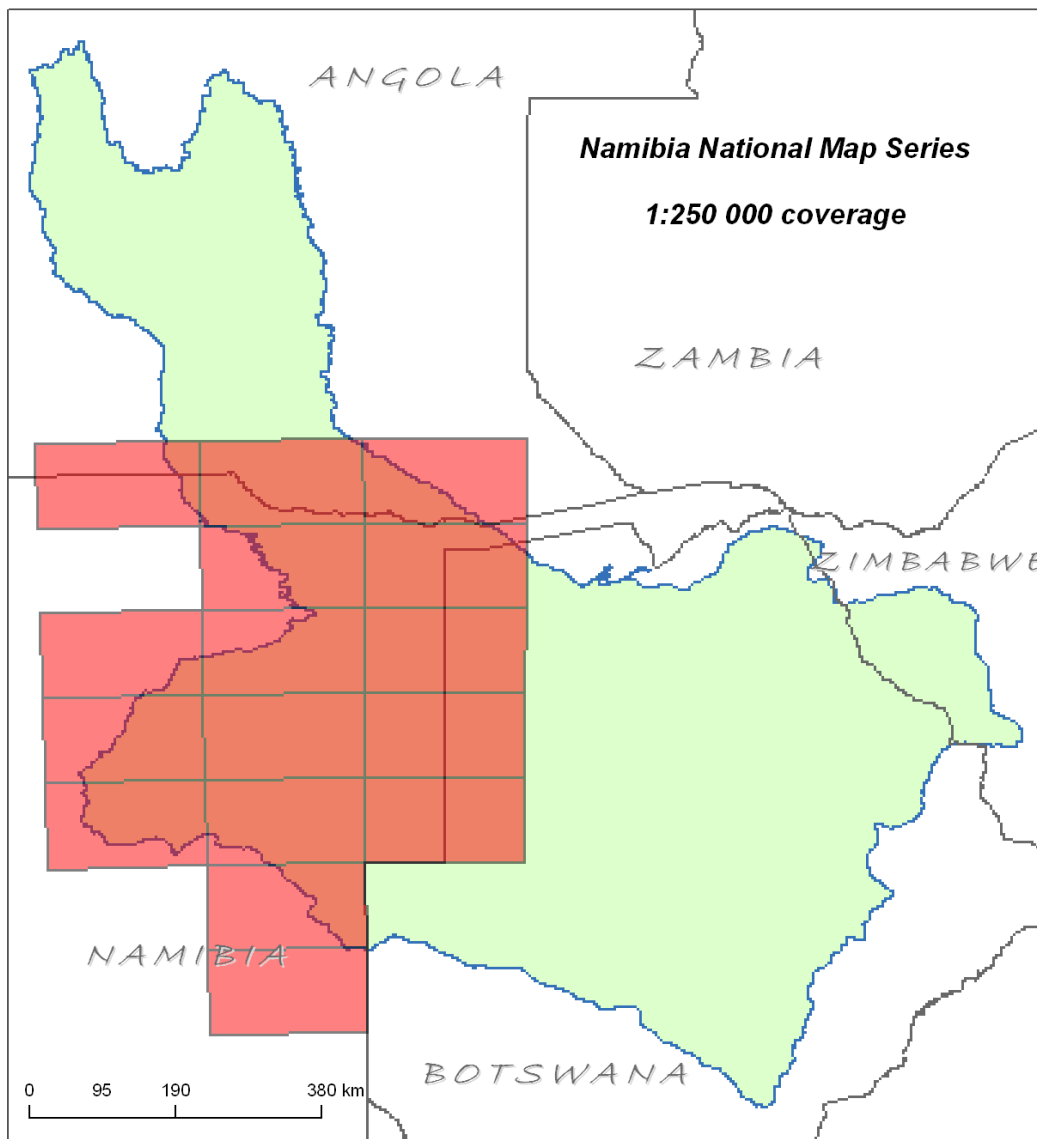
1:250 000 coverage

SECTION: BASE MAPS, REMOTE SENSE AND TOPONOMY

THEME CLASS: REMOTE SENSE
**COVERAGE NAME:** *LANDSAT IMAGERY*
FORMAT: *Geotiff*
SCALE: *1: 250 000 – 1:100 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: Partial coverage of band compositions data of Landsat MSS, Landsat TM and Landsat ETM, in the decadal intervals of 1972-87 (MSS), 1987-97 (TM), 1999-2008 (ETM).
SOURCE: Free of charge acquisition and pre processing under the GIS EPSMO program.
STATUS: Completed for revision
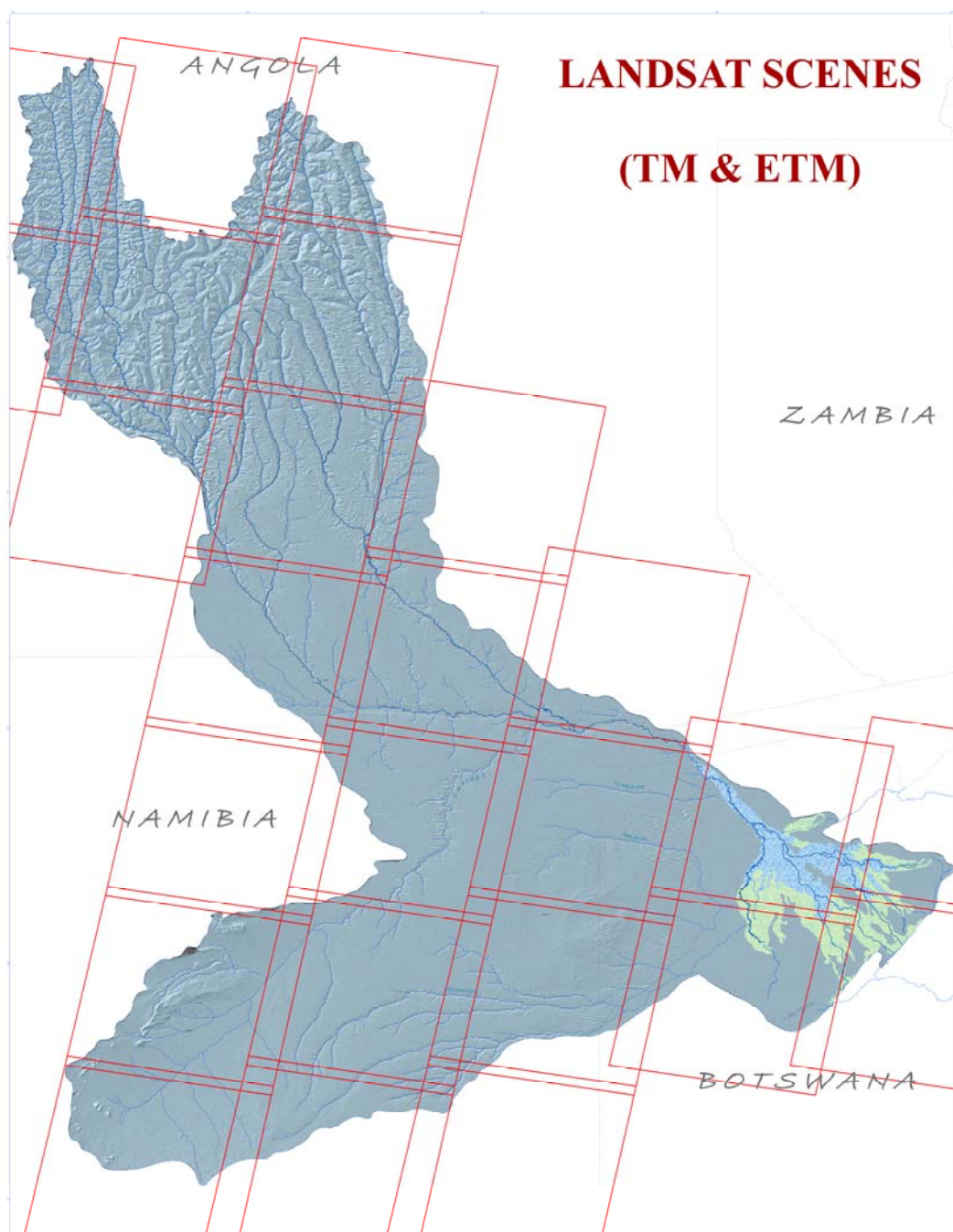
SECTION: BASE MAPS, REMOTE SENSE AND TOPONOMY

THEME CLASS: REMOTE SENSE
COVERAGE NAME: *IKONOS/QUICK BIRD IMAGERY*
FORMAT: *Geotiff*
SCALE: *1: 5 000*
COORDINATE SYSTEM: *GCS_WGS84*
OBSERVATIONS: A set of ortho-image maps was elaborated for the main settlements in the basin at the nominal scale of 1/5 000 (the coverage is constrained by the free availability of data).
SOURCE: Free of charge acquisition and pre processing under the GIS EPSMO program.
STATUS: Completed
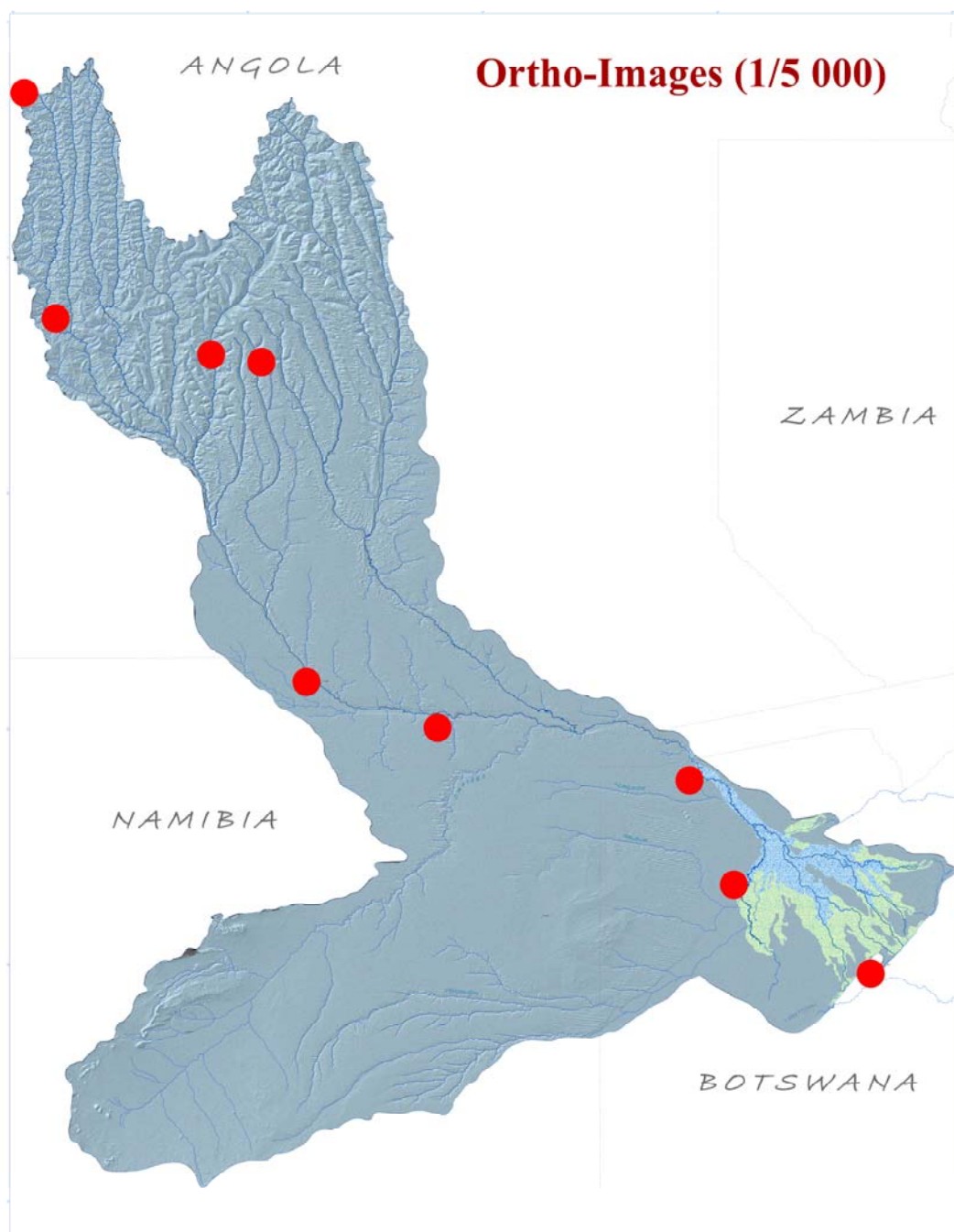
Ortho-image map of Rundo.

Part II – Okavango Active Catchment Area (Spatial Hydrology Modeling)
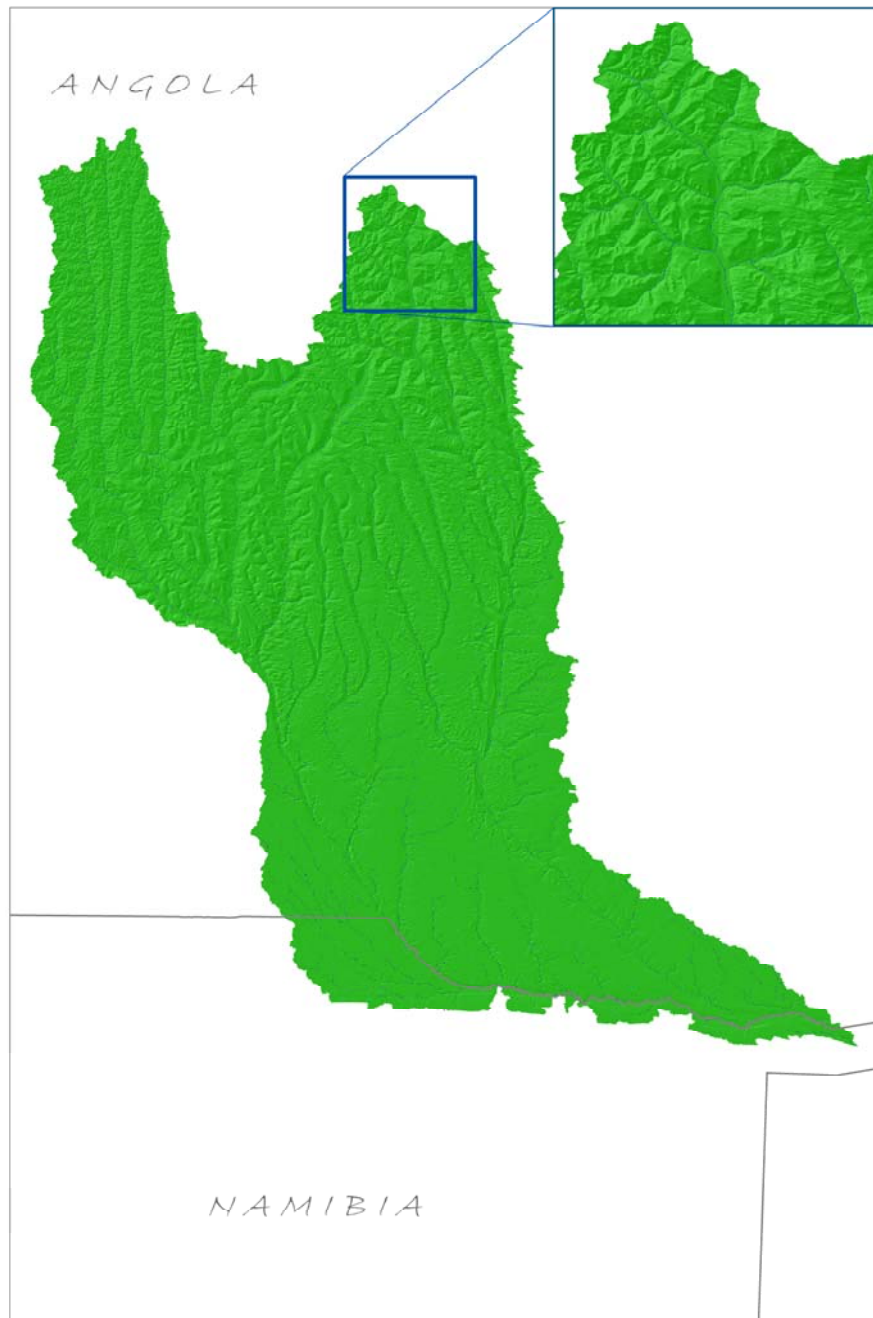
GIS Data Base / Map Sets

THEMES

Hydrology Modelling

- **FLOW DIRECTION**

Status – Completed / **Coordinate System** – WGS84

Observations - This raster layer (90m resolution) represents the flow direction of the OACA. The values in the cells of the grid indicate the direction of flow from that cell. This layer was created from the SRTM DTM (digital terrain model). In order to eliminate error, a "Fill Sinks" function was conducted on the SRTM DTM of the basin prior to the creation of this layer.

THEMES

Hydrology Modelling

- **FLOW ACCUMULATION**

Status – Completed / **Coordinate System** – WGS84

Observations - This raster layer (90m resolution) represents the flow accumulation in the OACA. This raster was created by interpolating the *Flow Direction* raster grid to discern the accumulated number of cells with flow direction upstream of a cell, for each cell in the input grid (zoom in for detail).
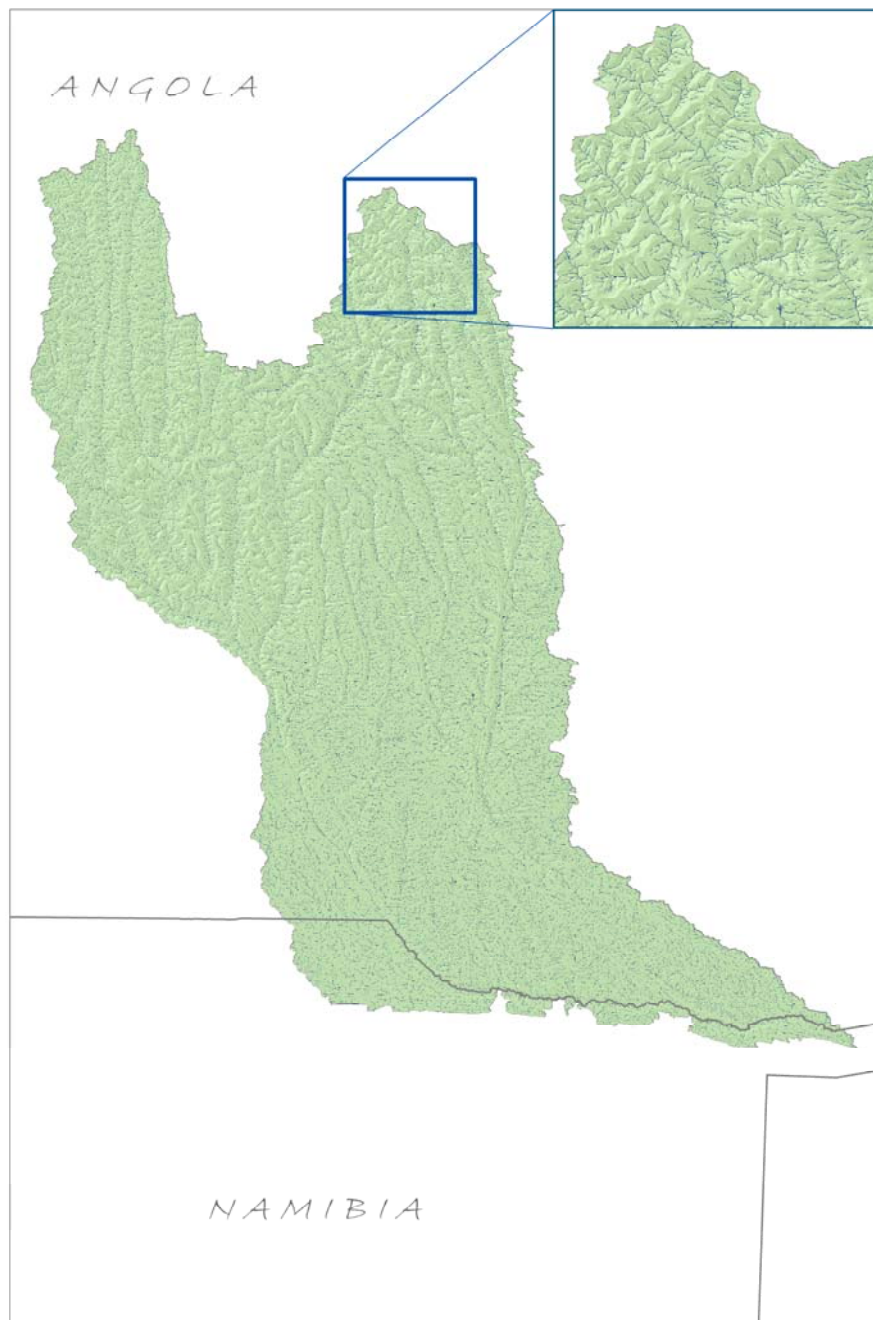
THEMES

Hydrology Modelling

- **STREAM DEFINITION**

Status – Completed / **Coordinate System –** WGS84

Observations - This raster layer (90m resolution) represents streams in the OACA. This layer was created by interpolating the *Flow Accumulation* raster. All cells in the input *Flow Accumulation* grid that have values greater than a defined threshold have a value of "1" for *Stream Definition* (zoom in for detail).
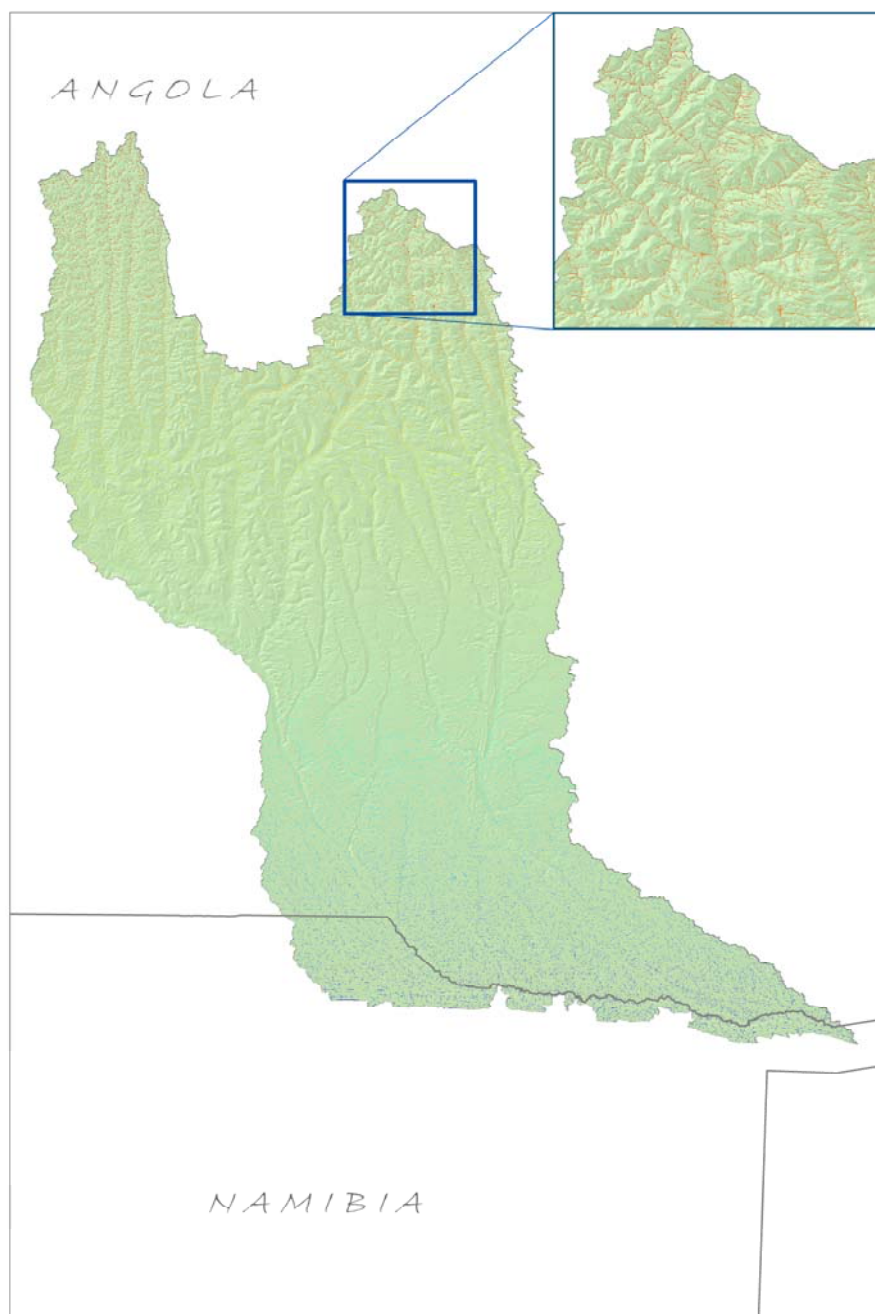
THEMES

Hydrology Modelling

- **STREAM SEGMENTATION**

Status – Completed / **Coordinate System –** WGS84

Observations - This raster layer (90m resolution) identifies stream segments in the OACA. Each segment has a specific grid code, which will be fundamental in later modelling of the hydrological network. This layer was created through computations of the *Flow Direction* and *Stream Definition* rasters (zoom in for detail).
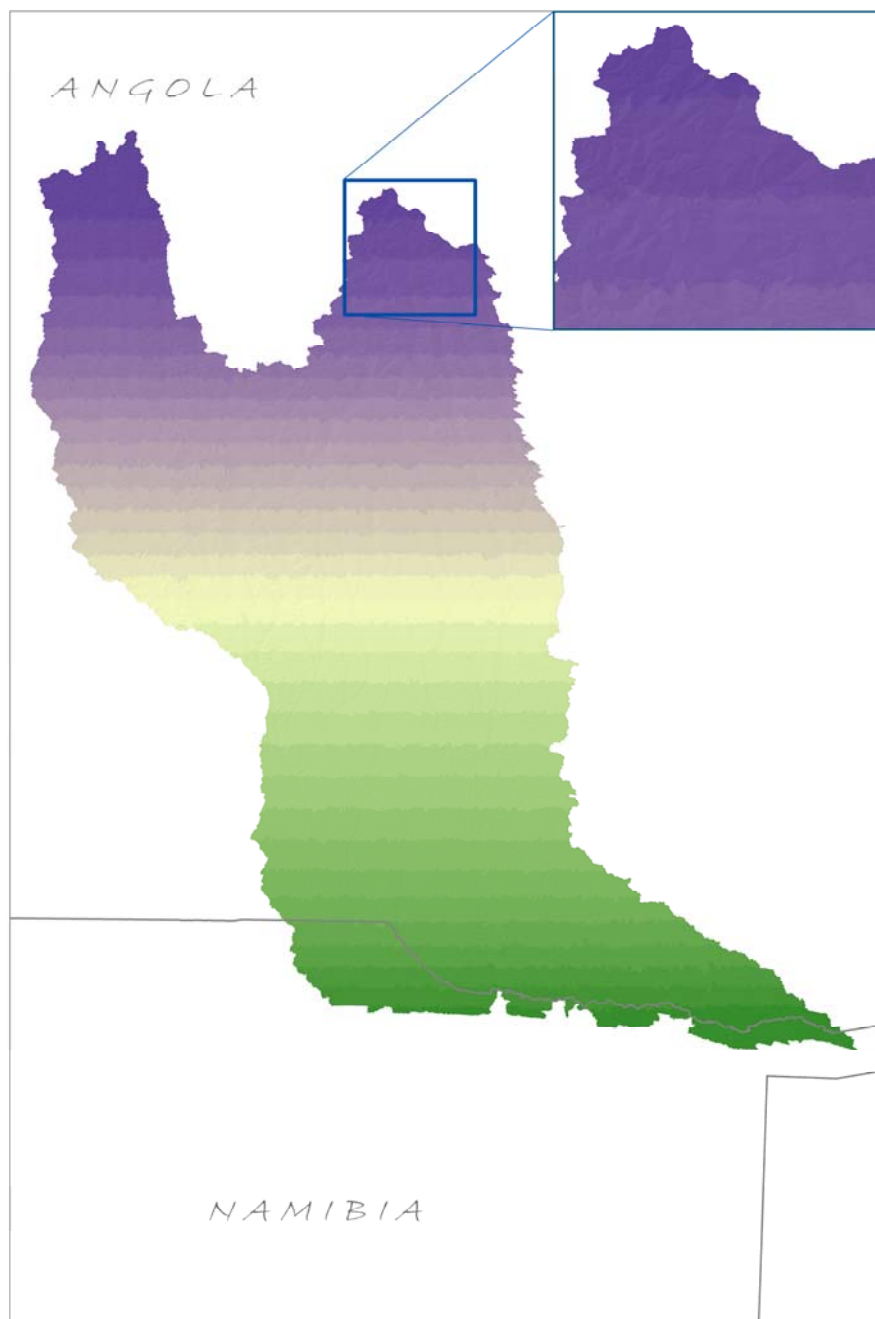
THEMES

Hydrology Modelling

- **CATCHMENT GRID DELINEATION**

Status – Completed / **Coordinate System –** WGS84

Observations - This raster layer (90m resolution) identifies the catchment area for each stream segment in the OACA. Each cell in the catchment area has a value corresponding to the value of the stream segment that drains that area, defined in the *Stream Segmentation* grid. This layer was created by computations of the *Flow Direction* and *Stream Segmentation* raster grids.

THEMES

Hydrology Modelling

- **CATCHMENT MICROBASINS**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (polygon) – reference scale 1/200 000 – also identifies the catchment area for each stream segment in the OACA. The value for each polygon corresponds to the value carried by the stream segment that drains that area, defined in the *Stream Segmentation* grid. This layer was created by converting the *Catchment Grid* raster layer into vector format (zoom in for detail).
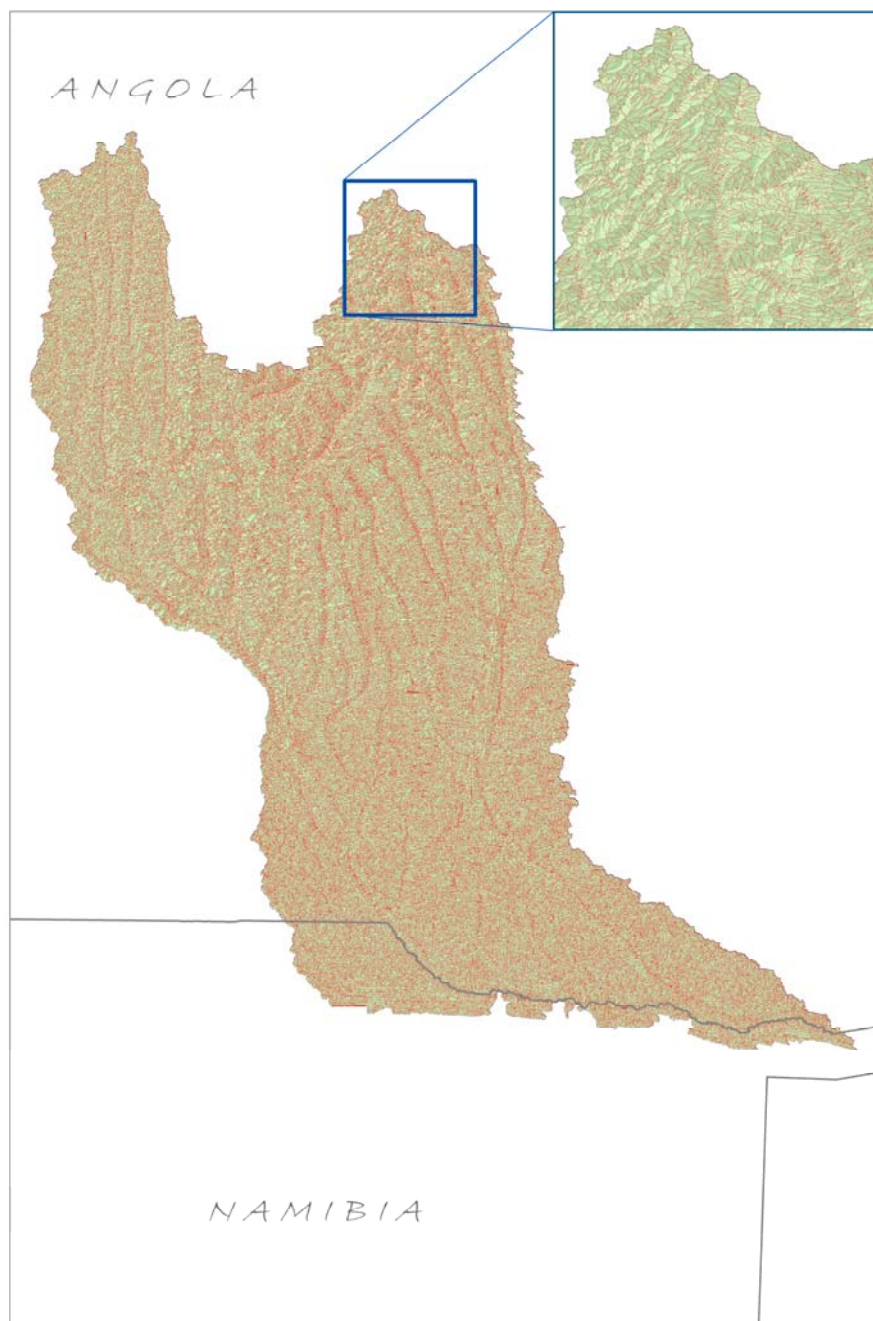
THEMES

Hydrology Modelling

- **DRAINAGE NETWORK MODEL**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (line) – reference scale 1/200 000 – is a drainage network model of the OACA. In the attributes table, each drainage line is linked to the micro catchment in which it resides. The creation of this layer was achieved by converting the *Steam Segmentation* grid layer into vector layer (zoom in for detail).
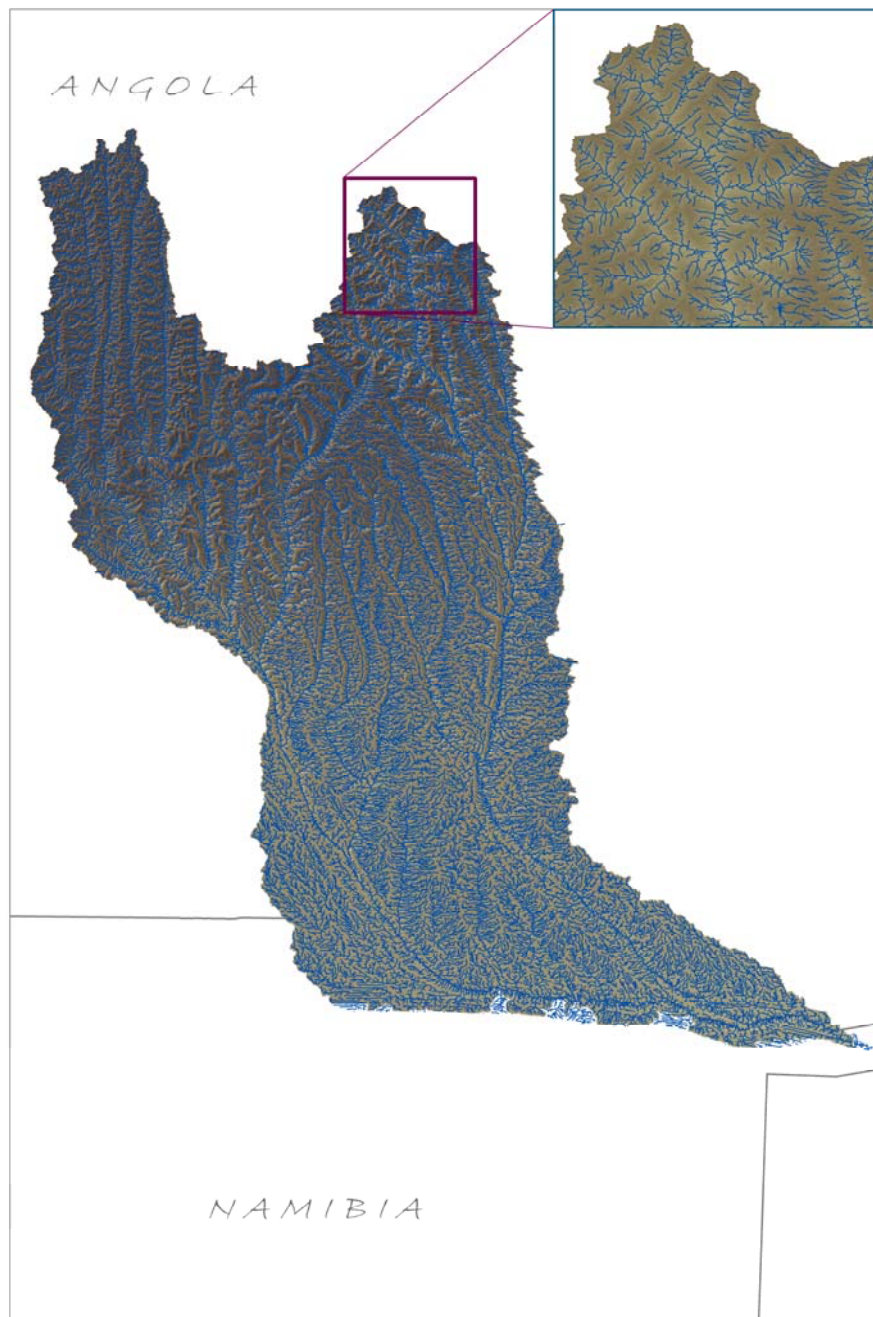
THEMES

Hydrology Modelling

- **SURFACE DRAINAGE NETWORK MODEL**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (line) – reference scale 1/200 000 – is a drainage network model of the OACA. In the attributes table, each drainage line is linked to the micro catchment in which it resides. The creation of this layer was achieved by filtering the previous model with visual analyses of topographic maps and DTM model

THEMES

Hydrology Modelling

- **SUB-SURFACE DRAINAGE NETWORK MODEL**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (line) – reference scale 1/200 000 – is a infered sub-surface drainage network model of the OACA. In the attributes table, each drainage line is linked to the micro catchment in which it resides. The creation of this layer was achieved by filtering the drainage network model with the previous model.
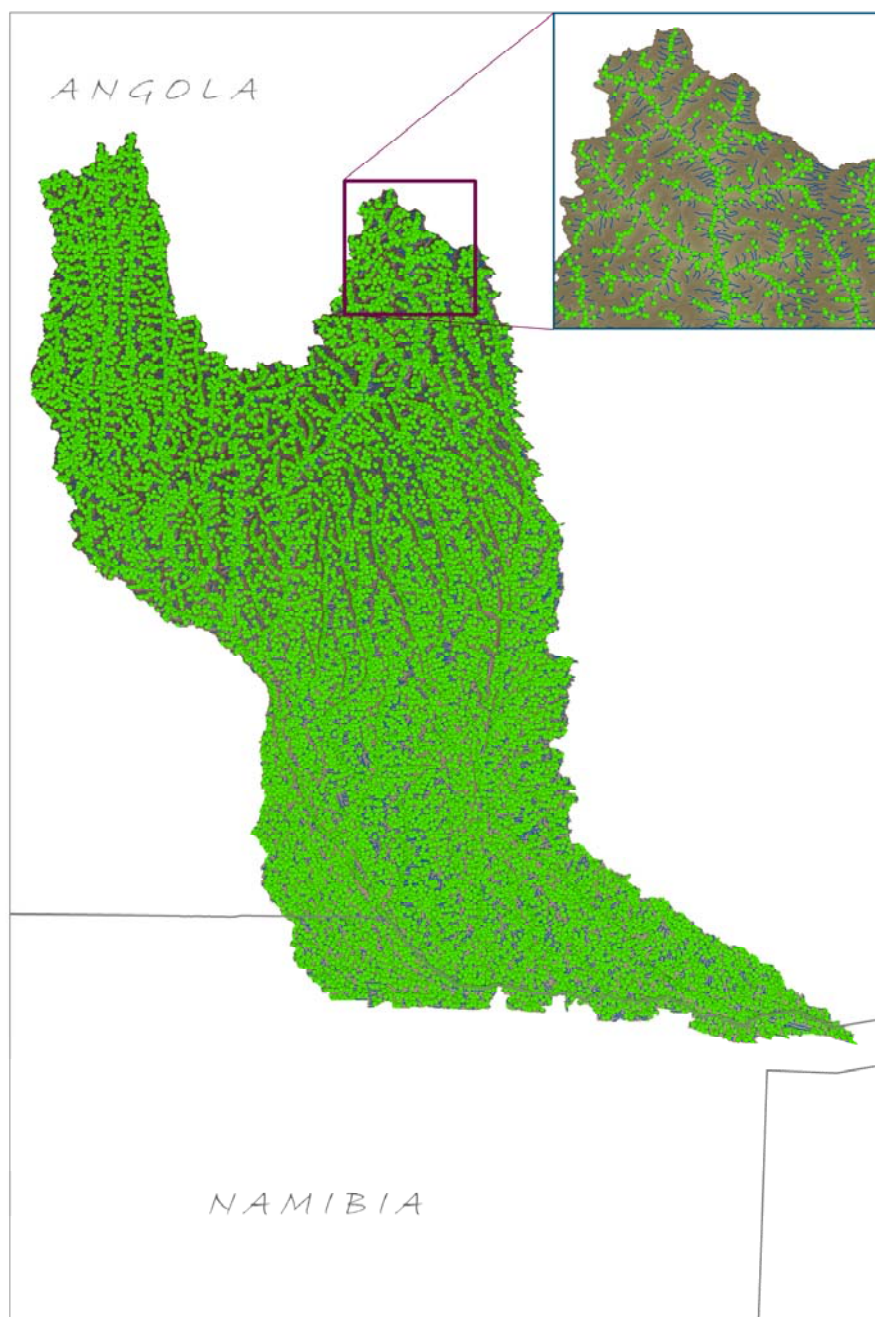
THEMES

Hydrology Modelling

- **DRAINAGE POINT**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (point) represents the points at which stream segments intersect in the OACA, and can aid in the identified of locations for potential hydrological monitoring. This was created by an interpolation of all stream intersections in the *Drainage Line* layer.
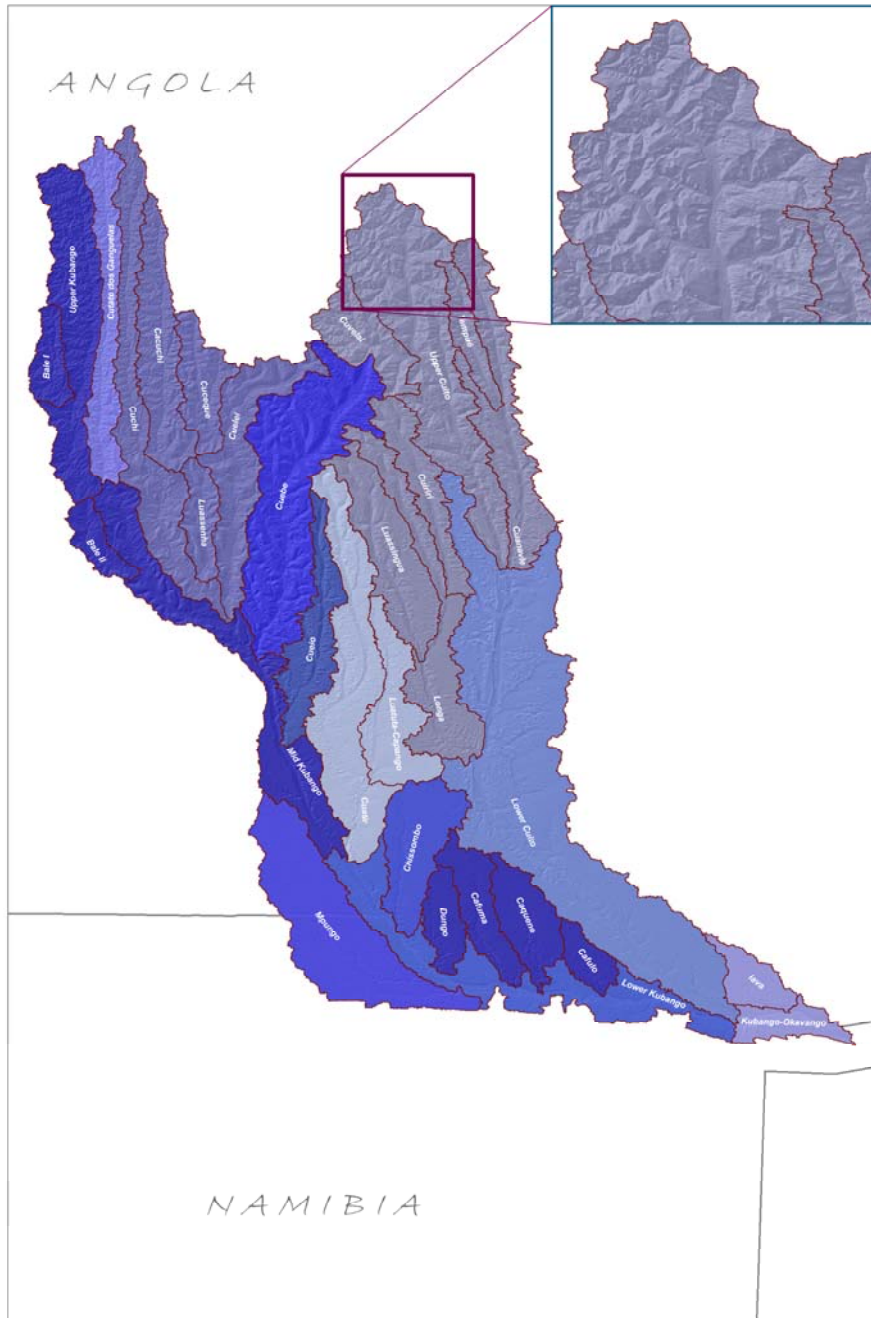
THEMES

Hydrology Modelling

- **Sᴜʙ ʙᴀsɪɴs Lᴇᴠᴇʟ III Dᴇʟɪɴᴇᴀᴛɪᴏɴ**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (polygon) – reference scale 1/200 000 – is a sub-basin delineation of the OACA, incorporating basins of the main tributaries and sub- tributaries of the Kubango/Okavango river. It was created by a supervised aggregation of micro basin units from the *Catchment MicroBasins* layer (zoom in for detail).
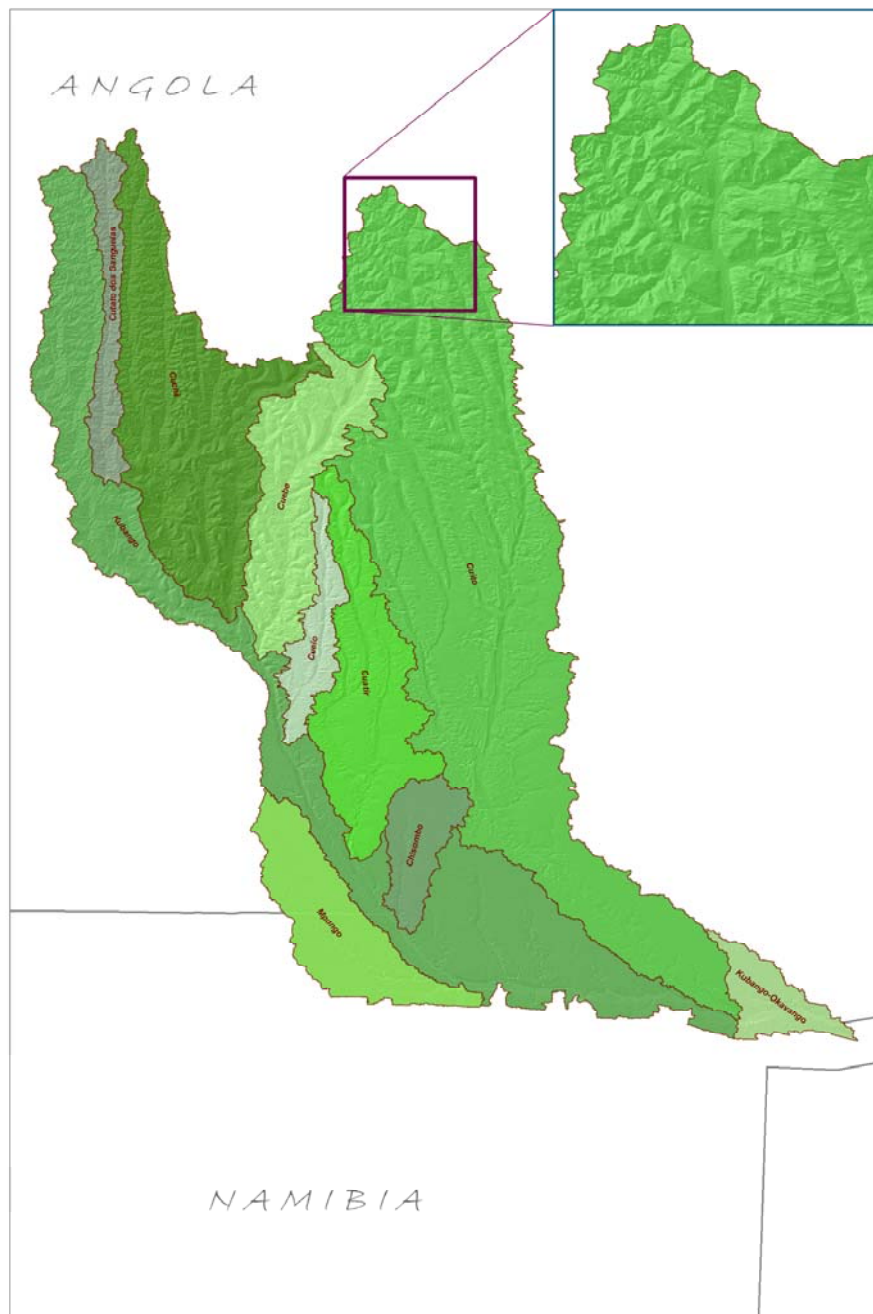
THEMES

Hydrology Modelling

- **SUB BASINS LEVEL II DELINEATION**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer (polygon) – reference scale 1/200 000 – is an aggregated sub-basin delineation of the OACA, incorporating basins of the main tributaries only. It was created by aggregation of the sub basin units from the *Sub Basins Level III* layer (zoom in for detail).
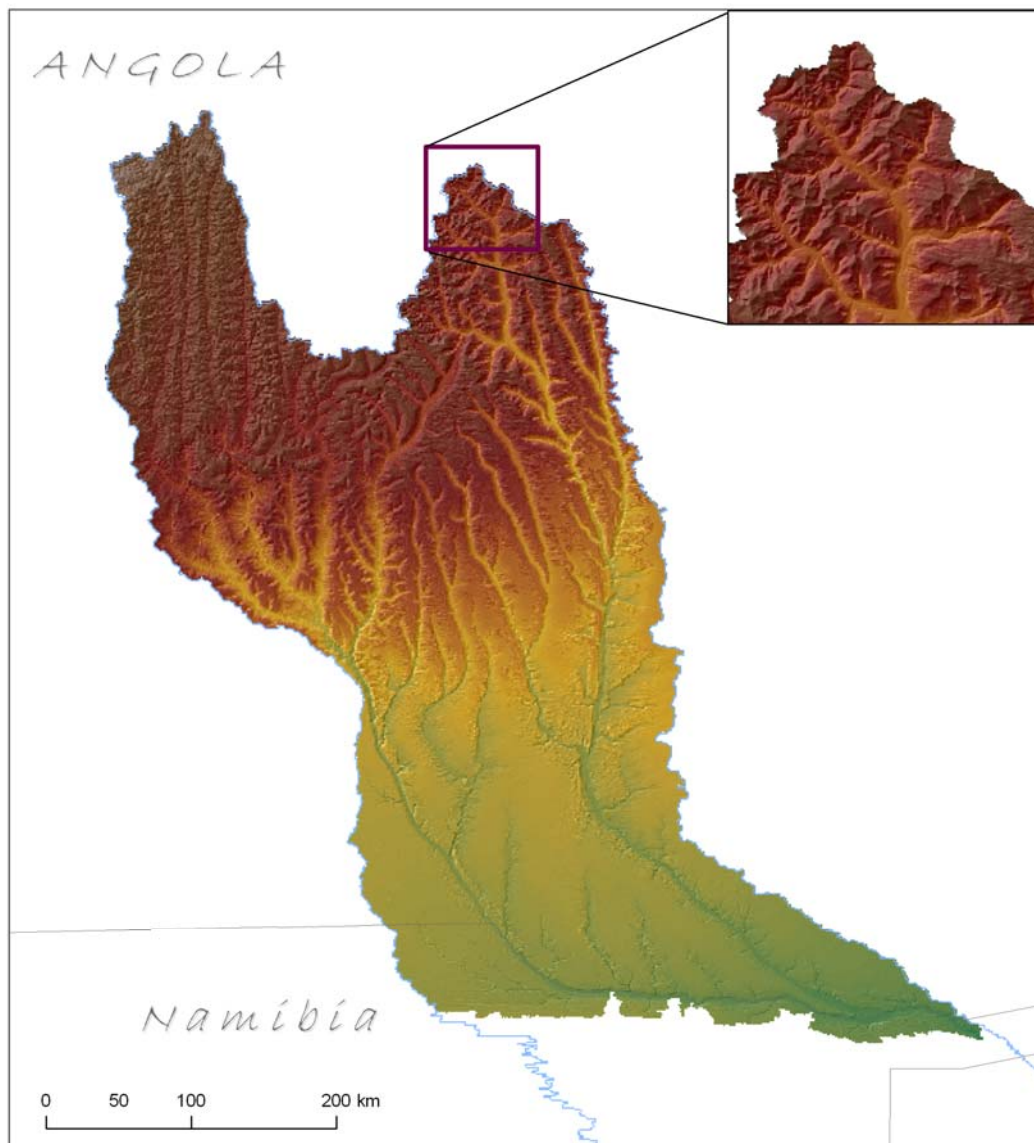
THEMES

Topographic Modelling

- **DIGITAL ELEVATION MODEL (DEM)**

Status – Completed / **Coordinate System –** WGS84

Observations – This raster layer is the Okavango Active Catchment Area DEM, in the reference scale of 1/200 000. It was created by converting raw SRTM data into a finalized raster layer for the OACA with 90m pixel resolution.
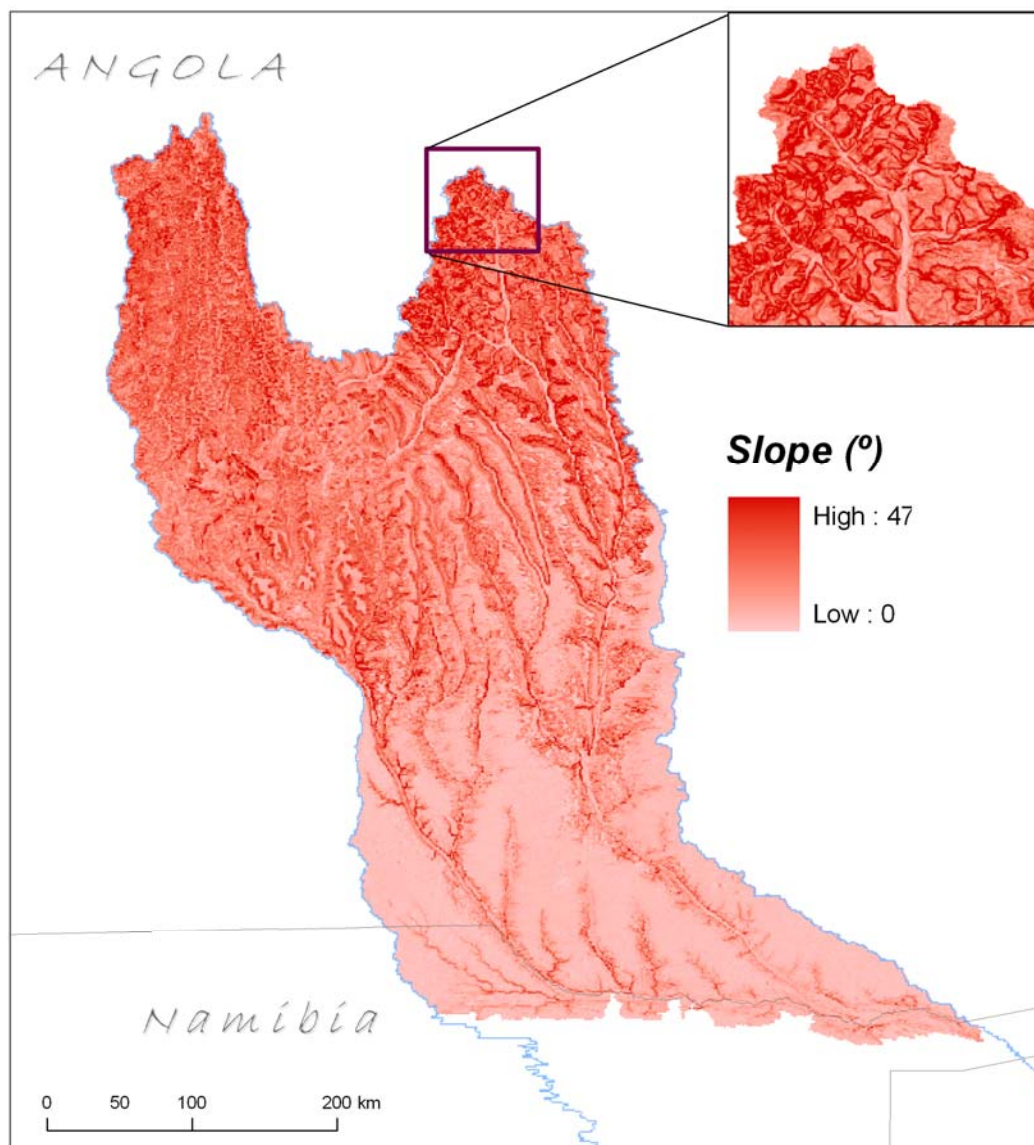
THEMES

Topographic Modelling

- **SLOPE MODEL**

Status – Completed / **Coordinate System –** WGS84

Observations – This raster layer represents the OACA slope model, in the reference scale of 1/200 000. The creation of this layer was achieved by interpolating the DTM raster layer. Units are organized by degrees(^{o}).
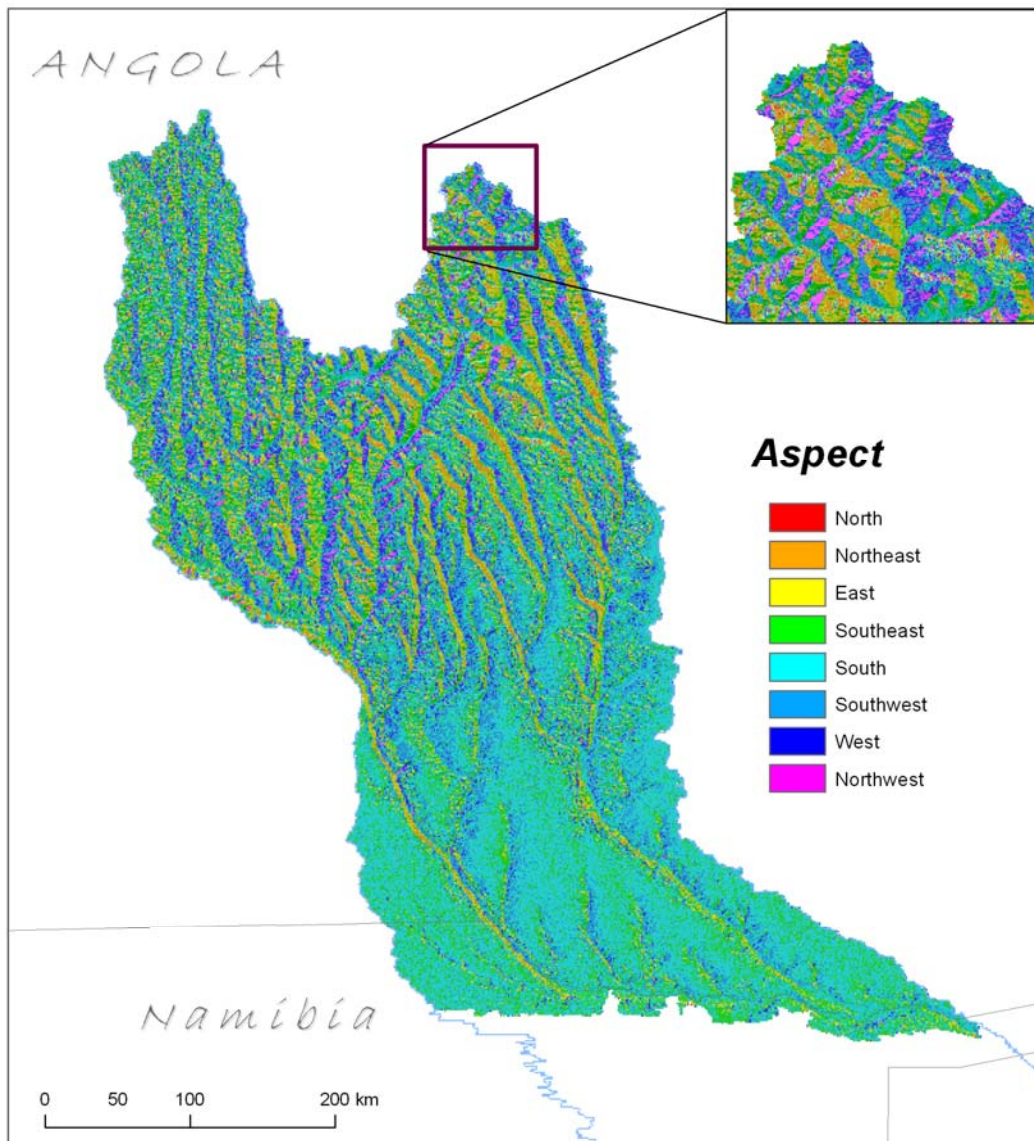
THEMES

Topographic Modelling

- **ASPECT MODEL**

Status – Completed / **Coordinate System –** WGS84

Observations – This raster layer represents the OACA aspect model, in the reference scale of 1/200 000. Aspect is the direction that a slope faces. It identifies the steepest downslope direction at a location on a surface. The creation of this layer was achieved by interpolating the DTM raster layer.
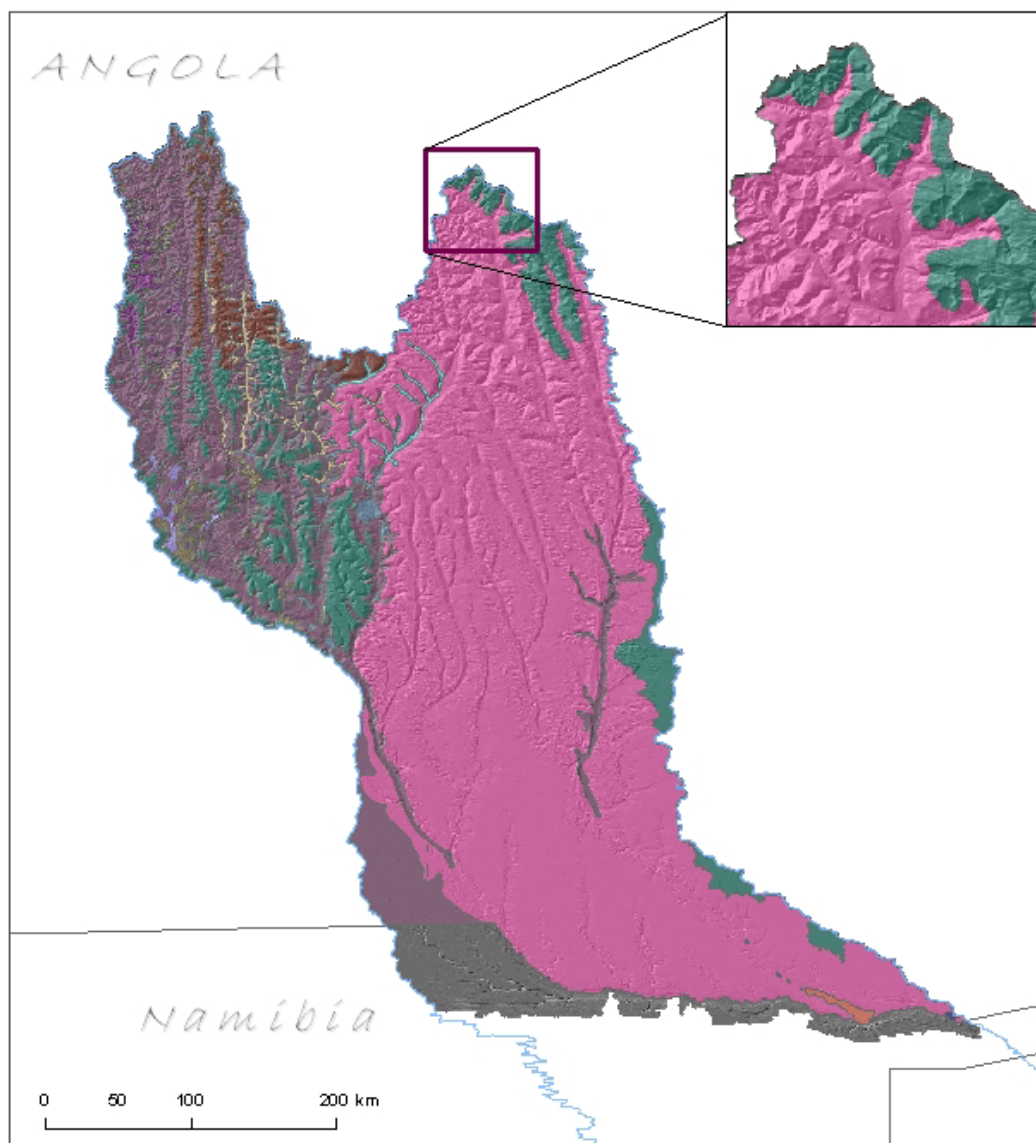
THEMES

Geology

- **GEOLOGIC UNITS**

Status – Completed / **Coordinate System** – WGS84

Observations – This vector layer represents the OACA geologic units in Angola, in the reference scale of 1/1 000 000. Data was provided by SINFIC, based on the Geologic Map of Angola (Laboratorio Nacional de Investigação Científica Tropica, 1982).
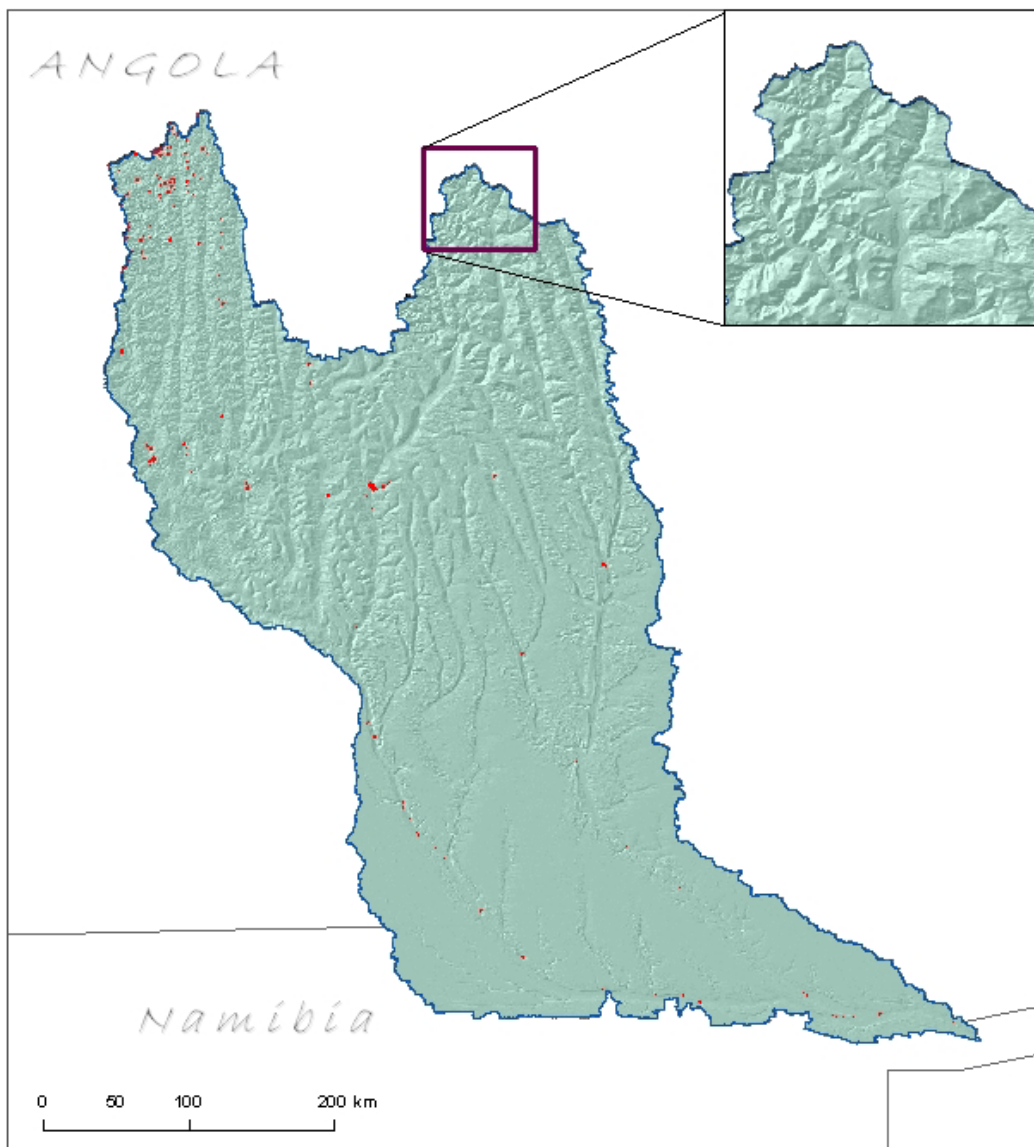
THEMES

Infrastructures

- **BUILD UP AREAS**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer represents the OACA build up areas in Angola, in the reference scale of 1/100 000. Data was provided by SINFIC, based on the Topographic Map of Angola (IGCA).
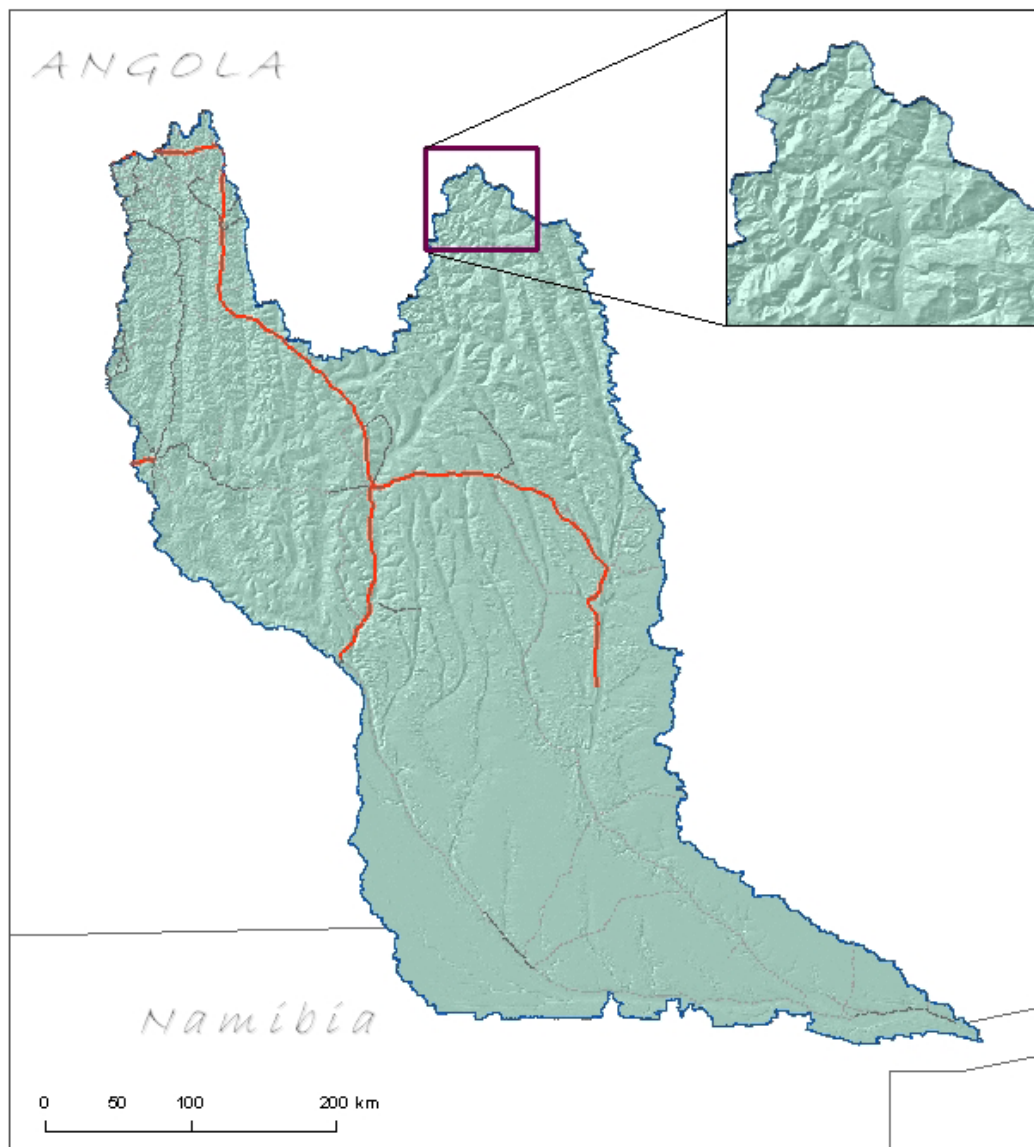
THEMES

Infrastructures

- **ROADS AND TRACKS**

Status – Completed / **Coordinate System –** WGS84

Observations – This vector layer represents the OACA network of Roads, Gravel Roads and Tracks, in Angola, in the reference scale of 1/100 000. Data was provided by SINFIC, based on the Topographic Map of Angola (IGCA).

THEMES

Infrastructures

- **RAILROAD**

Status – Completed / **Coordinate System** – WGS84

Observations – This vector layer represents the OACA railroad lines, in Angola, in the reference scale of 1/100 000. Data was provided by SINFIC, based on the Topographic Map of Angola (IGCA).