

Mapping and GIS at the Development Workshop, Luanda: an assessment of selected aspects

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Between the 4th and 13th of April 2006, I was invited to assess and advise on a number of components of the Development Workshop's (DW) GIS and mapping work (see the Terms of Reference in Appendix 1). The work on which this report is based was all done in Luanda since a planned visit to Huambo could not be arranged for logistical reasons. The report is divided into sections dealing with:

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Provincial and municipal profiles

The DW has on an ongoing programme to compile published profiles of provinces and municipalities in Angola. The first of these has just been published for the province of Zaire and its constituent municipalities, while the profile for Cabinda should be completed in a few weeks. Thereafter, work on profiles for five other provinces will commence. The main objective of the profiles is to assemble existing information on these areas for purposes of background reference with a view to assisting development agencies and local governments in identifying priorities for development. Each profile is printed in a limited edition of about 30 copies. I have the following recommendations and comments on the profiles:

Assembling information for the profiles

1. As a general point the profiles could benefit greatly from additional information, some of which is suggested below. One constraint, however, is that profiles are being compiled over fairly short periods of a few months, which might limit the chances of obtaining more complete and accurate data. If this supposition is correct, more time might be allowed for the gathering of information for each profile.
2. It would be useful to print maps of all existing geographic data on large sheets of paper and to use these in the field as a basis for checking and obtaining additional information. Such draft, or working maps provide a useful basis for discussion with local officials and informants who are often able to identify errors and missing information. It would also be useful to print out satellite

images on large sheets, again for use in the field where the identity and nature of features visible on the images can be checked.

3. A useful set of satellite images based on LandSat is available for free at the following website <https://zulu.ssc.nasa.gov/mrsid/mrsid.pl>. The images are in a MrSid compression format and each covers an area spanning 5 degrees of latitude and 6 degrees of longitude. We started to download the images for Angola while I was in Luanda and the remaining images should be obtained whenever possible. The MrSid images should be used as a backdrop in ArcMap or ArcView to check and update such features as rivers and roads, the positions of towns and other features that are clearly visible on the images. In essence, they can form the basis in compiling a great deal of mapped information for the profiles.
4. staff should make active attempts at seeking out appropriate data in other organisations. Specific examples are the mapped data for villages assembled by CNIDAH and recently information compiled by UNICEF on the locations of all or most Angolan schools. CNIDAH is also likely to have other useful data, for example on the condition of roads, especially as they relate to land mine risks. A review of other sources of GIS data in Angola is provided as Appendix 2, this being part of a review compiled by Artur Mugindo de Oliveira, National Institute of Statistics (INE) and me in November 2005.
5. Several sets of data on the boundaries of provinces, municipalities and comunas are in circulation and use in Angola. However, many of the boundaries in these data are inaccurate. The DW should attempt to correct obvious errors, for example by moving boundaries that follow features such as rivers and roads visible on the MrSid images, and verifying the positions of boundaries as described in the original legal documentation or government gazettes.
6. For purposes of reference and to direct development work to where services are most needed, I strongly recommend that major efforts be made to compile mapped information on the distribution of people. In addition to helping to identify where services can be targeted, these data will be valuable for land use planning, for example in showing areas that might be set aside for conservation. The easiest way of assembling this information would be by mapping the extent of cleared land off the MrSid satellite images. Once the patterns and colours of cleared areas have been identified, staff at the DW should then digitise their boundaries to compile a map of cleared areas. The MrSid images were taken several years ago (generally in 2000 or 2001) and thus provide reasonably current information on where people are living. The extents of larger villages and towns are also clearly visible on the images and they too should be traced into vector data sets. Additional information might be obtained from the CNIDAH data on villages, aerial reconnaissance flights (using a GPS to record the co-ordinates of villages and households and also photographing the settlements to later count the number of homes – see below) and local informants, as suggested in point 1 above.

Contents and publication of the profiles

1. The profiles could benefit from the inclusion of more information on the basic geography of each province or municipality. Where appropriate, I recommend having maps of soils, rainfall, altitudes, all social services (health facilities, schools, administrative offices, transport (roads – perhaps rated as being in

good, moderate or bad condition; rail; airports and air strips)), population distribution, centres of economic activity (informal markets – perhaps rated as big, medium or small; shops, industrial areas, commercial production farms), and orientation features (major roads, villages, towns, rivers, railways, communes etc).

2. More could be done to use maps to show development needs and priorities, for example in clearly highlighting population centres that have little access to schools or clinics. Readers are likely to pay more attention to maps and other striking images, and the opportunity should thus be used to convey important recommendations in the maps.
3. In cases where the maps need to be larger than those that can be printed on A4-size paper, consideration should be given to printing them on A3 paper and then folding the maps to be bound into the A4 bound profile report.
4. The circulation and availability of the profiles is now rather limited, since only 20 to 30 copies of each report are printed. The printing is in colour and is done on desktop printers. To make these documents more widely available, I suggest that digital pdf versions be created and placed on a website and also copied on to compact discs (CDs).

Map design

Layout issues

1. Maps should be as simple as possible, especially those printed as small images on A4-size paper. This is also especially important for maps that depict a particular theme where the intention is for the reader to grasp and understand the message as rapidly as possible. Thematic maps thus differ in function from “road” or orientation maps that are usually larger and designed to be consulted from time to time for reference.
2. Try to standardize the size of maps within the same document or report, perhaps using maps of two or three different sizes: small, medium or large maps. The whole idea is not to have too many images of different dimensions.
3. Many of the maps produced by the DW carry a block of credit and reference information. Much of this information is not needed and could be added where necessary as a footnote or endnote to the text of the report. Most importantly, these blocks consume space that could be profitably used to make the maps larger.
4. In addition to making maps simple, care should be taken to ensure that the messages or information they are intended to convey are very clear.
5. Each map should be designed so that it can be read separately from the text. This means that the map should have a clear title and legend.

Contents of maps

6. In line with the idea of keeping maps simple, active, sometimes ruthless decisions need to be made to leave out certain features. We are often inclined to include all the information we have, since the very fact that we have acquired the information somehow obliges us to publish it. However, anything that distracts from the purpose of the map must be excluded so as to maximize the impact of the intention of the message being conveyed to the reader.
7. Thematic maps that show values for different polygons, such as provinces, regions or municipalities are popular. Each area is shaded a different colour, such that the colours reflect values that are high or low, for example. These

shaded maps should, however, be used with caution because the use of even shading carries the implication that conditions are homogenous across the whole area. For example, a polygon might be shaded bright red to indicate that the region has a very high population. That might be true, but the red colour across the whole polygon suggests to the reader that the high population is spread throughout the region, which is usually not the case. A further difficulty with shaded polygons is that those regions that are large and coloured using a bright colour dominate the map and thus catch the readers' attention. However, these large, brightly coloured regions might not deserve as much attention as smaller regions. For example, Moxico or Kuando Kubango are very much larger, but have far smaller populations than Luanda. An approach that gets around these biases is to simply show the actual number of people in a region, perhaps as a histogram or as a printed number superimposed on the map.

8. Concepts that are difficult to grasp should be avoided. A popular example is population density. The average density of people across a whole region may be easy for us to calculate, but rather few people will immediately be able to grasp the reality of a figure such as 5.4 people per square kilometre.
9. Most small thematic maps do not need borders or grids of co-ordinates. However, for those maps where co-ordinates are useful choose to add them in degrees of latitude and longitude. Many more people understand these figures than those given in units of metres, for example UTM co-ordinates. An exception to this is for maps of very small, local areas where UTM or other metric co-ordinates are useful for purposes of assessing distances.
10. Scale bars should be added to maps and used in preference to numeric scales such as 1:50,000, which few people know how to interpret. Scale bars are also useful because the scale remains true if the map is enlarged or reduced when it is printed or photocopied.
11. Any text labels must be clearly legible, which means that they should be large enough, the font should be neat and simple (sans serif fonts, e.g. Arial or Helvetica are better than serif fonts, such as Times or Garamond), names all in capitals should be avoided (for example, DEVELOPMENT WORKSHOP is harder to read than Development Workshop), and the names should not overlie or be obscured by other features on the maps. These conditions are obvious for the original map, but care should also be taken to ensure that the names remain readable even if they are slightly reduced during printing or photocopying.
12. Simple, plain pastel colours should be used where possible, since bright colours often distract the reader away from the message of the map. At all times, ensure that the colours are distinct. Patterns might be added if a map is likely to be later photocopied in black and white, but the patterns need to be selected with care because they too can be distracting, both in overall visual impression and in interfering with labels. It would be a good idea to experiment with patterns, printing them in colour and then photocopying the maps in black and white to ensure that they remain attractive and useable.

Making more of maps and GIS

Map production in the DW is now largely the responsibility of the GIS/Mapping unit. Staff in this unit have a good idea of what mapped data are available, but they seldom know what issues emerging from each research project need to be analysed or mapped. Conversely, staff working on each research project often have little idea of what

mapping possibilities exist in the GIS/Mapping unit. In essence, there is a gap between the two activities. The following ideas could help bridge the gap

1. Perhaps the most important requirement is to encourage creative questioning and experimentation, indeed to develop a culture of probing, interrogating and lateral thought. Problems and questions need to be posed to stimulate ideas on how information can be first analysed geographically and second depicted on maps. Thus, research project staff need to ask questions about space and geography, such as:
 - a. How many people live within 5 kilometres of a water point, or are there enough people within a particular area to justify another water point?
 - b. Is there a geographic pattern to the incidence of a disease?
 - c. How do the locations of planned new water supply points relate to or compliment existing ones?
 - d. Where are concentrations of people who could be served by new cell phone coverage (as an example from the private sector)?
 - e. How many people live within 10 kilometres of each market?
 - f. In what provinces has the DW had greatest success in implementing projects?
2. Once these kinds of questions are asked and data are made available to answer them, research and GIS/Mapping staff need to get together and start experimenting with different methods of analysis and ways of mapping the results. New perspectives and new questions are likely to arise during this process of experimentation, some of which may require additional information to be compiled or considered.
3. A stronger view of geographical issues in the beginning will also help improve research designs and help ensure that appropriate data are collected from the start, for example GPS co-ordinates for every water point, or counts of households within the project area.

Development of GIS and mapping at DW

The DW has the aim of developing its GIS/Mapping unit to an extent that it has a strong capacity to produce maps, to analyse data on a geographic basis, and to have the most reliable and complete sets of geographic data for Angola. Such a development would be of substantial value to the DW as well as Angola, since there is limited use of GIS or map production in the country as a whole. The following comments are offered in pursuit of these goals.

1. Development and strengthening of GIS/mapping capacity must be led and driven by products. This will have the multiple effect of compiling some useful publications, developing the abilities of staff, building up useful sets of core GIS data, creating demands for mapping, and establishing the DW's reputation. Some examples of products that could be considered are:
 - Street maps of Luanda, Huambo and other cities
 - Attractive wall maps (e.g. elevations in Angola)
 - Atlas of Angola
2. Although it might seem like a mammoth task, I recommend that a project be started to map the approximate positions of all households in Angola. The resulting set of data would be of great use to most of the DW's projects that require assessments of populations, for example in provinces, municipalities,

other areas, or in the catchment areas of any services. The data would also become a valuable resource for the whole country. The data could be compiled from various sources, such as aerial surveys, high resolution satellite images (for example, Quickbird), and ground surveys in which locations of households are recorded using a GPS. In addition, sets of data that have simply estimated the number of households in each village can be used, since it is not necessary to obtain very great spatial accuracy. The data collected for villages by CNIDAH would be useful in this respect.

3. The production of an Atlas of Angola would be substantial project in itself, but it would lead and require the DW to assemble most GIS data in Angola. The DW would, as a result, have valuable data resources at its disposal. I would also strongly recommend that these data be published on compact disc on a website to ensure that they are freely and widely available to other users.
4. A policy of providing GIS for free will enhance the DW's reputation as a public resource, help develop an ethic of freedom of information in Angola, and encourage other data developers to share their information freely with the DW and others. In short, the more data you give, the more will be given to you.
5. Consideration will have to be given to increasing the number of staff and their abilities adaptively in response to growth and demand. The aspect of improving capacity would probably best be pursued as part of the compilation of the products mentioned above (i.e. learning by doing) and some intermittent training. In terms of recruiting additional staff, care should be taken in finding people who are keen to learn, keen to experiment and keen to be creative. Those qualities are much more important than technical skills or training.

Projections and co-ordinate systems

There is some confusion on what co-ordinate systems, projections, datums and spheroids/ellipsoids should be used for GIS data. Part of this confusion has arisen because the terminology and technical aspects behind the issues are difficult, while other problems arose because of the use of the Camacupa datum in Angola. A meeting of several GIS users and other interested people was arranged while I was in Luanda. The following points arose from that meeting and other discussions:

1. It is important to distinguish between the co-ordinate system (and its parameters) used to **store** vector GIS data and those used to **display** data on a screen or printed map. It was widely agreed that vector data should be stored in simple latitude–longitude co-ordinate system of degrees using a WGS84 datum and spheroid/ellipsoid. This is the simplest and most widely used set of parameters and it makes sharing data with other people easy. It also the system widely used for GPS co-ordinates.
2. For purposes of display, any appropriate projection can be selected. In many cases where users are overlaying latitude–longitude degrees on top of the scanned maps produced during the 1980s, they will have to select a UTM projection using the Clarke 1880 spheroid/ellipsoid and Camacupa datum, since these maps were drawn using that projection, spheroid/ellipsoid and datum. Note, that most small, thematic maps can be drawn without setting any projection because no reader would be aware of the tiny shifts in shape and size that a projection would depict.
3. For purposes of clarity and definition:

- Co-ordinate systems are the units of measurement used to locate a position on the surface of the earth. The commonest system is that which uses degrees of latitude and longitude. Another system that has gained widespread use is the UTM co-ordinate system. This uses metres in x and y dimensions in relation to a fixed line of latitude (usually the equator) and a central line of longitude or a meridian. The meridian lines change from one UTM zone to the next, and so it is always critical to know the zone for which the co-ordinates apply.
- Spheroids and ellipsoids are terms used interchangeably for a set of parameters used to describe the shape and size of the earth. WGS84 is the best known of about 20 or so spheroids and ellipsoids that are commonly used around the world.
- A datum refers to a reference point from which distances and angles are measured. Most datums are based on a particular spheroid or ellipsoid, which means that they use a particular set of estimates of the size and shape of the earth. For example, the Camacupa datum for Angola is based on the Clarke 1880 spheroid. Most datums refer to a local reference point within a country or relatively small area and are used to achieve high levels of accuracy for local measurements. An exception is the WGS84 datum uses the centre of the earth as a reference point and is the only datum based on the WGS84 spheroid.
- Projections are the mathematical models used to translate co-ordinates of latitude and longitude taken on the curved surface of the earth on to the flat surfaces of maps. A great variety of different projections are available, each of which has strengths and weaknesses in minimising the distortions that arise from depicting a curved surface onto paper. Some are better for purposes of estimating areas, while others reflect distances or directions more accurately. ArcView and ArcMap use projections “on the fly”, which means that they transform co-ordinates of latitude and longitude onto a projected image on the screen or printer. The original, stored data are not changed in any way, and can therefore be used repeatedly for different projections.

Appendix 1: TERMS OF REFERENCE

GIS CONSULTANT

Mission duration: 2 – 13 April

Location: Luanda & Huambo

Objective of the mission

Development Workshop is working with GIS (Geographical Information System) for several years, applying this tool for project monitoring, research sampling, demonstration of research results and monitoring of urban development in Luanda. DW's GIS unit is currently providing services to its own projects, partner organizations, international agencies and several Government institutions.

DW is contracting a consultant who will help DW to acquire the highest possible level of expertise specifically in three focus areas of GIS application.

1. One of the main research activities that DW is being involved in is the elaboration of provincial and municipal socio-economic profiles for clients from government, non-government and private sector. For these assessments, DW has developed a research framework that combines qualitative and quantitative research methods. Research data is stored and analysed in a standardized database that is linked to GIS. DW is currently revising this framework in order to improve GIS application. The consultant will have a leading role in this process.
2. Another main application of GIS is by DW's projects. Each one is storing monitoring data in specific databases. Some of these databases are already linked to GIS, others are being linked now. The consultant will revise these project databases and advise project and GIS staff for maximizing the application of GIS for the geographic representation of project indicators and project outcomes and results.
3. Third, DW is currently implementing land regularization pilot projects in Luanda and Huambo. In Huambo, the project staff initiated a process of land registry by which land plots are demarcated using GPS and information about land limits and land ownership are stored in a database linked to GIS. The consultant will revise the use of GIS in this process and advise project staff on how to improve application and management of this database.

Additionally, the consultant will develop a detailed proposal for the elaboration of an Atlas on Angola together with DW staff.

Duration and location

The consultant will spend approximately 7 days in Luanda and 4 days in Huambo. The intention of DW is to develop a long-term relationship with the consultant that would lead to follow-up and monitoring missions during 2006 and beyond.

Appendix 2: Selected components of a “Report on work to assess GIS (geographical information system) data for the Okavango Basin

GEF EPSMO Project, UNTS/RAF/010/GEF

November 2005

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&

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The report provides the results of investigation to determine the nature and availability of GIS data for the Okavango Basin, and to recommend how these data can be assembled to provide for planning needs. A substantial number of datasets have already been assembled in two databases, and most of these data have been circulated widely. Little new or other information is available for the Angolan catchment area of the Basin.

This report is a product of a consultancy assignment to (a) investigate what relevant GIS information and institutional capacities are present in Angola, Namibia and Botswana, (b) analyze issues and aspects of GIS information across the three riparian countries, and (c) develop recommendations on how best to get a GIS system up and running for the GEF EPSMO Project.

Principal databases

A considerable number of GIS data sets covering various aspects of the Okavango Basin have been assembled over the past three years. These are listed in Appendix 4. Most of the data have been compiled in two major databases. The first of these, known as the RAISON database, has been widely distributed in two versions, both of which were in English and Portuguese editions. The database was assembled in 2003 and 2004 by RAISON for the Namibian Ministry of Environment & Tourism, the Every River has its People project, and the Sharing Waters project. Approximately 200 different sets of GIS data are contained in this database (see Appendix 4).

GIS information in Angola

In Angola, it is only in the last two or three years that any public service organizations have started to develop an interest in GIS. While quite a few organizations claim to have a GIS, very few actually have any true GIS data or operational systems. In many cases, people considered that the few scanned maps they have constituted a GIS. Some institutions are now developing software and hardware systems, but many have yet to acquire appropriately interested or qualified staff. In some cases there is also a lack of perspective on what functions their GIS will or could serve. Another constraint is that most mapping and surveying activities are concentrated on the more densely populated and accessible parts of the country. With the exception on CNIDAH, we encountered no organization or institution that was actually doing any mapping within the catchment of the Okavango.

Notes on meetings and interviews

ENDIAMA, Friday 23 September 16h00 and Wednesday 28 September 09h00

This is the parastatal responsible for the diamond industry in Angola. Their main interest is in the north-eastern provinces of Lunda Norte and Lunda Sul where most diamonds are now found. The only data they claimed to have for the Okavango Basin were scanned maps, which they agreed to copy for us. In response to questions concerning data on possible kimberlites and deposits of alluvial diamonds in the Okavango Basin, they responded by saying that ENDIAMA had no information since this area was being explored by De Beers. We were promised that they would provide copies of their scanned maps and that Artur de Oliveira could fetch them at a later date.

Eli Porat, Saturday, 24 September, 19h00

Mr Porat is a local businessman working in conjunction with various interests based in Israel. Much of his work focuses on the production of aerial photographs for urban areas and for purposes of cadastral delimitation. He considers himself well versed in all aspects of GIS data and organizations in Angola, and thought that it very unlikely that we would find much, if any, useful GIS data for the Okavango catchment.

Development Workshop (DW), Monday 26 September, 09h15 and Tuesday 27 September 14h00

This organization concentrates on socio-economic research, and has accumulated considerable experience in the north-western parts of the Okavango Basin in the province of Huambo. At the moment much of their work is focused on areas around Luanda and in selected neighbourhoods of the city of Huambo and the nearby town of Caala. They do not have any specific GIS data for the Okavango Basin, but they do have black and white scans of the 1:100,000 maps. They also do not have any recent aerial photography of the Basin area, and neither do they know of anyone who has produced recent aerial photography. Mrs Katu Paulina is the person in charge of the GIS section of DW. Mr Beat Webber is her supervisor and responsible for Research and Evaluation.

Some useful secondary pieces of information were gathered. First, was the fact that Angola uses the Camacupa spheroid for its maps. Second, the DW recently completed a study of land use in areas around Huambo town, the results of which should be published and available in about two weeks.

The DW (and ADRA, another research NGO that concentrates on rural development and has an office in Huambo) have much to offer in terms of helping to understand patterns, processes, opportunities and constraints concerning land uses and socio-economic conditions in the Angolan part of the Okavango Basin.

Instituto Geodesia e Cartografia de Angola (IGCA), Monday, 26 September, 11h00

IGCA is part of the Ministry of Environment & Tourism. The meeting was with the Director of the IGCA, Eng. Benjamin. The focus of the IGCA is on cadastral limits, and their GIS work is now confined to areas around Luanda. They have no GIS data for the Okavango Basin other than scans the 1:100,000 maps. We were told that it would be possible to obtain copies of these and that we should contact the Technical Director of the relevant section. In response to queries about aerial photography, we were informed that IGCA does not have any recent aerial photographs of the Basin, but that we should contact ABSAT. This is a Brazilian company with offices here in Luanda. The IGCA

promised to provide copies of their scanned maps, which could be collected at a later stage.

Subsequently, Edlira Kollozaj at FAO in Luanda informed us that IGCA have aerial photographs of the Basin. These might have been taken in 1980, but it is also possible that they were taken in 1953 – 1957. She further informs us that she should a copy of all the 1953-1957 aerial photographs at the agriculture university in Tchianga, Huambo.

Faculty of Science, Universidade Angostinho Neto Monday 26 September 15h00

Meeting with Dr Joaquim Sucure who reported that his Department of Geography had no GIS information, and remarked that GIS is a very new enterprise in Angola as a whole. He provided the names and telephone numbers of several other people we could consult.

Artur de Oliveira later met with Prof. Igor Gramiz of the Geography Department who informed him that they have scanned maps of geology, demography, and some natural resources information, but that these maps have yet to be geo-referenced.

Ministerio da Geologia e Minas (Ministry of Geology and Mines), Tuesday 27 September 09h00

Meeting with Luzia Alexandre who explained that the most important sets of data they have are scanned maps at a variety of scales and information on mineral deposits and exploration and mining concessions. Their whole computer system is now out of commission and will only function again once they get a new server. She promised to provide copies of the scanned maps and would ask her supervisor for permission to supply copies of the data on mineral deposits and concessions. Subsequent discussions between Luzia Alexandre and Artur de Oliveira indicated that it will take some time for the sever to be fixed and for the data to become available.

CNIDAH, Tuesday 27 September 11h00

This is a parastatal organization responsible for planning and monitoring the clearing of landmines in Angola. Our meeting was with Mohamed Qasim who is responsible for maintaining the database. This is an impressive operation involving the systematic mapping and assessment of landmine threats throughout the country. The assessments are currently limited to areas of immediate impact to people, namely areas around villages and along roads. A database of some 19,000 villages has been compiled, and this includes the name and co-ordinates of each village and an assessment of whether landmines are a problem in surrounding areas. In addition, a wide variety of socio-economic data has been collected for about 1,400 of these villages where landmines are a threat. These data include information on numbers of people, the availability of social services, and farming and other economic activities.

Roads have been digitized off old 1:100,000 maps, and then checked for their current status and classified for risk associated with landmines. The mapping and assessments of all roads in the Okavango Basin provinces of Kuando Kubango, Bié and Huambo should be complete by the end of this year. Likewise, village mapping and assessments for Kuando Kubango will be complete at the end of 2005.

CNIDAH's policy is that all data should be freely accessible. This policy and the rich set of new data being compiled means that CNIDAH will be an important source of new GIS data for the Okavango Basin in Angola.

Biodiversity Programme, National Directorate of Environment, Wednesday 28 September, 11h00

Meeting with the coordinator of the biodiversity programme (Vladimir Russo), who reported two new programmes that may provide useful information in the future. The first is that the IGCA intends to establish a remote sensing centre, while the second is the establishment of a "State of Environment" programme by the Ministry of Environment. His biodiversity programme had commissioned several thematic studies, the results of which would soon be published. He suggested several other organizations and people who might have or know of GIS data.

ABSAT, Wednesday 28 September, 12h00

Meeting with João Ferreira who is the local representative of this Brazilian company which is mainly a provider of satellite imagery. Their prices for QuickBird images, which have a high pixel resolution of about 0.7 metres seemed very reasonable.

SINFIC, Wednesday 28 September 15h00 and Thursday 29 September, 17h00

Met João Canaria who explained that SINFIC is a private company that concentrates on urban planning in southern Angola, mainly in the provinces of Namibe, Huila and Huambo. Most of their staff are based in southern Angola. They do not have any GIS data of direct relevance to the Okavango Basin.

Angola Alliance, Thursday, 29 September, 11h00

Meeting with Nelus de Waal and Japie Krynauw who described the services that this grouping of private South African-based companies offers. Of particular interest were their projects to do land cover, land use, farming and conservation potential mapping in Namibe, Cunene, Huila, Huambo and Cuanza Sul provinces. Parts of Huambo and Huila fall within the Okavango Basin.

In essence they have used LandSat imagery, detailed elevation data and ground surveys to assemble sets of data on land cover, land uses, climatic factors, soil types, and vegetation types, and then used these to model potentials for different kinds of farming and for conservation. It might be useful to commission this organization to extend their approach and methodology to produce similar land cover and land use maps for the remaining parts of the Okavango Basin.

Direcção Nacional de Aguas (National Water Directorate), Thursday, 29 September, 14h00

Meeting with Francisco Quipuco who has a small GIS setup with a few layers of data (topography, river basin limits, some towns and villages, and major river lines). He claims that he can do no more to use or expand the work in the absence of an Internet connection. This assumption is incorrect because his GIS software runs independently of any Internet services and he should be able to add and manipulate any sets of data.

World Food Programme (PAM)

Ms Filomena Andrade emailed to us various GIS files that she had. These covered provincial, municipal and communa borders, some river lines, and towns. She also provided the following web-sites as sources of data:

<http://data.geocomm.com/catalog/AO/datalist.html>

<http://www.fao.org/geonetwork/srv/en/main.search>

<http://ortelius.maproom.psu.edu/dcw/>

<http://igskmncnwb015.cr.usgs.gov/adds/>

Subsequent information obtained

After the September visit to Luanda, several other pieces of relevant information became available. The National Institute of Statistics (INE) will be conducting a household income and expenditure survey in January 2006. The survey will cover the whole of Angola. A demographic survey for each province was done by INE in 2000. The INE further have sets of GIS data for the provinces of Bie, Huila, Benguela, Luanda, Cabinda and Cuanza Sul on roads and tracks, communa boundaries, rivers, and the limits of urban areas (bairro). Finally, the INE have data for each municipality on the number of men, women and children, and levels of education from a survey done three years ago in Kuando Kubango, Lunda Sul, Cabinda and Zaire provinces.

Artur de Oliveira also met Dr Maria Luiza who works in the Geology Department and has knowledge about the Engineering Laboratory. This Engineering Laboratory, however, has no GIS data and concentrates its activities on civil engineering projects.

Artur de Oliveira later met with Prof. Igor Grimize of the Geography Department who informed him that they have scanned maps of geology, demography, and some natural resources information, but these maps have yet to be geo-referenced.

Subsequent discussions between Luzia Alexandre and Artur de Oliveira indicated that it will take some time for their sever to be fixed and for the data to become available. Artur de Oliveira also met Eng. Gigi of the Ministerio das Obras Publicas. He stated that they have no data for the catchment provinces, but have some data for the cities of Luanda and Benguela, and scanned 1:100,000 maps. This Ministry concentrates its activities on urban areas.

The following sets of digital data were collected by Artur de Oliveira:

- Base of data of the main rivers of the Okavango Basin.
- Base of data on the population in the Angolan area of the Basin namely, communes of the province of Huambo, Bié and Kuando Kubango.
- Base data on infrastructure for the Angolan area of the Basin.
- ArcView shapefiles on administrative limits (provinces, municípios and comunas), highways, nature reserves and airports.
- Soil, geological, lithological and vegetation maps of agriculture areas for the Basin in Angola.

Names and telephone numbers of organizations and people who have an interest in GIS data in Luanda, Angola (names in **bold** are those of people personally consulted in September 2005)

GOVERNMENT AND PARASTATALS

Ministerio da Geologia e Minas

Sra Luzia Alexandre – 915-11580 or 324864
 CNIDAH (NGO for landmine clearing)
Mohamed Qasim – 923 526054 or 372 218
 Pedro Ribero
 Development Workshop (NGO) - 448 366 or 448 371
Allan Cain – 912 807 253 allan.dwang@angonet.org
Beat Webber 923 710 150 beat.dwang@angonet.org
Katu Paulina 912 519 534 gis.dwang@angonet.org
 ENDIAMA (parastatal for diamond exploration)
 Eng. Tamos – 923 729 300 or 912 200 149 –
 Eng. Adriano
Domingos Miguel Cristoves – 923 496705
 Universidade Angostinho Neto
Dr Joaquim Sucure, Associate Professor of Geography – 923-610 201
sucure@engineer.com
 Prof. João Silva in the Faculty of Sciences (tel. 923 400 575)
 Prof. Igor Grimize in the Faculty of Sciences (tel. 390 397 (h)) – known as the
 father of GIS in Angola
 Prof. Emilio Silva in the Faculty of Engineering (tel. 912 505 560) – has an
 interest in remote sensing
 Decano e Mata 372 850
 Dr Maria Luiza (tel. 350 526) and Dr Morais (912 502 443 or 350 551),
 Department of Geology and Engineering Laboratory of Angola
 World Food Programme (PAM)
Filomena Andrade – 923 606381 filomena.andrade@wfp.org
 Instituto Geodesia e Cartografia de Angola (IGCA)
Eng. Benjamin – 923 610 847
 Ministry of Environment and Urbanisation (National Directorate of Environment)
Vladimir Russo – 912 321 918
 Eng. Soki – 923 319 465
 Nascimento Antonio – 912 527 053
 National Water Directorate (*Direcção Nacional de Aguas*)
Francisco Quipuco 923 600150

PRIVATE COMPANIES

ABSAT

João Ferreira tel: 370276 or 370303

SINFIC

João Canaria – 923 526 720

Eli Porat

ANGOLA ALLIANCE

Nelus de Waal and Japie Krynauw (320 969)

Hennie van der Berg (+27182976287 or +27828781760,
hennievdb@softhome.net)

OTHERS TO BE FOLLOWED UP AT SOME FUTURE STAGE

1. Edlira Kollozaj – FAO consultant and advisor in Luanda who concentrates on the evaluation of natural resources in Angola, ekollozaj@yahoo.com
2. UNHCR – Mr Mulegeta 923 367 980/1

3. ADRA – this is a large NGO with offices in Huambo and some other provinces. The organization concentrates on research concerned with rural development.
4. SONANGOL – the state-owned parastatal concerned with oil exploration and production, Carlos Andrade – 912 509881 and Hamilton Cicero

PEOPLE/ORGANIZATIONS WHICH HAD NO GIS DATA

1. Domingos de Souza (tel: 912 242245), private enterprise but does not do GIS.
2. Policia Civil - Eng. Nelson Coluna – Police do not have a GIS.
3. Ministerio das Obras Publicas - Eng. Gigi